

19. SUBMISSION RESPONSES

This chapter presents Arrow's response to issues raised in public submissions on the Surat Gas Project Environmental Impact Statement (EIS). Issues and responses are presented in tables according to the following:

- Table 19.1, Project approvals
- Table 19.2, Project need
- Table 19.3, Project description
- Table 19.4, Consultation
- Table 19.5, Impact assessment methodology
- Table 19.6, Air quality
- Table 19.7, Greenhouse gas emissions
- Table 19.8, Climatic adaptation
- Table 19.9, Geology, landform and soils
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- Table 19.22, Preliminary hazard and risk
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- Table 19.25, Ecologically sustainable development
- Table 19.26, Coal seam gas water and salt management strategy

Note that Arrow's responses to the submission made by the Queensland Government Department of Environment and Resource Management (Submission S132) and Australian Government Department of Sustainability, Environment, Population and Communities (Submission S127) are provided in Chapter 20, Response to DERM Submission and Chapter 21, Response to SEWPaC Submission, respectively.

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Issue No.	Submission No.	Issue	Reference	Responses
R1001	S003, S009, S018, S020, S032, S037, S039, S053, S055, S059, S064, S065, S070, S076, S085, S088, S095, S096, S097, S098, S108, S114, S139, S140, S152, S154, S167	If this project is to be approved, conditions will need to set that ensure section 804 of the Petroleum and Gas Act is upheld. Many of the potential activities proposed in the EIS will present an unreasonable interference to landholder's lawful conduct of their farming activities.	EIS Chapter 13, Section 13.6.1 SREIS Chapter 8, Section 7.6	Section 804 of the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) requires that a petroleum authority holder carry out its activities in a way that does not unreasonably interfere with others conducting lawful activities. Where infrastructure is proposed on private property, Arrow will consult and agree with landholder on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation.
R1002	S157	Exploration activities are excluded from the EIS, and yet Arrow is seeking a single Environmental authority for the entire project. If exploration activities in ATP 683 are not covered by the EIS, then why is ATP 683 included in the development area? Also, operation under a single project environmental authority (EA) will mean that Arrow may avoid the scrutiny that transitioning from exploration to production activities would ordinarily require. They will be able to amend existing EAs, and if approvals are based on the EIS as it stands, insufficient detailed information will not be available.	EIS Chapter 2, Section 2.2.5 and Chapter 5, Section 5.3.1 SREIS Chapter 1, Figure 1.1, Chapter 2, Section 2.3 and Chapter 3, Section 3.4	Exploration activities are not included in the EIS as Arrow already has the authority to conduct exploration activities under granted authorities to prospect (ATPs), including ATP 683. Separate EAs specific to petroleum exploration activities have been granted under the <i>Environmental Protection Act 1994</i> (Qld)(EP Act) for these ATPs. An authority to prospect must be converted into a petroleum lease (PL) before production activities can be undertaken. The Surat Gas Project will require a site-specific environmental authority (formerly a Level 1 environmental authority) under the EP Act. The preparation of an EIS is the preliminary assessment process for identifying potential impacts and mitigation measures for resource activities. Following the completion of the EIS process, further approvals are required, including the amendment of Arrow's existing project EA or application for new EAs. This is envisaged to be a staged process over the life of the project. As each new stage of gas field development or facility is planned, progressive EA or EA amendment applications will be made to encompass these activities (SREIS Chapter 2, Project Approvals, Section 2.3). Specific conditions relating to individual facilities and locations (e.g., streams) will also be prescribed as the administering authority deems necessary. Site specific environmental assessment will be undertaken as required prior to each EA or EA amendment application in order to provide the level of detail required by legislation to support amendment the applications. Arrow's existing ATPs and PLs are shown on SREIS Chapter 1, Introduction, Figure 1.1. At the time the EIS was published, progressive development of five development regions (Wandoan, Chinchilla, Dalby, Millmerran and Goondiwindi) was proposed (EIS Chapter 5, Project Description, Section 5.3.1). The development sequence has been revised to the progressive development of eleven drainage areas, identified by sequential numbering, that correspond with the gas reserves that will be fed into each central gas processing facility (CGPF) (SREIS Chapter 3, Project Description, Section 3.4).

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Issue No.	Submission No.	Issue	Reference	Responses
R1003	S088	Request that the regulator free the constraints on Arrow from developing coal seam gas activities on state land, in exchange for staying off the highly valuable black soil floodplain until the resource is expended on state land.	EIS Chapter 8, Section 8.4	Noted. Arrow will develop the gas resources in accordance with applicable laws, including on land that can be accessed for petroleum development.
R1004	S081	Are petroleum activities exempt from State Planning Policy 1/92: Development and the Conservation of Agricultural Land and Strategic Cropping Land (SCL) Legislation?	EIS Chapter 2, Table 2.3 and Chapter 13, Section 13.4.7 SREIS Chapter 2, Section 2.4.1	Petroleum activities are exempt from State Planning Policy 1/92, however the project has considered this and other key state planning policies in EIS Chapter 2, Project Approvals, Table 2.3. Further assessment of potential impacts on good quality agricultural land is presented in EIS Chapter 13, Agriculture, Section 13.4.7. Petroleum activities are not exempt from the requirements of the <i>Strategic Cropping Land Act 2011</i> (Qld). See SREIS Chapter 2, Project Approvals, Section 2.4.1 for further information.
R1005	S081, S094	The chief executive should not allow the EIS to proceed until the EIS can conform to the standard criteria. If the EIS cannot satisfy the standard criteria, then the project should be refused.	EIS Attachment 7	Standard criteria are defined in Schedule 4 of the <i>Environmental Protection Act 1994</i> (Qld)(EP Act). The standard criteria pertain to matters that the chief executive of the administering authority must consider when making decisions under the EP Act. This includes determining whether an EIS is required for a development and the regulatory requirements that must be addressed when the chief executive prepares an EIS assessment report. There is no requirement for an EIS to 'satisfy the standard criteria', however the EIS and SREIS must address the prescribed EIS Terms of Reference (TOR). The TOR require the EIS to 'present a brief summary of the project's compatibility with the standard criteria as defined by the <i>Environmental Protection Act 1994</i> , which include the principles of ESD and other relevant policy instruments.' This requirement has been addressed in EIS Attachment 7, Ecologically Sustainable Development, Section 6.
R1006	S094, S108, S117, S138, S142, S163	The chief executive should not allow the EIS to proceed until all the deficiencies of the EIS have been addressed and it can convincingly show a significant net social, economic and environmental benefit.	EIS Chapter 21, Section 21.6 SREIS Chapter 3	The SREIS presents changes to the project description that have occurred since the publication of the EIS (SREIS Chapter 3, Project Description) and discusses any outstanding information requirements in accordance with the prescribed terms of reference. EIS Chapter 21, Economics, Section 21.6 presents a cost-benefit analysis for the Surat Gas Project.
R1007	S157	Of particular concern to the submitter is the possibility of the Coordinator General being approached prior to the issuing of an EA for the project. There is concern that the flaws in the EIS and the EMP will pollute decision making.	SREIS Chapter 2, Section 2.3	The EIS for the Surat Gas Project is being assessed in accordance with the requirements of the <i>Environmental Protection Act 1994</i> (Qld)(EP Act). The decision maker under the EP Act is the chief executive. Completion of the EIS process as set out under the EP Act does not negate the need for Arrow to obtain EA or EA amendments for the project; see SREIS Chapter 2, Project Approvals, Section 2.3. For further clarity, EIS Attachment 5, Environmental Management Plan (EMP), which has been updated in SREIS Attachment 2, Strategic Environmental Management Plan, is a preliminary document that will be

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R1007	S157			further developed to support the application for development approval of all of the project components. The plan summarises the mitigation, inspection and monitoring measures identified in the EIS developed to manage impacts and reduce environmental risk. While representing a thorough summary of Arrow's commitments to avoid, minimise, mitigate and manage environmental impacts it does not contain all the site-specific information required for formal issuance of an EA or EA amendment. EA or EA amendment application(s) will be lodged in accordance with the statutory requirements and will include supporting technical information, as required. These requirements are currently outlined in the EHP Guideline "Application requirements for petroleum activities". An alternative EIS process in the State of Queensland is that regulated under the <i>State Development and Public Works Organisation Act 1971</i> (Qld) (SDPWO Act), The Coordinator-General is the decision maker under SDPWO. This process is not applicable to the Surat Gas Project.
R1008	S014, S044	The administering authority should take into account the Condamine Floodplain residents' public interest and lack of support for the project, as it relates to the Environmental Protection Act 1994 Standard Criteria used to assess the Surat Gas Project.	-	Noted. Under the standard criteria as defined in Schedule 4 of the <i>Environmental Protection Act 1994</i> (Qld), the chief executive is required to consider all submissions made by the project proponent and submitters and the public interest.
R1009	S055	Prior to approval all environmental values within the project area must be properly described, otherwise the nature and severity of impacts may be underestimated and environmental controls may not be appropriate.	EIS Chapters 9 to 26 and Attachment 10 SREIS Chapter 2, Section 2.3 and Attachment 8	EIS Chapters 9 to 26 describe the environmental values of the project area. Where applicable, environmental values within the project area have been incorporated in constraints mapping presented in EIS Attachment 10, Preliminary Constraints Maps and SREIS Attachment 8, Constraints Mapping Update. The framework approach identifies constraints to coal seam gas development in the project development area, having regard to the sensitivity of identified environmental values. Site specific environmental assessment will be undertaken as required, prior to each EA or EA amendment application in order to provide the level of detail required by legislation to support these applications (see SREIS Chapter 2, Project Approvals, Section 2.3).
R1010	S116	An EA must provide minimum conditions for minimising: • Traffic movements • Noise Pollution • Light Pollution	-	Environmental conditions considered relevant to the project will be set by the administering authority.
R1011	S130	Western Downs Regional Council requests that the project be assessed under the 'significant' project legislation, in line with other similar projects including QCLNG and APLNG.	EIS Chapter 1, sections 1.1 and 1.4	Unlike the other LNG projects in Queensland, at the time the EIS processes for the Surat Gas Project, Arrow Surat Pipeline (formerly the Surat Gladstone Pipeline), and Arrow LNG Plant (formerly the Shell Australia LNG Project) commenced in 2009, each project was proposed by a different proponent. On this basis, separate approvals processes commenced under the

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R1011	S130			<p><i>Environmental Protection Act 1994</i> (EP Act) (Arrow Surat Pipeline and Surat Gas Project) and the <i>State Development and Public Works Organisation Act 1971</i> (SDPWO Act)(Arrow LNG Plant). In the case of the Arrow Surat Pipeline, the EIS process was completed in January 2010 and an EA and pipeline license have since been issued.</p> <p>On 23 August 2010, a 50:50 joint venture between a subsidiary of Royal Dutch Shell plc and a subsidiary of PetroChina Company Limited (PetroChina) acquired ownership of Arrow Energy (EIS Chapter 1, Introduction, Section 1.4). Under this new ownership structure, the above projects together with the Bowen Gas Project and Arrow Bowen Pipeline have come to comprise the larger Arrow LNG Project (EIS Chapter 1, Section 1.4). Existing EIS processes, which were well advanced at the time of the Royal Dutch Shell and PetroChina acquisition of Arrow Energy, have continued. Each project must address comprehensive terms of reference under either the EP Act or the SDPWO Act and there is no benefit to be gained from recommencing a consolidated EIS process under the SDPWO Act, especially as two components of the larger Arrow LNG Project (Arrow Surat Pipeline and the Arrow Bowen) have already been approved.</p>
R1012	S150	<p>The EIS must provide information on whether Arrow intends to reinject gas as a means of safeguarding the domestic gas supply. The submitter has been informed by DERM that other companies perform gas reinjection. The submitter makes the following recommendations:</p> <ul style="list-style-type: none"> • That all gas reinjection pilot trials or operational activities require a full and accurate assessment of all minor and major risks to environment and human health and well-being including sustainable economic development of the region. • That Arrow be required to produce independently peer-reviewed scientific data to support all future applications to trial reinjection of gas whether it be a pilot study or any other gas reinjection activity. • That a fully explained business case which includes a full cost analysis around the gas management practices that cause the need for storing excess gas in the first instance is provided by Arrow. • That EHP (formerly DERM) make publically available information outlining where gas reinjection activities are currently occurring or are proposed to occur and all conditions associated with those gas reinjection activities or trials. 	-	The reinjection of gas is not proposed as part of the Surat Gas Project.

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Issue No.	Submission No.	Issue	Reference	Responses
R1013	S150	The Queensland Murray Darling Committee is concerned by the number of additional key permits and approvals required and the compliance obligations attached them. How will the level of monitoring be resourced considering the number of additional permits and approvals required?	EIS Chapter 2, sections 2.2.5 and 2.3	Noted. Arrow will be required to hold all relevant permits and approvals under applicable legislation. Arrow will use and/or establish processes and procedures under the company's HSEMS to achieve compliance with environmental conditions.
R1014	S150	The Queensland Murray Darling Committee Mining and Energy Policy has been updated since 2009 (October 2011). There are a number of key changes that would require Arrow to revisit if they are serious in their consideration of key planning policies.	EIS Chapter 2, Section 2.5.1 SREIS Attachment 7	Noted. Reference to this planning document has been included in SREIS Attachment 7, Legislation and Policy.
R1015	S150	The Regional National Resource Management Plan was not considered by Arrow and is missing from Table 2.3. Suggests that this Plan is an invaluable tool for Arrow to consider.	EIS Chapter 2, Section 2.5.1 SREIS Chapter 9, Section 9.3.	Noted. Reference to this planning document has been included in SREIS Chapter 9, Surface Water, Section 9.3.
R1016	S011	Appendix K, Section 4.5.2 (Approach to Impact Significance Developments) makes conclusions regarding the significance of impacts based on the assumption that proven mitigation measures will be utilised and applied successfully. Therefore, any project approval or conditions which are based on this assessment of significance must be contingent on proven mitigation measures being utilised and applied successfully.	–	The administering authority will consider the proposed mitigation and management measures (commitments) in setting conditions of approval for the project.
R1017	S157	The terms of reference also recommend that the Environmental Management Plan make an assessment of the project's compatibility with the standard criteria as defined by the Environmental Protection Agency, which require consideration of the "character, resilience and values of the receiving environment". The Environmental Management Plan is deficient in relation to these topics, and does not support the underlying intent of the terms of reference to enable the "potential for petroleum activities to occur on any individual lot of land in the project area". Arrow therefore fails to fulfil the requirements of Section 5 of the terms of reference.	EIS Attachment 5 SREIS Chapter 2, Section 2.3.2 and Attachment 2	For further clarity, EIS Attachment 5, Environmental Management Plan (EMP), which has been updated in SREIS Attachment 2, Strategic Environmental Management Plan, is a preliminary document that will be further developed to support the application for an environmental authority (EA) or EA amendment for all of the project components. The plan summarises the mitigation, inspection and monitoring measures identified in the EIS developed to manage impacts and reduce environmental risk. While representing a thorough summary of Arrow's commitments to avoid, minimise, mitigate and manage environmental impacts it does not contain all the site-specific information required for formal issuance of an EA or EA amendment. For further clarity, the EMP updated for the purposes of the SREIS has been termed a Strategic EMP. The purpose of the Strategic EMP and subsequent

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R1017	S157			plans that may be developed as the project progresses are presented in Section 1.3 of the Strategic EMP (SREIS Attachment 2). The EA or EA amendment application(s) will be lodged in accordance with statutory requirements and will include supporting technical information as outlined in the EHP Guideline "Application requirements for petroleum activities".
R1018	S157	Landholders can apply under Section 537DB to the Land Court for orders that no activities be undertaken on their land. However, without understanding the separation distances for all infrastructure and land uses etc., landholders are not sure if they are able to apply for a similar order based on activities on neighbouring land.	–	Arrow is not in a position to offer legal advice. The circumstances of each case would need to be considered individually by a legal professional. A minimum buffer distance of 200 m has been developed by Arrow to address a range of issues including community concerns over proximity of infrastructure to people's homes. Arrow has committed to ensuring that emissions from Surat Gas Project activities comply with established air quality (EIS Chapter 9, Air Quality, Section 9.6). In the case of noise, site-specific, detailed noise modelling of production facilities and the application of acoustic treatments will be undertaken where the modelled noise from facilities exceeds the established noise criteria at one or more sensitive receptors. Consideration of intrinsically quieter equipment or design of acoustic treatments such as hospital-grade exhaust systems and mufflers, or barriers and equipment housing will be given (Commitment C310). In December 2012, Arrow commenced a process of Area Wide Planning with landholder groups throughout the Surat. This process aims to enable Arrow and landholders to understand the potential impacts gas field infrastructure may have on farming operations, overland flow on the wider floodplain and address how these impacts can be mitigated or minimised, on both individual and neighbouring properties.
R1019	S157	Even if more location specific information is being provided by Arrow confidentially to the regulator, Arrow still fails to meet the requirements of the terms of reference specifically section 3.1.2, Local Context. Even though the terms of reference recognise that the exact location of infrastructure will not be able to be presented in the EIS (Section 4.14), the submitter indicates that this is contradictory to the requirements in the following section of the terms of reference". Section 3.1.2, which asks for "identifying potential areas to site infrastructure". Section 4.14 (second paragraph) which asks for "information and criteria used to inform the site selection and decision making on the siting of project activities..." Section 4.14 (third paragraph) which requires "the analysis must be sufficient to determine the potential for petroleum activities to occur on any individual lot of land in the	EIS Chapter 5, Chapter 8 SREIS Chapter 3, Section 3.5 and Attachment 8	The Surat Gas Project is a progressively staged development in eleven drainage basins over the estimated 35 year project life (SREIS Chapter 3, Project Description, Section 3.5). EIS Chapter 5, Project Description, Section 5.2 described the various project components and identified that development may occur on any parcel of land within the project development area, except urban areas, 'no go' areas, and areas subject to other environmental constraints as discussed in EIS Chapter 8, Framework Approach. Arrow has proposed the framework approach to inform the siting of infrastructure. The framework identifies constraints to coal seam gas development in the project development area, having regard to the sensitivity of identified environmental values. The level of environmental constraint provides an indication of the project activities that could occur in a particular area, subject to the application of appropriate environmental management controls. The framework approach also indicates what project activities should not occur in certain areas; see EIS Chapter 8, Table 8.1. Known and potential areas of development (regional and local context) are presented in SREIS Attachment 8, Constraints Mapping Update.

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R1019	S157	project area."		<p>Precise locations of wells and associated infrastructure will be agreed with landholders under the terms of a conduct and compensation agreement, taking into account environmental and existing land use constraints. The EIS conceptualised that vertical wells would be drilled across the project development area with a separation distance between wells averaging a minimum of 800 m. As discussed in SREIS Chapter 3, Project Description, Section 3.4, the use of deviated drilling technology may allow the surface well pad sites for multi-well pads to be separated over a distance in excess of 2,000 m where possible.</p> <p>It is not feasible that the precise location of approximately 6,500 wells be known in advance, as knowledge of gas reserves will evolve over time and infrastructure needs to be planned to reduce impacts to landholder's existing and future land use. Site-specific environmental assessment will be undertaken, as required, prior to each environmental authority (EA) or EA amendment application in order to provide the level of detail required by legislation to support these applications (see SREIS Chapter 2, Project Approvals, Section 2.3). Since the publication of the EIS, property locations have been identified for four CGPFs and a temporary workers accommodation facility (see SREIS, Chapter 3, Project Description, Section 3.5). These sites have been investigated as part of the SREIS to determine potential impacts and management measures. This information will support an EA or EA amendment application for the initial stage of proposed development.</p>

Table 19.2 Project Need

Issue No.	Submission No.	Issue	Reference	Responses
R2001	S046	Coal seam gas is a very considerable emitter of greenhouse gas in comparison with solar.	–	Noted.
R2002	S150	The preparation of technical reports should include an evaluation of alternative forms of development, and significant weight should be given to those strategies which minimise the impacts on natural resources.	EIS Chapter 8	As described in EIS Chapter 8, Environmental Framework, the technical reports have been prepared to inform the protection of environmental values and natural resources of the project development area. The framework approach allows appropriate environmental management controls for project activities to be identified and has underpinned the preparation of the EIS. Technical studies have identified and documented environmental and social constraints to activities within the project development area. Constraints mapping will be utilised to assist in siting project infrastructure, and will be updated on an ongoing basis. The framework approach provides for the orderly development of coal seam gas fields through the application of environmental management controls (avoidance, mitigation and management) that are reflective of the level of sensitivity of environmental values. In doing so, the approach allows for alternative sites to be considered for facilities and wells where environmental and social impacts can be avoided or reduced.
R2003	S050, S082	No alternatives have been proposed that preserve the premium agricultural assets and allows a gas industry on the non-cropping and marginal cropping land. This is an extremely unbalanced view given the world's need to double food production by 2050 and the Queensland Government's policy is to do likewise.	EIS Chapter 13, Section 13.6	EIS Chapter 13, Agriculture, Section 13.6, notes that through appropriate consultation with landholders and the broader community, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Key strategies for reducing the potential for permanent alienation of IFL include the siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, aligning new infrastructure with existing infrastructure where practicable and locating production facilities on less productive land, not IFL. Further, as part of Arrow's commitment to coexistence, Arrow has committed to minimising its operational footprint to less than 2% of total IFL area.
R2004	S081, S082, S108, S111, S117, S138, S142, S163	The need for the project appears to rely on data from 2007 and projects a linear growth in demand for all energy sources to 2030. These projections neglect the recent and significant changes in the renewable sector, particularly the role of solar in meeting energy demands. These changes will significantly erode the need for future gas supplies, a factor which is neglected in the EIS. The supplementary EIS therefore needs to look at other options rather than full on, irrational exploitation of coal seam gas reserves with its associated significant impacts. There are better	EIS Chapter 3, sections 3.1.1 and 3.3.2	Alternative energy sources (including renewables) to coal seam gas do exist, although not currently on a scale and stage of development that will meet Australian and world energy demands in the short to medium term. Natural gas has been widely identified as a 'transitional' fuel that will allow governments to implement policies that provide both for economic growth and a move from a high dependence on carbon rich fossil fuels (such as coal) to a range of less carbon intensive sources, including renewable energy. Predictions by the International Energy Agency, published in 2010 and discussed in the EIS, identified natural gas, in particular, as playing a central role in meeting the world's energy needs for the next two-and-a half decades (EIS Chapter 3, Project Need, Section 3.1.1). The International Energy Agency's most recent World Energy Outlook (IEA, 2012), which focuses on

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R2004	S081, S082, S108, S111, S117, S138, S142, S163	energy alternatives to coal seam gas.		the period 2010 to 2035, predicts that renewables will grow rapidly and provide an increasing share of global primary energy use on the basis of government support, falling costs, carbon pricing and rising fossil fuel prices in the longer term. Fossil fuels (oil, gas and coal) are however expected to remain the principal source of energy worldwide, with natural gas almost overtaking coal as the primary energy supply mix by 2035. In Queensland, the Government considers the use of gas to be a key factor in reducing the greenhouse gas emissions intensity from electricity generation (Queensland Government, 2007). Reliance on natural gas therefore will continue through the next 20 to 30 years while alternatives, such as solar, become more viable on a large scale.
R2005	S030	There are many other sites more suitable for the development of the gas resource other than highly developed irrigation farmland. By the project not proceeding, the supposed benefits will not be lost; they will be deferred to a more appropriate time when science can fully inform an approval.	EIS Chapter 13, Section 13.6	The Surat Gas Project aims to extract coal seam gas for domestic use and LNG export. The location of the proven and probable coal seam gas resources will determine the most appropriate and viable areas for field development. EIS Chapter 13, Agriculture, Section 13.6, notes that through appropriate consultation with landholders and the broader community, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Key strategies for reducing the potential for permanent alienation of IFL include the siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, and locating production facilities on less productive land, not IFL.
R2006	S108, S117, S138, S142, S163	The supply of LNG is not guaranteed to substitute higher emission energy sources as it may delay the implementation of zero emission energy projects such as wind or solar. A report prepared for APPEA (Australian Petroleum Production and Exploration Association) showed that emissions are highly dependent on technology and even ultra super critical black coal power stations can have lower life-cycle emissions intensity than some open cycle gas turbine power stations. Assessment criteria for the Project Environmental Authority do not include assessment of the impact of other activities that may seek approval if the project does not proceed. Further, it would be neglecting the requirements of the Environmental Protection Act to disregard the emissions from the project due to a hypothetical consideration of other projects that may seek approval if the project is refused.	EIS Chapter 3, sections 3.1.1 and 3.3.2 SREIS Appendix 3, Section 6	Natural gas has been widely identified as a 'transitional' fuel that will allow governments to implement policies that provide both for economic growth and a move from a high dependence on carbon rich fossil fuels (such as coal) to a range of less carbon intensive sources, including renewable energy. Predictions by the International Energy Agency are that natural gas, in particular, will play a central role in meeting the world's energy needs for the next two-and-a half decades (EIS Chapter 3, Project Need, Section 3.1.1). In Queensland, the Government considers the use of gas to be a key factor in reducing the greenhouse gas emissions intensity from electricity generation (Section 3.3.2). Reliance on natural gas therefore will continue through the next 20 to 30 years while alternatives, such as solar, become more viable on a large scale. The move to alternative energies and the rate of this change will, to a large extent, also be dependent on the policy framework adopted by different governments around the world. The EIS can only assess projects that exist, have taken a financial investment decision to proceed, or have sufficient information available to enable cumulative impacts to be assessed. Projects meeting these criteria have been included in the cumulative assessment (EIS Chapter 28, Cumulative Impacts). The EIS is not required to assess hypothetical alternatives as

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R2006	S108, S117, S138, S142, S163			typically there is limited information to inform an adequate assessment. An assessment of life cycle emissions for the SREIS worst-case greenhouse gas emissions year (2029) in comparison with brown coal, black coal and natural gas is presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 6. Table 6.1 shows that the total life cycle emissions per unit of energy of fuel are 58 for coal seam gas, 93 for brown and black coal and 59 for natural gas.
R2007	S141, S144	The EIS ignores the existing coal seam gas developments in Queensland and supposes that without this particular project proceeding Queensland will miss out on the economic opportunities offered by the broader coal seam gas industry.	EIS Chapter 28, Section 28.3.10	The EIS considers other coal seam gas developments in Queensland in the context of economic, social and environmental impacts and acknowledges that other projects will also have a positive economic impact on the regional, state and national economies. What the EIS identifies is the additional benefits, economically, that will accrue to Queensland and Australia from the project, which are significant and would be lost if the project does not proceed. As described in the EIS Chapter 28, Cumulative Impacts, Section 28.3.10, the Surat Gas Project's maximum contribution to the annual gross regional, state and domestic product is estimated to be approximately 5%, 0.3% and 0.1%, respectively. This equates to a maximum annual increase of about \$1.4 billion per annum for these economies.
R2008	S026	The project will increase supply to an already oversupplied market.	EIS Chapter 3, sections 3.1.1 and 3.1.2	EIS Chapter 3, Project Need, discusses International (Section 3.1.1) and Australian (Section 3.1.2) gas and energy demand. A key point in the discussion of gas demand (and supply) is the ability of LNG to be transported around the world. Traditionally, gas has been a regional resource due to limitations on transport (the requirement for transmission pipelines). The transportability of LNG across longer distances and oceans means it has become a worldwide commodity supplying a global market. This market for LNG is not currently oversupplied, nor is it predicted to be during the life of the project. World energy demand is predicted by the International Energy Agency to increase by 35 to 40% between 2008 and 2035 and the independent Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), has predicted ongoing increases in Australian LNG exports to meet this demand, particularly from emerging economies.
R2009	S108	Arrow claims that the project will ensure domestic gas demand can be met at least well into the next century, without any commitment to ensure this.	EIS Chapter 3, sections 3.2 and 3.3	EIS Chapter 3, Project Need, Section 3.2.1 discusses the estimates of domestic gas resources by Geoscience Australia and ABARES. Estimates of reserves are equivalent to 180 years of 2010 production rates and are likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore sufficient to sustain both a domestic and export industry (Section 3.2.3) and the project is expected to contribute to meeting domestic gas demand, as well as exporting gas as LNG. However, it is not Arrow's role to commit to meeting domestic gas demand. The ongoing development of a competitive gas market will assist in providing efficiency, transparency and appropriate investment

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Issue No.	Submission No.	Issue	Reference	Responses
R2009	S108			signals.
R2010	S150	Arrow should assess all risks minor and major to the environment and human health and well-being including the region's economic sustainable development and describe fully the preventative measures Arrow proposes to safeguard domestic gas supply. It is not clear how the international energy market demand safeguards Australia's domestic gas supply.	EIS Chapter 1, Section 1.5.1 and Chapter 3, Section 3.2 and Chapters 9 to 28 SREIS Chapters 5 to 15	A key objective of the EIS is to examine and assess potential environmental, social and economic impacts of the proposed project, both direct and indirect (EIS Chapter 1, Introduction, Section 1.5.1). The findings of the assessments are included in EIS chapters 9 to 28 and the revised assessments are in SREIS chapters 5 to 15. The SREIS summarises the further studies that have been carried out for the project development area and provides additional information and assessment of potential impacts of the project. An efficient gas market with international linkage will deliver competitively priced gas without the need for a distortionary energy policy to safeguard domestic gas supply. Arrow shares the objective that Queensland households and business have access to long-term, secure supplies of energy. Arrow is, and remains, committed to meeting its contracted domestic supply obligations and is presently producing in excess of 100TJ per day. Arrow is continually looking for opportunities in all areas of the value chain and has positioned itself as a lead participant in this area in Queensland. LNG projects require scale investments to establish the infrastructure, processes and technologies that are required to competitively produce coal seam gas. Without the development of domestic, and linkage to international markets orderly development of supply by way of investment could not be assured and the absence of competitive forces lead to inefficient pricing. Sustainable commercial viability is underpinned by access to international LNG pricing. Current estimates of gas reserves in Australia are equivalent to 180 years of 2010 production rates and these estimates are likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore sufficient to sustain both a domestic and export industry (EIS Chapter 3, Project Need, Section 3.2.3). The ongoing development of a competitive gas market will assist in providing efficiency, transparency and appropriate investment signals.
R2011	S150	A number of issues (e.g., energy demand management, climate change impacts, and environmental impacts) have not been considered fully to give credibility to Arrow's statement that Australia's gas resources are sufficient to sustain both a domestic and export industry.	EIS Chapter 3, Section 3.2 and Chapter 29	EIS Chapter 3, Project Need, draws on the most recent published information available on energy demand and markets and the current understanding of Australia's gas reserves. These sources are included in Chapter 3 with detailed citations in EIS Chapter 29, References. Current estimates of gas reserves in Australia are equivalent to 180 years of 2010 production rates and are likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore considered, by several sources, to be sufficient to sustain both a domestic and export industry (EIS Chapter 3, Project Need, Section 3.2.3).

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R2012	S150	The EIS should provide all relevant information related to the influence of energy market demands, commercial sales contracts and exploration information on the rate of field development and project phasing.	EIS Chapter 3, Section 3.2.2 and Table 3.3 SREIS Chapter 3	Information on market gas demand and Arrow's current long term gas supply agreements are provided in EIS Chapter 3, Project Need, Section 3.2.2, Table 3.3. Further updated information is provided in the SREIS Chapter 3, Project Description on the rate of field development and project phasing.
R2013	S024, S025, S036, S081, S083	For how long will Australia's gas resources sustain both a domestic and export industry, from all the various projects that have been approved?	EIS Chapter 3, Section 3.2.3	EIS Chapter 3, Project Need, discusses the estimates of domestic gas resources made by Geoscience Australia and ABARES. Estimates of reserves are equivalent to 180 years of 2010 production rates and are likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore sufficient to sustain both a domestic and export industry (Section 3.2.3) for the foreseeable future. The project is expected to contribute to meeting domestic gas demand, as well as exporting gas as LNG.
R2014	S150	The EIS fails to address other key energy policy drivers and has selected only those that promote economic development.	EIS Chapter 3, Section 3.3	The energy policy framework described in EIS Chapter 3, Project Need, Section 3.3 is based on several factors that include economic considerations, but also other considerations. These include the strategic need for long term security of energy supply for the ongoing health and well-being of Australia's economy and people as well as the need to reduce greenhouse gas emissions. The national and state level policies described in this section touch on all these elements.
R2015	S150	More detail is needed to fully consider environmental and social impacts especially with regards to an economic analysis and impacts on natural and social capital. What impact on the region's communities and natural resource assets does placing more importance on the economy than the natural or social capital have?	EIS Chapter 21 and Chapter 22 SREIS Chapter 14	The purpose of the EIS is to provide assessment of the potential environmental, social and economic impacts of a project. The social (EIS Chapter 22, Social) and economic (EIS Chapter 21, Economic) impact assessments undertaken for the EIS draw on all available research and government data and adopt recognised methods for the assessment of social and economic impacts. The updated social assessment for the SREIS is included in SREIS Chapter 14, Social.
R2016	S150	Arrow should provide independently peer reviewed research data that analyses what the impact on the region's communities and natural resource assets are when more importance is placed on the economy than on natural or social capital.	EIS Chapter 21 and Chapter 22 SREIS Chapter 14	The social (EIS Chapter 22, Social) and economic (EIS Chapter 21, Economic) impact assessments undertaken for the EIS draw on all available research and government data and adopt recognised methods for the assessment of social and economic impacts. The updated social assessment for the SREIS is included in SREIS Chapter 14, Social.
R2017	S108	Arrow states that by the project not proceeding negative impacts include 'Potential investment in local and regional infrastructure and services may not occur or may occur more gradually....' This is equivalent to saying that the government and other industries will pay for providing services to Arrow to utilise if the project does go ahead.	EIS Chapter 3, Section 3.4 SREIS Attachment 3	EIS Chapter 3, Project Need, Section 3.4 makes the point that the development of local and regional services and infrastructure would likely be aided by the project proceeding, but that this opportunity, through the Surat Gas Project, will be lost if the project does not go ahead. Any additional services and infrastructure in the regions that might be provided as a result of the project proceeding would not be provided solely to Arrow and in some cases may be partially funded by Arrow (SREIS Attachment 3, Social Impact

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Issue No.	Submission No.	Issue	Reference	Responses
R2017	S108			Management Plan). It is this opportunity to improve services for the benefit of the community that would be lost.
R2018	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S050, S053, S059, S064, S065, S070, S076, S085, S088, S095, S096, S097, S098, S108, S114, S139, S140, S152, S154, S167	The EIS points out that by not proceeding, soils and waters won't be impacted and additional strain will not be placed on supply of skilled workers, however the EIS fails to make any compelling environmental or social case for proceeding.	EIS Chapter 1, Section 1.5.1, Chapter 3, Section 3.5, Chapter 21 and Chapter 22 SREIS Chapter 14	A key objective of the EIS is to examine and assess potential environmental, social and economic impacts of the proposed project, both direct and indirect (EIS Chapter 1, Introduction, Section 1.5.1). As such, it does not aim to make an environmental or social case for proceeding but to provide a basis of understanding of the project for affected persons and government. EIS Chapter 3, Project Need, focuses on the main drivers for the project, which are to use gas from the Surat Basin to supply the domestic market and Queensland's growing LNG export industry (Section 3.5). The economic and social impacts of the project are discussed in EIS Chapter 21, Economics and EIS Chapter 22, Social and SREIS Chapter 15, Social.
R2019	S143	There is disagreement with the stated negative impacts of the project not proceeding (EIS Chapter 3, page 17). The economic benefits of the project have been overstated (e.g., high exchange rate for the Australian dollar and resulting impacts on local manufacturing and tourism job opportunities are not new jobs but are replacements to jobs lost and social impact of FIFO (fly-in, fly-out) is not complete). A cost benefit analysis of all aspects of the project should be undertaken.	EIS Chapter 21, sections 21.4.1 and 21.4.3 Chapter 22, sections 22.6.2 to 22.6.8 SREIS Chapter 14	EIS Chapter 21, Economics, provides a detailed analysis of the potential economic impacts of the project. This analysis includes impacts on gross regional, state and national product (Section 21.4.1) and impacts on employment, workforce and wages (Section 21.4.3). EIS Chapter 22, Social, includes a detailed assessment of the potential impacts of a FIFO (fly-in, fly-out) workforce on the communities within the project development area (sections 22.6.2 to 22.6.8). The social impacts for the revised project description are discussed in SREIS Chapter 15, Social.
R2020	S162	EIS Chapter3, Section 3.4 has not put a strong case forward to show an overriding public need in proceeding with this project nor what the state and region will miss out on if it does not proceed. Outside of revenue for the state treasury, there is very little this project offers that benefits the local community as a whole which other projects don't already offer. The risk and uncertainty caused by impacts to strategic cropping land, GQAL (good quality agricultural land) classes 1 and 2, alluvial floodplains and aquifers do not outweigh the job creation (in a region below 'full employment' levels) and economic benefit.	EIS Chapter 1, Section 1.5.1 and Chapter 3, Section 3.5	A key objective of the EIS is to examine and assess potential environmental, social and economic impacts of the proposed project, both direct and indirect (EIS Chapter 1, Introduction, Section 1.5.1). As such, it does not aim to make an environmental or social case for proceeding but to provide a basis of understanding of the project for affected persons and for government to inform their assessment of potential impacts in view of legislative and policy provisions. The purpose of the EIS is also to propose management measures to address the identified impacts. EIS Chapter 3, Project Need, focuses on the main drivers for the project, which are to use gas from the Surat Basin to supply the domestic market and Queensland's growing LNG export industry (Section 3.5).
R2021	S162	Chapter 3 requires Arrow to describe the potential losses and benefits of this project not going ahead. The only benefit to the state is the revenue generated through royalties. There is very little	EIS Chapter 21 and Chapter 22 SREIS Chapter 14	The economic and social impacts of the project are discussed in detail in EIS Chapter 21, Economics and EIS Chapter 22, Social, and SREIS Chapter 15, Social. Economic benefits of the project extend further than just state revenue and accrue to the region and local areas. These economic benefits are in

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R2021	S162	local benefit that is not already being influenced by other projects and with three approved coal seam gas export projects it is hard to argue there is an overriding need for the resource to be extracted. As Arrow cannot demonstrate an 'overriding need' as defined by Strategic Cropping Land Legislation, it should therefore not be able to move on strategic cropping land (especially east of the Condamine River) until the 'overriding need' exists.		addition to any benefits attributable to other coal seam gas projects. Sustainable development of Queensland's resources is in the public interest as it provides broad benefits to Queensland and Australia in terms of economic development and diversification of industry which will assist in reducing the impact of drought in the Darling Downs region.
R2022	S108	No effort is made in the EIS to address the long term economic consequences in comparison with renewable energy production.	EIS Chapter 3, sections 3.1.1 and 3.3.2	Renewable energy production does not represent a viable alternative to natural gas at this time. Natural gas has been widely identified as a 'transitional' fuel that will allow governments to implement policies that provide both for economic growth and a move from a high dependence on carbon rich fossil fuels (such as coal) to a range of less carbon intensive sources, including renewable energy. Predictions by the International Energy Agency are that natural gas, in particular, will play a central role in meeting the world's energy needs for the next two-and-a half decades (EIS Chapter 3, Project Need, Section 3.1.1). In Queensland, the Government considers the use of gas to be a key factor in reducing the greenhouse gas emissions intensity from electricity generation (Section 3.3.2). Reliance on natural gas therefore is expected to continue through the next 20 to 30 years while alternatives, such as solar, become more viable on a large scale.
R2023	S024, S025, S026, S036, S081, S083	Is there potential for domestic gas supplies to become scarce or even exhausted? If so, what are the financial, logistical, and sovereign risk ramifications of this scenario?	EIS Chapter 3, sections 3.2.1 and 3.2.3	Australian gas resources are unlikely to become scarce in the foreseeable future. Estimates of domestic gas resources by Geoscience Australia and ABARES (EIS Chapter 3, Project Need, Section 3.2.1) are that there is the equivalent of 180 years of gas (at 2010 production rates) in Australia. This estimate is likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore sufficient to sustain both a domestic and export industry (Section 3.2.3).
R2024	S002, S003, S004, S006, S009, S018, S019, S020, S030, S032, S037, S039, S050, S053, S059, S064, S065, S070, S076, S085, S088, S095, S096, S097, S098, S108, S114, S139, S140, S149,	It is incorrect to claim that failure of the project proceeding will cost jobs and the opportunity for Queensland to compete in the global gas industry. The resource will remain in the ground, and the opportunities deferred to a later date, when the science and impacts are better understood.	EIS Chapter 3, sections 3.1.1 and 3.4	EIS Chapter 3, Project Need, Section 3.4 states that there will be an opportunity cost in terms of jobs associated with the project not proceeding, rather than it costing existing jobs i.e., the 1,000 jobs that would have been created by the project during construction, and 400 permanent jobs during operation, would not eventuate. Section 3.4 also states that Queensland will potentially miss the opportunity to capitalise on the current forecast global demand for LNG if the project does not proceed. This demand is expected to be very strong over the next 20 to 25 years (Section 3.1.1) as global energy demand increases by up to 40% to 2035. Gas is seen as a key transitional fuel during this period as countries

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R2024	S002, S003, S004, S006, S009, S018, S019, S020, S030, S032, S037, S039, S050, S053, S059, S064, S065, S070, S076, S085, S088, S095, S096, S097,			move away from traditional carbon intensive fuels to renewable energy sources. Leaving the gas resource in the ground would mean that this forecast window of opportunity would not be taken up. Consequently, the Queensland Government would not receive royalties from this resource during this period. There is an additional possibility that should this opportunity not be realised at this time, international demand will be sourced from other markets. The opportunity may not return to Australia, particularly if sovereign risk is perceived.
R2025	S157	The EIS states '[f]rom a commercial perspective, the 2P reserves are important, because the establishment of long term sales gas agreements generally require this level of confidence.' 2P reserves have a 50% confidence level with a likely percentage chance of coal seam gas activities occurring in those areas. There is a lack of clarity in this regard.	EIS Chapter 3, Section 3.2.1	2P reserves are those that are proven and probable i.e., proven reserves (1P) plus those reserves that analysis of geological and engineering data suggests are more likely than not to be recoverable (EIS Chapter 3, Project Need, Section 3.2.1). Long term sales gas agreements are based on the 2P reserve estimates. For the 'probable' proportion of these estimates, there is a greater than 50% chance that the gas will be recoverable. Experience shows that estimates of gas resources increase (rather than decrease) with field exploration and development. This trend has been the experience with coal seam gas, where growth in gas reserve estimates in Australia has been exponential since 2003.
R2026	S109	Local gas reserves in Queensland are being exhausted over a period of 3 to 50 years to satisfy immediate overseas demand, with little consideration for long term implications.	EIS Chapter 3, sections 3.2.1 and 3.2.3	Australian gas resources are unlikely to become scarce in the foreseeable future. Estimates of domestic gas resources by Geoscience Australia and ABARES (EIS Chapter 3, Project Need, Section 3.2.1) are that there is the equivalent of 180 years of gas (at 2010 production rates) in Australia, with a significant proportion of this found in Queensland. This estimate is likely to increase as reserve estimates tend to increase as exploration in new areas is undertaken. Australia's gas resources are therefore sufficient to sustain both a domestic and export industry (Section 3.2.3). The rate and extent of development of Queensland's gas resources will ultimately depend on market variables, such as energy market demand, gas prices, market locations, contracted quantities, and the prevailing regulatory environment. The Surat Gas Project is one of several developments in Queensland that together are improving the level of confidence in the extent of the gas reserves in the state.
R2027	S111	The long term is not considered i.e., revenues from coal seam gas are high now but what will happen in 50 years.	–	The recognised estimates of the domestic and global demand, even for long term predictions do not extend beyond 20 to 30 years. For example, the current longer term analysis by the International Energy Agency is to 2035, and includes a significant proportion of energy demand to be filled by gas resources. Predicting demand (and therefore the likely gas price) beyond this timeframe is inherently uncertain and likely to be influenced by numerous factors that are almost certain to change.
R2028	S015	How long will this remain a globally competitive industry (from reserves in the Surat Basin)? This	EIS Chapter 3, Section 3.1.1 and	Current predictions for global energy demand by the International Energy Agency are for increases of between 36 to 40% to 2035 (EIS Chapter 3,

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R2028	S015	comes to an end and people will still require food and good water.	Chapter 13, Section 13.6 SREIS Attachment 4	Project Need, Section 3.1.1). Natural gas is set to play a significant role in meeting this additional demand, with emerging economies in particular likely to become increasingly significant importers of LNG. The project is expected to supply the domestic and LNG export market, with a production life dependent on the depletion rate of the gas reserves in the Surat Basin. Facilities have a design life of approximately 25 years. Arrow has made numerous commitments, updated in the SREIS (Attachment 4, Commitments Update) to avoid, reduce and manage the potential environmental impacts of the project in the Surat Basin, including on water and soil resources. Arrow recognises the concerns that the community has in relation to the project and is working with the community and landholders to resolve how their interests can be considered and addressed through planning, design, construction and operation of the project. As set out in EIS Chapter 13, Agriculture, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL.
R2029	S037	Why would you potentially harm the environment for short term gain when the highly productive current land use could be continued for centuries?	EIS Chapter 5, sections 5.5.1 and 5.7.1 and Chapter 27, Section 27.3 SREIS Chapter 3 and Attachment 4	The EIS concludes that project impacts are manageable with implementation of the identified mitigation measures. Studies and assessments carried out for the SREIS validated this conclusion. Where required, further studies, as described in the EIS, will be carried out at proposed facility locations to inform the specific measures to be implemented in each location to avoid or reduce local impacts. Arrow has made significant commitments in the EIS to protecting the environment, which have been reviewed and updated for the SREIS. The final list of commitments is contained in SREIS Attachment 4, Commitments Update. Disruption to activities on agricultural land from wells and access tracks will be greatest during construction and are expected to generally decrease during operations. For example, the typical short-term construction footprint for each single production well is 1 ha and the operational footprint will be reduced in accordance with the Strategic Cropping Land Standard Conditions Code for Resource Activities. The design life of facilities is approximately 25 years with wells having a production life of 15 to 20 years and is dependent on depletion rate of the gas reserves over years. Decommissioning and rehabilitation will be a progressive process (Section 5.7). Following decommissioning, the well sites will be rehabilitated to a standard consistent with the surrounding land use, or as agreed with the landholder (Section 5.7.1). No permanent alienation or diminished productivity of the land is expected. Arrow recognises the concerns that the community has in relation to the project and continues to work with the community and landholders to resolve how their interests can be considered and addressed through planning,

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R2029	S037			design, construction and operation of the project.
R2030	S075, S077, S089, S112	The primary justification for the sustainability of the project is that 'the greenhouse gas emissions of coal seam gas are about half those of brown coal.' The statement does not take into account cumulative emissions from the life cycle of the project or emissions over the critical period for affecting climate change in the coming decades.	EIS Chapter 3, Section 3.1.1, Table 3.1 and Appendix D, Section 6 SREIS Chapter 6, Section 6.5 and Appendix 3, Section 6	EIS Chapter 3, Project Need, Section 3.1.1, Table 3.1 shows the greenhouse gas emissions per GJ of fuel combusted, not total life cycle emissions. Life cycle analyses are discussed in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 6. The updated life cycle assessment for the revised project description is provided in SREIS Appendix 3, Section 6. SREIS Appendix 3, Section 6 presents end-user Scope 1 (i.e., combustion of coal seam gas) and Scope 3 (i.e., extraction and transportation of coal seam gas) emissions factors derived for the worst-case year of the life of the project. The overall emission factor (Scope 1 and 3) associated with the use of coal and the use of coal seam gas shows that coal seam gas is less emissions intensive. The worst-case greenhouse gas CO ₂ -equivalent emissions for the year with the highest emissions from the project indicate that 2029 project emissions are equivalent to 0.012% of global 2009 emissions for consumption of fossil fuels. The updated greenhouse gas emissions for the revised project description are presented in SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5. The potential residual impact associated with climate change directly attributable to the Surat Gas Project on a global scale is negligible.
R2031	S108	Project demand for gas internationally and nationally is outlined and touted as a transition energy source but no effort is made to address the impact of coal seam gas on greenhouse gas production and climate change and the long term economic consequences in comparison with renewable energy production.	EIS Chapter 3 SREIS Chapter 6, Section 6.5	A direct comparison with renewable energy production for the period over which this project will operate is not necessarily relevant. Commercially viable renewable energy production on a scale to fully substitute more carbon intensive energy sources is still some time away. In the meantime, natural gas has been identified as a 'transitional' fuel that will allow governments to implement policies that provide both for economic growth and a move from a high dependence on carbon rich fossil fuels (such as coal) to a range of less carbon intensive sources, including renewable energy (Queensland Government, 2007). The worst-case greenhouse gas CO ₂ -equivalent emissions for the year 2029 (the project year with the highest estimated emissions) are equivalent to 0.012% of global 2009 emissions for consumption of fossil fuels. The updated greenhouse gas emissions for the revised project description are presented in SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5.

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Issue No.	Submission No.	Issue	Reference	Responses
R3001	S011	Toowoomba is 80 km and not 45 km from the project development area as stated in the EIS.	EIS Chapter 9, Section 9.2.1	EIS Chapter 9, Air Quality, Section 9.2.1 states that DERM ambient air monitoring stations, located in Toowoomba and Flinders View approximately 45 km and 135 km east of the project development area. According to current GIS data for the project, the project area is situated approximately 50 km from the centre of Toowoomba, and approximately 45 km from the outskirts of Toowoomba.
R3002	S123	Arrow need to undertake a comprehensive research project including, actual chemical composition of the salt, current markets for industrial salts, and potential new uses. If this work is being done, Arrow need to provide more information about some of the industrial use potentials that really exist.	EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.4.4	EIS Chapter 5, Project Description, Section 5.6.4 states that Arrow is consulting commercial enterprises to investigate viable opportunities for the beneficial use of brine. As part of this process, Arrow will commission selective salt precipitation trials to further: <ul style="list-style-type: none"> • Understand the chemical composition of the brine. • Identify methods to enhance precipitation of the brine. • Identify viable chemical processes to transform the brine into commercial products. The gathering of additional information regarding the collaborative and Arrow-only selective salt recovery plant options is provided in SREIS Chapter 3, Project Description, Section 3.4.4.
R3003	S124	Arrow to provide more accurate estimations of salt/brine waste volumes.	EIS Chapter 5, Section 5.6.1 SREIS Chapter 3, Section 3.4.4	As discussed in EIS Chapter 5, Project Description, Section 5.6.1, assuming an average salt concentration of 4,500 mg/L, Arrow expects that treatment of coal seam gas water will generate in the order of 4.5 t of salt per megalitre of coal seam gas water. Figure 5.17 of the same EIS chapter, indicates the coal seam gas water distribution sources and which are suitable to receive treated and untreated water. This figure has been updated for the SREIS to reflect the revised coal seam gas water and salt management strategy. SREIS Chapter 3, Project Description, Section 3.4.4, explains that the northern water treatment facility is currently expected to be sized to treat approximately 35 ML/d of coal seam gas water from the production wells in the area and the southern water treatment facility is expected to be rated at approximately 90 ML/d.
R3004	S092	Arrow is asked to detail the remedial actions for brine disposal, following restrictions to brine dams when floodwater closes major access roads for weeks at a time. Queries how Arrow will dispose of 10 to 20 truckloads per day.	–	Brine dams will be located at each water treatment facility, which are co-located with central gas processing facilities (CGPFs), CGPF2 and CGPF9. These dams will be designed with contingency for atypical weather events. The EIS presented estimates of the number and frequency of trucks required to remove brine (as a concentrate) from the brine dams at each of the six proposed water treatment facilities. The estimated number of trucks assumes removal of brine concentrate over a 10 year period leading up to and following decommissioning of the facilities. As water production will have significantly reduced or ceased prior to decommissioning, delays to trucking brine concentrate caused by flood events or other unforeseen circumstances will not affect storage capacity which will be designed to maintain an operating reserve. In reality, brine concentrate will be progressively removed over the life of the project resulting in less traffic and exposure to flood events etc. The scenario presented in the EIS represents a worst case and was

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R3004	S092			developed for traffic modelling and assessment purposes.
R3005	S011	Prior to project approval Arrow should develop, trial and gain approval for an alternative method of brine/salt disposal.	SREIS Chapter 3, Section 3.7.5	The preferred brine management option is selective salt recovery, allowing beneficial use opportunities. This may be performed using a brine treatment facility referred to as a selective salt recovery plant which will either be co-operated by multiple coal seam gas industry proponents (producing multiple salt products) or by Arrow (producing single salt products). As described in SREIS Chapter 3, Project Description, Section 3.7.5, Arrow is consulting with commercial enterprises to investigate viable opportunities for the beneficial use of brine/salt. As part of this process, Arrow is commissioning selective salt recovery trials to further: <ul style="list-style-type: none"> • Understand the chemical composition of the brine. • Identify methods to enhance precipitation of the brine. • Identify viable chemical processes to transform the brine into commercial products. Alternative methods of brine disposal are also presented in the form of injection, discharge to the ocean via pipeline and disposal to landfill at a suitably licenced facility.
R3006	S007, S112	Arrow should be required to come up with a viable plan to safely handle the salt produced by the project before any approval is considered, and all exploration work should be halted in the interim.	SREIS Chapter 3, Section 3.4.4	Although beneficial use is the preferred option for brine management (as detailed in SREIS Chapter 3, Project Description, Section 3.4.4), for the purposes of the EIS impact assessment, it was assumed that brine will be stored in dams and disposed to a suitably licenced landfill, and thus representing a worst-case scenario (in terms of greenhouse gas emissions and traffic generation) for assessment. This worst-case option, disposal to landfill, was fully assessed and found to be manageable.
R3007	S011	Concerned with cumulative amount of waste and brine/salt quantities from surrounding projects and its disposal. None of the possible methods of disposal have been determined to be safe and acceptable (e.g., unknown effect on water quality in aquifers or reinjection of brine).	EIS Chapter 26, Table 26.1, and Chapter 28, Section 28.3.13 SREIS Chapter 3, Section 3.4.4	EIS Chapter 26, Waste Management, Table 26.1 and Chapter 28, Cumulative Impacts, Section 28.3.13 explains that it is assumed waste management infrastructure within the region is able to cope with new developments. Should this not be the case, the project will transport waste to another facility with adequate capacity. Beneficial use is the preferred option for brine management (as detailed in SREIS Chapter 3, Project Description, Section 3.4.4), however for the purposes of the EIS impact assessment, it was assumed that brine will be stored in dams and disposed to a suitably licenced landfill, and thus representing a worst-case scenario (in terms of greenhouse gas emissions and traffic generation) for assessment. This worst-case option, disposal to landfill, was found to be manageable.
R3008	S081	Provide further details about a selective salt precipitation plant i.e., How many plants will there be? Where will these facilities be located? In association with integrated production facilities? What are the by-products of this process? What is done with the waste component? How long will it take to construct the plant? How long are they	SREIS Attachment 5	An investigation of a collaborative approach (with the other coal seam gas proponents in the region) for the development of a selective salt recovery plant for the management of brine is currently underway. At this stage, it is considered that the selective salt recovery plant be in the vicinity of CGPF2 (central gas processing facility). This is Arrow's most preferred brine management option, and should this or an Arrow-only selective salt recovery plant be progressed, a separate approvals process will be undertaken for the

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R3008	S081	operational? How much noise do they make? Are there any other emissions? Describe the environmental values, their sensitivity, the magnitude and extent of impacts, mitigation strategies?		plant and associated infrastructure.
R3009	S158	The construction of brine dams requires additional land use, which has not been accounted for in the opening description of the land use requirements of the 7,500 plus wells.	EIS Chapter 5	The brine dams are accounted for in the water treatment facility footprint, which could be up to 2 km ² (200 ha), as originally stated in the EIS.
R3010	S162	EIS Chapter 25, Table 25.3 requires a 30 m buffer, which differs greatly from the 10 m by 10 m space alluded to in the project description described in Chapter 5.	EIS Chapter 25, Section 25.4.1	As described in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1, the distance is dependent on the type of adjacent land use (generally dependant on the amount of time spent in that land use). The minimum distances for each land-use type (i.e., industrial (10 m), active open space (25 m), business and residential (30 m) and sensitive developments (35 m)) show that persons using the land-use types beyond those buffer zones are not exposed to unacceptable risk. The 10 m zone maintained around an operational well relates to the distance that will be maintained to confirm the safety of people and assets.
R3011	S024, S025, S026, S034, S036, S054, S069, S071, S081, S083, S162	What is the footprint of the camp and the small mobile camps associated with the drilling activities, the location (as the need to have them close to the central gas processing facilities means that they are likely to be on privately owned land) and what is the associated timeframe for their construction?	SREIS Chapter 3, Section 3.6.8	The construction workforce will be accommodated in temporary workers accommodation facilities (TWAFs) located in proximity to the central gas processing facilities. In some instances small mobile drilling camps may also be required. These camps accommodate less than 20 people per drill rig and would be located near production well drilling sites. Their location will be agreed with the landholder if not located on Arrow-owned or leased properties. These camps would contain a small canteen, vehicle parking areas and waste collection and storage areas. Construction of these small mobile camps is anticipated to take up to four weeks.
R3012	S143	Footprint and proposed locations of workers camps has not been provided. This information is required to understand the potential impact to lifestyle, services and amenity.	SREIS Chapter 3, Section 3.5	The property location for temporary workers accommodation facility (TWAF) TWAF F, located near Cecil Plains, is presented in SREIS Chapter 3, Project Description, Section 3.5. The five remaining TWAFs will be located on the same properties as the central gas processing facilities located between Wandoan and Miles and between Cecil Plains and Millmerran, as well as those near Miles, Kogan and Daandine.
R3013	S150	Queensland Murray Darling Committee is concerned that the full impact of both construction camps and small mobile camps is not being fully assessed especially if these camps are not located on land owned by Arrow.	SREIS Chapter 3, Section 3.5	Temporary worker accommodation facilities (TWAFs) will be located on the same property that is purchased to site the central gas processing facilities. The location for TWAF F, near Cecil Plains is presented in SREIS Chapter 3, Project Description. Additional terrestrial and aquatic ecology and surface water studies have been conducted for this site and are presented in the SREIS. The EIS has considered all project-related activities, identifying areas of constraint to project activities i.e., those areas with varying degrees of environmental value, within the overall project development area. Potential

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R3013	S150			impacts to all land tenure are assessed.
R3014	S134	Arrow to provide further details on how the camps are being serviced, including supply of water, treatment of sewerage and removal of waste.	EIS Chapter 5, Section 5.2.7, and Chapter 26, Section 26.6.4	EIS Chapter 5, Project Description, Section 5.2.7 explains that potable water is required during construction and operational activities. Water will be sourced and trucked from existing town water supplies, groundwater bores or treated coal seam gas water depending on the location of the activities and production facilities. EIS Chapter 26, Waste Management, explains that general waste will be segregated, treated if necessary and stored onsite prior to disposal. Segregation will include the separation of liquid from solid waste, separation of regulated from non-regulated waste, and separation of reusable and recyclable from non-reusable and non-recyclable waste (Commitment C496). Section 26.6.4 of the chapter explains that onsite waste treatment will be used for such purposes as sewage, which will be treated in packaged sewage treatment plants. Sewage treatment plants will be located at production facilities and include settlement, digestion, aeration, clarification and disinfection equipment.
R3015	S031	The location of the central gas processing facility within the Wandoan development region may impact on the submitter's property. Submitter unsure if the central gas processing facility will be located on their property.	–	The property on which the Wandoan-based central gas processing facility will be sited is not yet known, however the facility will be constructed on an Arrow-owned (preferred) or Arrow-leased property, as negotiated with the landholder.
R3016	S157	The EIS does not adequately detail the chemicals Arrow plans to use in its processes, and potentially bring on to food producing properties. Arrow should be required to detail all relevant chemicals, provide material safety data sheets, quantities, and indicate a means for accounting for quantities used and quantities remaining on the ground or in the aquifers.	EIS Chapter 5, Chapter 12, and Chapter 26, Table 26.2	Arrow manages drilling fluids across their life cycle, from production through to final disposal including transport, storage and usage. For every product that Arrow uses, we maintain a material safety data sheet (MSDS), which contains information on safe handling of the product, first aid and toxicity. Arrow has an MSDS for every chemical purchased and used in our operations, which are kept on site. Further, regular audits are carried out to show that all chemicals are handled and stored in accordance with regulatory safety requirements. EIS Chapter 26, Waste Management (including Table 26.2) outlines typical waste streams and projected quantities of waste to be generated by the project, including proposed methods of disposal and management. The type, quantity and management of wastes are indicative estimates only as the detailed design and execution plans have yet to be completed. EIS Chapter 5, Project Description details Arrow's current drilling activities and drilling fluid composition and explains that drilling fluid used in production well drilling and well site completion will be collected in surface tanks or in pits. The drilling fluid will be either removed from site for disposal at a licensed facility or stored in purpose-built containment structures on the property. Arrow will be required to contain all drilling muds and prevent uncontrolled runoff. During drilling activities, the volume of muds used will be continually monitored and at the completion of drilling, the muds will be stored in the surface containers for potential recycling and re-use during the drilling of other wells. The management of land contaminated through project

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R3016	S157			activities is discussed in EIS Chapter 12, Geology, Landform and Soils. Relevant commitments identified in the EIS to manage chemicals, included the following: <ul style="list-style-type: none"> • Apply appropriate international, Australian and industry standards and codes of practice for the handling of hazardous materials (such as chemicals, fuels and lubricants) (Commitment C035). • Minimise the inventory of hazardous materials stored on site (Commitment C177).
R3017	S157	No detail is given as to what method of well stimulation Arrow intends to undertake. All possible methods of well stimulation must be disclosed, and Arrow should commit to not engage in stimulation of wells or use chemicals that may cause environmental harm to aquifers e.g., acidisation.	–	Arrow will enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079).
R3018	S136	Black spots in the project area have been identified by emergency services, who request the opportunity to engage with Arrow regarding gaining access to new radio communications towers planned for construction.	–	Arrow will work with emergency service providers to promote efficiencies in the development of telecommunications systems for the project. At this point in time, communications are specific to construction and operations.
R3019	S150	Are communication towers included as key components of the infrastructure? If not, why not? What is their impact on the region e.g., air, biodiversity, vegetation, soils, floodplain function, electromagnetic radiation etc?	EIS Chapter 5, Section 5.2.7	EIS Chapter 5, Project Description, Section 5.2.7, describes supporting infrastructure required for the project, including telecommunications systems. Communication towers are planned for construction close to a central gas processing facility, at a distance from residences (at least 200 m).
R3020	S011	Preliminary constraints map number 8 (EIS Attachment 10) does not acknowledge the presence of several large livestock operations in the Millmerran to Cecil Plains area. The map shows the areas where these operations are located as low constraints areas. This casts doubt on the accuracy of other maps in the area.	EIS Chapter 8, and Attachment 10	EIS Chapter 8, Environmental Framework and the 'sources' identified on the maps provided in EIS Attachment 10, Preliminary Constraints Maps, explain that the maps comprise constraints related to environmental values of the natural environment (terrestrial ecology and nature conservation reserves etc), aquatic ecology, heritage, surface water hydrology and land tenure. The maps do not include data on industry or agricultural operations located on private land within the project development area. Constraints specific to a landholder's property will be identified through discussions with the landholder as part of a conduct and compensation agreement process.
R3021	S134	Arrow to avoid the siting of infrastructure on areas of high sensitivity.	EIS Chapter 8	EIS Chapter 8, Environmental Framework, explains that the principal objective of the environmental framework is to protect environmental values within the project development area (as defined in government policies and regulations or as an attribute of the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environment values. Central gas processing

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R3021	S134			facilities will not be developed within areas of high sensitivity. Any other project activities will be conducted in accordance with site-specific management controls identified prior to ground disturbing works.
R3022	S134	Arrow to identify whether pipelines will all be located outside protected and sensitive areas.	EIS Chapter 8, Section 8.2 and Attachment 10 SREIS Attachment 8	EIS Chapter 8, Environmental Framework, presents the categories that define levels of environmental constraint within the project development area, including the 'No Go' category, within which no project activities will be conducted. Section 8.2 presents the preliminary constraints analysis results, including areas categorised as 'No Go'. Gathering systems may however, be permissible in areas of high environmental constraint, subject to site-specific environmental management measures. Updated mapping is presented in SREIS Attachment 8, Constraints Mapping Update.
R3023	S110	Comment to government regarding development in state forests, national parks and state reserves. These locations should be free from constraints to enable coal seam gas developers to develop state land in exchange for avoiding floodplain strategic cropping land areas.	–	Noted.
R3024	S099	Design specifications relating to the Health, Safety and Environmental Management System do not consider constraints imposed by flood plains on strategic cropping land, flood plain soil types, discharge of coal seam water on flood plain soils or constraints imposed by flood plain water flows.	EIS Chapter 5, Table 5.10, and Chapter 13	The design specifications outlined in EIS Chapter 5, Project Description, Table 5.10 relate to initial, high-level constraints identified prior to preparation of the EIS. The technical studies conducted to support the EIS, considered these constraints when identifying the potential impacts that project activities may have. The various technical studies that supported the EIS identified a number of additional environmental constraints to the project activities. EIS Chapter 5, Project Description also describes the disposal options for discharge of coal seam gas water, which do not include discharge to land. Coal seam gas water dams on Arrow owned or leased land will be lined. In particular EIS Chapter 13, Agriculture described potential impacts to the agricultural land uses (including potential impacts to flood plain soils and overland flows) and presented a number of mitigation and management measures to address the potential impacts identified. Further constraints will be identified during conduct and compensation agreement negotiations, during which, individual landholders will detail constraints specific to their property and operations.
R3025	S146	Requests a detailed understanding of how certain factors would constrain the installation of gas wells, giving consideration to environmental and social values, economics, reservoir characteristics and existing land use.	SREIS Chapter 3	In the first instance, an area must prove to be prospective through exploration to warrant Arrow developing a particular location within the project development area. For example, SREIS Chapter 3, Project Description presents parcels of land within the project development that have been relinquished by Arrow since publication of the EIS. Environmental, social and existing land use constraints will influence the final location of any wells (infrastructure and facilities), through conditioning of the project by EHP, commitments made by Arrow in the EIS (and SREIS) and through negotiation of conduct and compensation agreements with individual landholders. Area

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R3025	S146			Wide Planning, which aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties, will also influence the location of wells and associated access tracks and gathering lines.
R3026	S158	Construction of 7500 production wells at a rate of approximately 400 wells per year is far too high a rate of construction to be managed, resourced or staffed competently.	–	Noted.
R3027	S119, S123	Provide details on construction methods that minimise riverbed scouring during when open cut trenching methods are used to cross waterways. The use of horizontal directional drilling or boring is preferred as these methods result in significantly less environmental disturbance compared to open cut methods.	EIS Attachment 8 SREIS Attachment 4	Commitments were presented in the EIS (see EIS Attachment 8, EIS Commitments Summary) that detail the types of construction management measures that Arrow will employ to reduce riverbed scouring. These have been updated in SREIS Attachment 4, Commitments Update as follows: <ul style="list-style-type: none"> • Construct watercourse crossings in a manner that reduces sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation. For example, the crossing location will be at low-velocity, straight sections, with the pipeline or road orientated as near as perpendicular to the water flow as practicable. (Commitment C164). • Design flumes used to construct watercourse crossings to a suitable size to maintain flows and enable fish passage. Protect the bed of the watercourse from scouring at the site of the downstream discharge of any flumes or pipes (Commitment C196). The trench will be backfilled with bed material of the same quality and gradation as that which was removed.
R3028	S150	Queensland Murray Darling Committee notes that some boreholes drilled for the installation of high pressure gas pipelines may not be cased for horizontal directional drilling purposes. Arrow has not provided detail on why this is unnecessary and what risks may be attached to such a practice.	EIS Appendix S, Section 3.6	EIS Appendix S, Preliminary Hazard and Risk Assessment, Section 3.6 explains that for each location where the high pressure gas pipeline will be installed, a risk assessment study will be conducted in accordance with the requirements in the Australian high pressure pipelines code AS 2885. The study will consider the characteristics (e.g., geology) of the potential location through which the pipelines will pass, and the types of risks to and from the pipeline. The study will show that all possible risks are identified, evaluated and appropriately planned for to confirm appropriate management of any risks during the pipeline construction and operation.
R3029	S081	The statement 'temporary fencing may be established around sensitive areas occurring along the right of way to ensure they are not disturbed during construction' is vague. Any fencing, temporary or not, can potentially impact on other users of the land. What size area may be contained by temporary fencing?	–	The extent of temporary fencing will be determined once the siting of production wells and the associated gathering lines are known. Siting is dependent on discussions with individual landholders as part of the conduct and compensation agreement process as well as the Area Wide Planning. Temporary fencing will also be established in consultation with landholders.
R3030	S014, S044, S081, S162	How many workers will be on each drill site and how much traffic flow will this create on properties?	EIS Chapter 5, Tables 5.11, 5.15	Workforce requirements differ for construction, operations and decommissioning of well sites. Tables 5.11, 5.15 and 5.16 within EIS Chapter

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R3030	S014, S044, S081, S162	This will impact more on the intensive farming areas than grazing blocks.	and 5.16, and Appendix M SREIS Chapter 12	5, Project Description, outline the construction, operations and decommissioning workforce requirements, respectively. EIS Appendix M, Road Impact Assessment based the assessment of traffic-related impacts from construction of production on an estimated 10 day construction timeframe which corresponded with 50 heavy vehicle return trips and 91 light vehicle return trips. SREIS Chapter 12, Roads and Transport presents an update to this estimate, comprising a 15-day construction duration to show that the current understanding of a 'worst-case' traffic generation impact is assessed.
R3031	S024, S025, S026, S034, S036, S069, S081, S083, S162	What is the maximum length of trench that is dug at any one time?	EIS Chapter 17	The maximum length of the trench that is open at any one time will depend on site-specific circumstances. Arrow will minimise the time a trench is left open and construct exit points when construction is within 1 km of native vegetation, using appropriate material. Arrow will provide fauna refuges, such as sawdust-filled bags, regularly through areas of high fauna activity (Commitment C233).
R3032	S134	Arrow to ensure that there will be no construction limitations to Council work operations undertaken within road reserves next to gas or water lines.	–	Noted. Arrow will continue to consult with the Western Downs, Goondiwindi and Toowoomba regional councils regarding the locations of project infrastructure. Arrow is committed to working with local and state government so that project activities do not obstruct other works within the project development area.
R3033	S135	Issue raised that some drilling may occur under lower order state controlled roads as well, not just major state controlled roads as stated, and requires a road corridor permit from Department of Transport and Main Roads.	SREIS Chapter 13	Noted. The appropriate environmental approvals and permits will be gained prior to ground disturbance. SREIS Chapter 12, Roads and Transport further describes the approval processes and permits, as well as the nominal timeframes that will be triggered by project activities affecting state controlled roads.
R3034	S146	Arrow should specify the codes of practises and standards it will impose for coal seam gas well drilling and construction.	EIS Appendix S, Appendix 1	Appendix 1 of the EIS Appendix S, Preliminary Hazard and Risk Assessment, provides a list of codes and standards relevant to the construction and operation of the project. In November 2011 (when the EIS was about to be issued to the then DERM, for the compliance check), the Code of Practice for Constructing and Abandoning Coal Seam Gas Wells in Queensland was released by the Department of Employment, Economic Development and Innovation (DEEDI) (who acknowledge significant input from DERM and Australian Petroleum Production and Exploration Association (APPEA)). Arrow will comply with this code of practice.
R3035	S130	Why have construction equipment and techniques for well and processing facilities not been finalised?	–	As is typical for natural resource developments, the EIS was prepared based on a conceptual project design reflecting the level of information for construction equipment and techniques that was available at the time. The front-end engineering design (FEED) process undertaken after completion of the EIS, is expected to commence in mid 2013 and will further refine project options and processes. FEED is the engineering phase which follows the conceptual design phase, focusing on the technical requirements as well as

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R3035	S130			investment costs for the project and is used as the basis for bidding the execution phase contracts and as the design basis.
R3036	S079	What is classed as a typical site layout and indicative equipment of the project development area as per EIS Chapter 20, Section 20.2.	EIS Chapter 5, Section 5.5.3 and Figure 5.6	EIS Chapter 5, Project Description Figure 5.6 presents a 'typical integrated processing facility arrangement' indicative of the facility layout that will be constructed for the Arrow project. Further discussion regarding the factors that will influence the potential location, orientation and layout of the facilities is provided in Section 5.5.3.
R3037	S139	What are the construction criteria for coal seam gas related ponds and dams?	–	As described in Commitment C141, the construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and identification of the hazard category of the dam, will be developed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Arrow will construct the dams under the supervision of a suitably qualified and experienced person in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements.
R3038	S143	Construction footprint and timing of construction is not provided for facilities. This information is required to understand the potential impact to farming business.	EIS Chapter 5, Table 5.11 and Figure 5.4 SREIS Chapter 3, Section 3.4	EIS Chapter 5, Project Description shows the footprint and timing of construction (see Table 5.11) associated with production wells, gas and water gathering systems, production facilities and water storage facilities (see Figure 5.4) and high pressure gas pipelines for both the construction and operation phases. SREIS Chapter 3, Project Description, Section 3.4 reiterates the expected footprints for facilities and infrastructure and also presents any updates to what was presented in the EIS (including the footprint for multi well pads).
R3039	S157	The submitter is attempting to link 2P gas reserves with the likelihood of coal seam gas development occurring in areas defined as containing 2P reserves. There is nowhere in the EIS that shows where these reserves exist and how they relate to property boundaries.	SREIS Chapter 3, Figure 3.7	Certified project development area reserves as a 31 December 2009 are presented in EIS Chapter 3, Project Need, Table 3.4. Note that listed companies are required to report reserves, whereas unlisted companies are not. As of August 2010, Arrow became a wholly owned subsidiary of Arrow Energy Holdings Pty Ltd, a 50:50 joint venture between a subsidiary of Royal Dutch Shell plc and a subsidiary of PetroChina Company Limited, and is no longer required to report their reserves. SREIS Chapter 3, Project Description Figure 3.7 indicates the sequence of development, which would provide the best indication of when areas within the project development area will be developed. In terms of potential properties that will be developed, only detailed reservoir engineering will refine the development area to the property level.
R3040	S134	What selection criteria were used to identify the wells included in Arrow's current coal seam gas production?	–	In the development planning for Arrow's current coal seam gas production activities within the Surat Basin (Daandine, Stratheden, Kogan North and Tipon West), techniques utilised for site selection included: <ul style="list-style-type: none"> • The exploration and appraisal history and status. • Geological and reservoir modelling and subsurface development schemes.

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R3040	S134			<ul style="list-style-type: none"> • The number of wells to be drilled, their location, sequencing and spacing to meet the required production rates. • The location, quantity and size of production facilities. • The quantity of water produced and subsequent treatment and storage requirements. • The pipeline networks needed to transport gas and water. • The high-level operations philosophy for the field layout. • Capital and operating expenditures as well as schedule estimates. • Risk and opportunity register.
R3041	S157	The description of the scope of the EIS indicates some areas have been explored extensively. More detail and information should be provided on the coal seam gas resource in those areas, allowing landholders to make a more meaningful judgement/prediction around the likely level of impact on their property.	SREIS Chapter 3	Areas where exploration has been more extensive mostly relate to the Arrow's current coal seam gas production activities within the Surat basin (Daandine, Stratheden, Kogan North and Tipon West). SREIS Chapter 3, Project Description explains that results of progressive exploration have led to the relinquishment of around 30% of the project development area. Arrow will continue to consult with landholders and other stakeholders as further information becomes available and as the project progresses.
R3042	S134	Arrow to provide adequate detail regarding how often water is pumped out and where it is pumped out to including quantities of water being pumped into dams, into the reverse osmosis plant and into distribution sources. Arrow to distinguish all distribution sources to say which will be treated and untreated water distribution sources.	EIS Chapter 3, Figure 5.17 SREIS Chapter 3, Section 3.4.4 and Attachment 5	The primary process used for water treatment is desalination via reverse osmosis, producing a low salinity (treated water) stream and a high salinity (brine) stream for further treatment. The revised field layout described in SREIS Chapter 3, Project Description, comprises two water treatment facilities co-located within the central gas processing facilities in drainage areas 2 and 9. The northern water treatment facility (within drainage area (DA)2) is currently expected to be sized to treat approximately 35 ML/d of coal seam gas water from the production wells in the area and the southern water treatment facility (within DA9) will have a maximum treatment capacity of approximately 90 ML/d. EIS Chapter 5, Project Description Figure 5.17 indicates the coal seam gas water distribution sources and which are suitable to receive treated and untreated water. This figure has been updated to reflect the revised coal seam gas water and salt management strategy. The total maximum storage area required in terms of brine and water storage dams at each facility is 174 ha. The total footprint at each water treatment facility could be up to 2 km ² (200 ha), as originally stated in the EIS. Management options for treated and untreated coal seam gas water for the project are presented in SREIS Chapter 3, Project Description, Section 3 and in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy. All coal seam gas water distributed will be provided within the prescribed limits, including quality and volume, which will dictate the appropriateness for treated or untreated water for each identified end use.
R3043	S119	Request that the Coordinator General consider a condition that will require the proponent obtain development approval for operational works in	–	The Coordinator General assesses projects deemed significant under the State Development and Public Works Organisation Act 1971, for which an EIS is required. The Surat Gas Project EIS was submitted voluntarily in

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R3043	S119	relation to the ocean outfall option, that is the removal, destruction or damage of marine plants that does not meet the requirement of a self-assessable code.		accordance with the Environmental Protection Act 1994, to EHP, and will be conditioned through a decision by the Chief Executive of EHP. Arrow will obtain the necessary permits under all relevant legislation, for works undertaken for this project.
R3044	S081	Describe the process of removing bulk water in the gas including defining what a slug catcher is.	–	Bulk water in the gas is removed through the use of low point drains along the gathering system, with bulk water in the gas described as free water. The slug catcher is the vessel at the central gas processing facilities, which has sufficient buffer volume to trap the largest slugs of free water expected to arrive at the central gas processing facilities, allowing removal from the gas.
R3045	S022	Requesting information on where water will be stored.	SREIS Chapter 3, Section 3.4.4	As described in SREIS Chapter 3, Project Description, Section 3.4.4, dams for water storage, both treated and untreated, will be situated at both water treatment facilities.
R3046	S139	What flood capacity can the storage dams hold?	SREIS Chapter 3, Section 3.4.4	SREIS Chapter 3, Project Description, Section 3.4.4, identifies each dam as: <ul style="list-style-type: none"> • Raw (untreated) water dam capacity: 450 ML/d to 1,050 ML/d. • Treated water dam capacity: 900 ML/d to 4,200 ML/d. • Brine dam capacity: 90 ML/d to 2,880 ML/d. Arrow has committed to design and size dams to account for predicted flood conditions (Commitment C211), and to subject each dam to separate approvals by the regulating authority. Each approval will require the incorporation of general and specific controls to avoid, mitigate or manage threats associated with flooding (Commitment C206).
R3047	S079	What is the composition of the inert gas and water used for the decommissioning process?	EIS Chapter 5, Section 5.7.2	EIS Chapter 5, Project Description, Section 5.7.2, explains that decommissioning of gathering lines will involve purging the gas pipelines, filling with an inert gas or water, then capping the ends; along with other processes discussed within that section. Suspending a pipeline would involve filling it with inert gas (e.g., nitrogen) or water containing corrosion-inhibiting chemicals and capping the ends.
R3048	S109	Is there sufficient data regarding the wells' integrity at depth after decommissioning so they do not collapse and form a direct pathway for water to move between aquifers?	–	When the wells reach the end of their production life (approximately 15 to 20 years), the wells will be decommissioned in accordance with the Queensland Code of Practise for Constructing and Abandoning Coal Seam Gas Wells in Queensland version 1.0. As a component of this process, the well casing and gathering line connections below ground surface will be cut off, and the well will be plugged with concrete to isolate formations.
R3049	S134	Arrow to provide a framework for how Arrow will meet their goals for decommissioning as set out in EIS Chapter 5, Section 5.7.	EIS Chapter 5, Section 5.7	The framework for achieving the decommissioning goals outlined in EIS Chapter 5, Project Description, Section 5.7 will be developed in accordance with land use and regulations at the time and in consultation with landholders.

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R3050	S159	What is considered successful rehabilitation of a well site? Who determines whether a well site rehabilitation has been successful?	EIS Chapter 5, Section 5.7	As discussed in EIS Chapter 5, Project Description, Section 5.7, final rehabilitation involves the final reinstatement of topography, re-profiling and revegetation of the site (where required) to return the disturbed land to as near as possible the pre-disturbance state. Compacted areas will be ripped or scarified and topsoil will be respread to encourage natural revegetation. In some cases, stabilisation measures will be used to show that topsoil remains intact. Site-specific rehabilitation plans will be developed for areas where natural vegetation regeneration may be problematic. The final rehabilitation will be determined in conjunction with the landholder. The goals of decommissioning and rehabilitation are to show that the project development area is: <ul style="list-style-type: none"> • Safe to humans and wildlife; • Non-polluting; • Stable (landforms); • Able to sustain a useful land use project. Prior to decommissioning, detailed objectives, criteria and performance indicators will be developed for each of the above goals in consultation with the appropriate regulatory agency and landholders. The outcome of the final rehabilitation process will be determined by Arrow in conjunction with the landholder.
R3051	S099	More details required on the statutory signposts for marking production wells post rehabilitation. Provide details of the materials used, lifespan of signposts, future maintenance (costs) and responsibility. Government should consider maintaining a central register of GPS locations of wells, and placing a bond on proponents to ensure restoration of decommissioned infrastructure.	EIS Chapter 5, Section 5.7.1	EIS Chapter 5, Project Description, Section 5.7.1 explains how when wells reach the end of their production life (approximately 15 to 20 years), decommissioning will be conducted in accordance with the Petroleum and Gas (Production and Safety) Act 1994 requirements. The act makes provisions for the responsibility of the well post decommissioning. Section 6.8 of the Code of Practice for Construction and Abandonment of coal seam gas Wells in Queensland (DEEDI, 2011) details the mandatory requirements for abandonment of production wells including the requirement for installation of a wellhead marker plate as per legislative requirements and upkeep of complete and accurate records of the entire abandonment procedure, with these records submitted as part of the legislative reporting requirements for the abandonment of coal seam gas wells.
R3052	S051	EIS states total foot print of the wells coming back to only 75 ha. The nature of black soils makes this not possible, as there will be well work overs every two or three years and it would be impossible to rehabilitate strategic cropping land in that period between work overs.	–	The construction footprint for a single well may require an area of up to approximately 100 m by 100 m (i.e., 1 ha) for a single well and 100 m by 200 m (i.e., 2 ha) for a multi-well pad, when allowance is made for sediment and erosion controls. This requirement forms the basis for compensation. The footprint of well pads will be reduced between workovers to accord with the Strategic Cropping Land Standard Conditions Code for Resource Activities or as agreed for multi-well pads. In either instance, each well site will be rehabilitated after final abandonment activities. Well sites will be assessed on an individual basis to reduce the footprint as far as practicable following installation and completion of a well.
R3053	S027	Where does the gravel used around well heads,	–	Arrow's preferred disposal option for gravel used around facilities and

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R3053	S027	facilities and roads go once removed?		infrastructure is re-use and will initially involve discussion with the landholder and other third parties, following consideration of Arrow's own needs for gravel.
R3054	S158	The word 'disturbance' is euphemistic. Disturbance implies a temporary condition, but the reality of this project's activities is that there will be environmental destruction, or loss and long-term, possibly irreversible changes to ecosystems.	–	The EIS explains that site rehabilitation will occur as soon as reasonably practicable and during the decommissioning process. Management and mitigation measures will also be implemented throughout all phases of the project (planning and design, construction, operations and decommissioning) to reduce the environmental impacts associated with the project and show that development is ecologically sustainable.
R3055	S150	The project development area is in a rural area which by its nature will have major impacts on households and businesses that do not typically operate from or within a 'town'. Therefore the statement that infrastructure will not be located within towns is irrelevant in such a setting.	–	Arrow has also committed to locating wells and infrastructure away from homes in consultation with landholders (with a minimum distance of 200 m). Potential impacts due to project activities were assessed throughout the project development area, including the expanse of land where homes are situated on large properties.
R3056	S041, S110, S141, S144, S146, S157	Supplementary investigations need to be conducted that reflect that 3750 ha does not include all areas that will be affected (i.e., road access tracks, pipeline right of ways and above ground infrastructure).	EIS Chapter 13, Section 13.4.7	EIS Chapter 13, Agriculture, Section 13.4.7 explains that Arrow's experience to date indicates that up to 2 to 3% of land associated with a typical production well spacing of 800 m, which equates to 65 ha (160 acres), will be required and disturbed by activities associated with the construction and operation of a production well, the associated water and gas gathering lines, and the access track. Only when the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), will Arrow be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning will also influence the location of wells and infrastructure, which aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties.
R3057	S108	Full details of land disturbance areas for all project infrastructure, including linear infrastructure must be set out in comprehensive detail in one place in the EIS so that the full extent of the alienation of cropping land can be assessed.	EIS Executive Summary, Section 5.1	As described in the EIS Executive Summary, Section 5.1, coal seam gas field development typically proceeds on an incremental basis, with exploration and reservoir engineering respectively confirming the most productive areas and well density required to maximise recovery of gas. The actual locations of wells and production facilities are consequently, progressively identified and refined over the life of the project. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan demonstrate catchment wide integration and balance the needs of individual landholders with the needs of neighbouring properties) will also influence the final siting of facilities and infrastructure. For example, since publication of the EIS, exploration has

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R3057	S108			allowed Arrow to relinquish tenure that was within the project development area, as it did not prove to be viable.
R3058	S025	What will be the minimum disturbance of each of the various types of project infrastructure to towns, both less than and greater than 10 people?	EIS Chapter 20, Section 20.6.1	Arrow has committed to locating wells and infrastructure away from homes in consultation with landowners (with a minimum distance of 200 m).
R3059	S014, S044	Following comment in EIS, 'Arrow will calculate financial assurance required for the project based on the maximum area of disturbance'. Stakeholder requests that the supplementary report to the EIS includes information on the maximum area of disturbance and clarification on the financial assurance amount and a clarification of the area that will be included in the 'maximum area of disturbance'.	EIS Attachment 5	Financial assurance for the project is required by the EHP (previously DERM) guideline for Financial Assurance for Petroleum Activities (DERM, 2011c) as part of the application for an environmental authority (EA) or EA amendment (EIS Attachment 5, Environmental Management Plan, Section 1.9). The level of financial assurance will require acceptance and approval by EHP. Arrow will calculate financial assurance in accordance with the above guideline at the time it applies for or to amend an environmental authority, at which time the detailed location of infrastructure will be known and the required area of disturbance can be calculated.
R3060	S014, S044	Central gas processing facilities (CGPFs) and integrated processing facilities require large tracts of land for activities that are environmentally damaging to clay soils. The EIS suggests that if necessary or found to be unavoidable Arrow would place this type of infrastructure on good quality agricultural land (GQAL) and strategic cropping land (SCL); such actions would be unacceptable considering the limited availability and value of GQAL and SCL. If the project is approved we would request the administering authority impose conditions that prevent, in all circumstances, CGPFs and integrated processing facilities on GQAL and SCL.	SREIS Chapter 3	Through Arrow's adoption of the pitless drilling method, pad drilling (a new concept introduced in the SREIS Chapter 3, Project Description which explains how one well pad can hold up to 12 well heads, each targeting different points in the coal seam), and no major infrastructure on intensively farmed land (IFL) Arrow has reduced its footprint to less than 2% on IFL. IFL refers to land actively being used for broad acre cropping, using either dry land or irrigated farming practices and having been altered to suit those cropping purposes e.g., laser levelled, irrigation channels and existing dams. For the purposes of Arrow's tenure, IFL applies to areas over the Condamine Alluvium, on authority to prospect (ATP) 683 and 676 in the Surat Basin.
R3061	S014, S034, S044, S069, S081, S134, S139, S150	The EIS states that liquid and solid wastes will be removed offsite with the exception of drilling mud. What does Arrow intend to do with the residual drilling mud? Arrow to specify: <ul style="list-style-type: none"> • How waste drilling fluids will be contained on site. • If the drill water and associated 'muddy water' will be treated and if so, what level of treatment. • Volume, process and timing for removal of treated or untreated solids and liquids. • The location and capacity of proposed disposal sites for this waste. Asserts that use and management of drilling fluids needs further consideration, given that the management of this 	-	Arrow is moving to pitless drilling as a standard use, which means storing waste in portable, temporary tanks, rather than conventional pits, as follows: <ul style="list-style-type: none"> • In the trials, potassium sulphate was added to the drilling fluid, rather than the traditional potassium chloride. Potassium sulphate is commonly used in fertilisers, so the drilling mud can be reused as a soil enhancer. • Arrow is exploring beneficial reuse of cuttings in site rehabilitation works and erosion and sediment control. • Currently there is potential to use cuttings in commercial composting operations as a soil enhancer and reducing farmers' need for synthetic fertilisers. Drilling muds will not be used for land spraying, and until the success of beneficial uses for drilling fluid is realised, will either be reused to drill other coal seam gas wells, or disposed offsite at a licensed waste facility. Arrow is required to manage drilling muds in accordance with their

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R3061	S014, S034, S044, S069, S081, S134, S139, S150	material may vary greatly depending on agreements made with landholders (allowing material to be released directly to the ground etc). Questions whether there is consideration for land-spraying drilling muds? If so has this been considered in the EIS and environmental management plan? What tests have been carried out? Arrow should consider the variety of spatial cumulative impacts and risks associated with the disposal of drilling fluids.		environmental authority (EA), or EA amendment.
R3062	S146	If the use of surface tanks is seen as a way to minimise impact and reduce contamination, why will Arrow not use surface tanks for drilling fluids on all other lands? Concerned that Arrow will use surface tanks on intensively farmed land for drilling fluids and use pits on all other lands.	–	Arrow is moving to pitless drilling as a standard use, which means storing waste in portable, temporary tanks, rather than conventional pits. In the Surat Basin, Arrow has successfully trialled six pitless drilling operations, including on black soil.
R3063	S034, S069	How large are the purpose-built containment structures for storage of drilling fluid? Are the purpose-built containment structures for storage of drilling fluid permanent? If not, for how long will they be located on the property?	–	The temporary drilling fluid tanks are large enough to contain the drilling fluids required to drill a well. The tanks are small enough to be transported off-site once drilling is complete. Drilling tanks will be moved off site on completion of the well installation (and returned for work-overs).
R3064	S150	The EIS's risk assessment must fully assess the 'potential toxicity' of drilling fluids. Is the cocktail of chemical used in drilling fluids unable to be treated? The submission lists several common drilling mud additives, and then goes on to assess the possible environmental and human health implications.	–	<p>Arrow uses water based drilling fluids that contain 2% to 3% of salts. Other additives used in the drilling fluids include clay stabilisers, disinfectants and viscosifiers. These additives are managed in accordance with material safety data sheets and standard operating procedures to show that they are used, handled and stored appropriately. These muds are stored at the surface prior to reuse in other drilling activities or disposed offsite at a licensed waste facility. The drilling fluids are not released to land or disposed to watercourses. Arrow is moving to pitless drilling as a standard use, which means storing waste in portable, temporary tanks, rather than conventional pits, as follows:</p> <ul style="list-style-type: none"> • In the trials, potassium sulphate was added to the drilling fluid, rather than the traditional potassium chloride. Potassium sulphate is commonly used in fertilisers, so the drilling mud can be reused as a soil enhancer. • Arrow is exploring beneficial reuse of cuttings in site rehabilitation works and erosion and sediment control. • Currently there is potential to use cuttings in commercial composting operations as a soil enhancer and reducing farmers' need for synthetic fertilisers. Drilling muds will not be used for land spraying, and until the success of beneficial uses for drilling fluid is realised, will either be reused to drill other coal seam gas wells, or disposed offsite at a licensed waste facility. Arrow is required to manage drilling muds in accordance with their

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R3064	S150			environmental authority (EA) or EA amendment.
R3065	S150	Argues no effective risk assessment has been carried out (with regard to drilling materials).	–	The drilling process is included in the EIS as a project-related activity with the potential to impact on environmental values. The various impact assessment chapters in the EIS provide an assessment of these potential impacts and the mitigation measures required to manage them.
R3066	S150	Asserts that use and management of drilling fluids needs further consideration, given that the management of this material may vary greatly depending on agreements made with landholders (allowing material to be released directly to the ground etc).	–	Drilling muds will not be released directly to the ground, and will either be reused to drill other coal seam gas wells, or disposed offsite at a licensed waste facility. Arrow is required to manage drilling muds in accordance with their environmental authority (EA) or EA amendment.
R3067	S150	The lack of specific legislation around disposal of drilling by-products from the gas and oil industry means that new disposal methods will be open to interpretation of various non-specific legislation and guidelines. This opens the industry to self-regulation, the intention of a coal seam gas company may be to set a high standard of environmental protection, however other companies may not perform to the same corporate standard leaving the environment open to potential harm.	–	All coal seam gas proponents are required to manage drilling fluids in accordance with their environmental authority conditions.
R3068	S014, S044, S081, S139	What is the water quality in drilling sumps? What is the potential impact to farming soils if a spill occurs? Has any trials been undertaken in regards to soil remediation?	–	Arrow is moving to pitless drilling as a standard use, which means storing waste in portable, temporary tanks, rather than conventional pits. In the Surat Basin, Arrow has successfully trialled six pitless drilling operations, including on black soil. Trials that Arrow are currently undertaking include: <ul style="list-style-type: none"> • In the trials, potassium sulphate was added to the drilling fluid, rather than the traditional potassium chloride. Potassium sulphate is commonly used in fertilisers, so the drilling mud can be reused as a soil enhancer. • Arrow is exploring beneficial reuse of cuttings in site rehabilitation works and erosion and sediment control. • Currently there is potential to use cuttings in commercial composting operations as a soil enhancer and reducing farmers' need for synthetic fertilisers. Drilling muds will not be used for land spraying, and until the success of beneficial uses for drilling fluid is realised, will either be reused to drill other coal seam gas wells, or disposed offsite at a licensed waste facility. Arrow is required to manage drilling muds in accordance with their environmental authority (EA) or EA amendment.
R3069	S108	Any temporary dams used during drilling will contain saline soils and water. The management of this material needs to be specified. Is it to be	EIS Chapter 5, Section 5.5.1	Drilling muds will either be reused to drill other coal seam gas wells, or disposed offsite at a licenced waste facility. EIS Chapter 5, Project Description, Section 5.5.1 contains information on the additives used in

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R3069	S108	trucked out or piped to a water processing plant?		drilling fluids.
R3070	S150	An assessment of the drilling fluids in the drilling mud needs to include all chemicals and substances used.	–	At the end of their use, drilling fluids will be disposed offsite at licensed waste facilities with capacity, and appropriate licenses in place to accept this material.
R3071	S134	Arrow to address the construction, operation and decommissioning phases for pilot projects.	EIS Chapter 5	EIS Chapter 5, Project Description explains that assessment and approval of exploration activities is governed by existing approvals covering tenures across much of the project development area and that pilot wells form Phase 3 of the exploration activities.
R3072	S014, S044	At the Community Consultation Session on 1 May 2012, questions were raised about the size of a field compression facility and the number of compressors to be used. In response, the size is approximately of a shipping container and only one compressor is required. People will remain confused about the Project, while inconsistent information is supplied.	EIS Chapter 5, Figure 5.4	EIS Chapter 5, Project Description, Figure 5.4 presents the approximate footprint for the three types of production facilities including the field compression facility, which is 100 m by 50 m.
R3073	S014, S044	Regarding EIS Chapter 5, Figure 5.11, stakeholder enquires if there will be only one field compression facility in each of the blue circled areas. Stakeholder requests that Arrow provide a scale picture of a field compression facility in the SREIS.	SREIS Chapter 3, Figure 3.6	SREIS Chapter 3, Project Description explains the revised number of production facilities (revised from 18 to 14). The option for approximately six field compression facilities is retained and their nominal location (within a 12 km radius circle showing expected location) is shown to be within the same area of potential facility development as the central gas processing facilities (SREIS Figure 3.6).
R3074	S024, S026, S036, S079, S081, S083, S162	What is the area of completed well sites that will be fenced to prevent access? What is the range of heights that fences are constructed to, since the higher the fence, the greater the interference?	SREIS Chapter 3	SREIS Chapter 3, Project Description explains that completed well sites will be fenced and the design of the fence (including the height) will be dependent upon the location, risk of unauthorised access and the results of a quantitative risk assessment.
R3075	S130	Western Downs Regional Council requests that financial assurance for the project is calculated by an independent assessor appointed by state government not Arrow.	–	Noted.
R3076	S024, S026, S079, S081	During shut-down maintenance, planned flaring events are expected to occur. What is the usual duration of shut-down maintenance? Does the flaring last for the duration of the maintenance period?	EIS Chapter 5, Section 5.3.2 SREIS Chapter 5, Table 5.3	Arrow will operate and maintain plant and equipment in accordance with manufacturers' specifications to protect warranty provisions. Maintenance will comprise scheduled minor and major outages of plant and equipment with the frequency of outages specified in the warranty provisions, and following the warranty period, in accordance with Arrow's operation and maintenance program. It will also include repairs following unscheduled events or upset conditions. Minor maintenance outages are typically measured in hours up to a day. Major maintenance outages are typically several days but can extend over weeks depending of the scope of the activities required to satisfy the

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R3076	S024, S026, S079, S081			maintenance program for the particular item of plant or equipment. Flaring is required to purge the equipment to be maintained or repaired as a result of an upset condition. The duration of flaring will be dependent on the inventory (volume) of gas within the item of equipment and associated pipework. Estimates of flaring provided in SREIS Chapter 5, Air Quality, Table 5.3 include allowance for flaring associated with maintenance.
R3077	S081	For what reason may flaring be undertaken at wellhead locations? What are the impacts of wellhead flaring to all relevant environmental values?	EIS Chapter 5, Section 5.3.2, and Chapter 18, Section 18.6.1 SREIS Chapter 5, and Chapter 13	Flaring is the safest and most environmental friendly way to dispose of any gas that cannot be processed. During installation, flaring may be undertaken at wellheads for safety reasons. In other words, if drilling resulted in the release of gas it could be safely flared to avoid serious injury to the drilling crew. Once a well is drilled it is capped and left until the workover crew come to establish the wellhead infrastructure and downhole gear including pumps etc. The gathering system needs to be in place to commission a well as when they turn on the pump to extract water it has to go back to the central gas processing facility for storage, treatment and disposal. As the gas stream is established, produced gas would be flared at the central gas processing facility until sufficient pressure and flow is established to sustain production i.e., as explained in the EIS. Flaring which is a burning process contributes to air and noise emissions and visual impacts. EIS Chapter 18, Landscape and Visual Amenity, Section 18.6.1 presents mitigation measures for minimising light spill from flaring. The SREIS air quality and noise and vibration assessments, SREIS Chapter 5 and Chapter 13 respectively, have assessed the worst-case emissions scenario for flaring. EIS Chapter 5, Project Description, Section 5.3.2 states that gas will be flared only as a last resort. Arrow is investigating options other than flaring to assist in managing ramp-up gas. This includes design options such as increased well spacing and selective well start-up.
R3078	S014, S044	Stakeholder requests information on flaring in relation to well density. Could density be increased beyond the stated point (65 to 130 ha) to avoid flaring gas?	EIS Chapter 5, Section 5.3.2	Arrow is investigating options other than flaring to assist in managing ramp-up gas. This includes design options such as increased well spacing and selective well start-up. Note that increased well spacing would reduce the well density. EIS Chapter 5, Project Description, Section 5.3.2 states that gas will be flared only as a last resort.
R3079	S081	What is control failure that would result in flare gas?	–	During normal operations, hydrocarbons are constantly flowing through the central gas processing facilities. Whenever there is an interruption to the usual operation of the facility, such as an equipment or power stoppage, the constant flow is interrupted and any excess hydrocarbons are sent to the flare and safely ignited via a pilot light. Burning the excess hydrocarbon gases certifies that the gases are safely combusted and do not escape into the atmosphere.
R3080	S024, S026, S081	What time of the day are temperature inversions most prevalent? What happens when flaring occurs during a temperature inversion?	EIS Appendix C, and Appendix N	A temperature inversion is caused when a layer of cool air at the surface is overlain by a layer of warmer air (inversion layer). An inversion will form under conducive, meteorological conditions, typically late afternoon and evening

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R3080	S024, S026, S081		SREIS Appendix 2, and Appendix 11	and will break up in the morning. An inversion can retard dispersion of plumes (e.g., from flaring) and also increase the distance that sound can travel (e.g., from flaring) as it bounces off the inversion layer. Temperature inversions have been assessed for the air quality and noise and vibration studies in the EIS (appendices C and N, respectively) and SREIS (appendices 2 and 11, respectively).
R3081	S024, S025, S081, S162	Will fuel storage and handling facilities be compliant with Australian Standard 1940?	EIS Chapter 14	EIS Chapter 14, Groundwater, contains the commitment that Arrow will store onsite materials in suitable containment systems constructed to industry standards and Australian standards (AS 1940-2004, The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2004a), and AS 3780, The Storage and Handling of Corrosive Substances (Standards Australia, 2008b) at a minimum). Maintain quality control and quality assurance procedures to monitor volumes and quantities. Bund aboveground storage areas to contain spills (Commitment C102).
R3082	S079	Is there a gas detection system on every well? Does it detect all/any leaks? Does the system have a minimum level of gas emission before it is detected and what is that level? If a leak is detected, how long does it take for the detection system to notify Arrow and what is the procedure or process to fix it?	–	Arrow will comply with the relevant legislation for leak detection procedures and reporting including the Code of Practice for coal seam gas well head emissions, detection and reporting (DEEDI, 2011a) (or the relevant legislation at the time), which aims to set a standard method to detect, classify and report gas leaks.
R3083	S014, S044, S081, S139	Are there spill monitoring or leak detection devices in all ponds? How are these monitored and at what frequency are these dams and ponds monitored? What are the spill or leak response processes? Have these been tested in the past?	EIS Chapter 14, and Attachment 9, Section 2.6	EIS Attachment 9, Coal Seam Gas Water Management Strategy Section 2.6, explains the regulatory framework specific to coal seam gas water storages, acknowledging that EA conditions will invoke and approve an appropriate Infrastructure Groundwater Monitoring Program to regulate monitoring, leak detection and audits of dams. EIS Chapter 14, Groundwater includes two commitments that discuss the monitoring and leak detection systems for dams, as follows: <ul style="list-style-type: none"> • Develop the construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and determine the hazard category of the dam in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Construct the dams under the supervision of a suitably qualified and experienced person, in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141). • Install groundwater monitoring bores near dams as a leak detection measure: – The number of monitoring bores and their location will take into account site-specific hydrogeology, preferential pathways and potential receptors of impacts. – Monitoring bores installed near dams will have groundwater levels and relevant water quality parameters monitored on a

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R3083	S014, S044, S081, S139			routine basis. – The number of monitoring bores and associated monitoring frequencies will be increased and further investigation will be triggered where impacts are identified (Commitment C504).
R3084	S014, S044	If there is an accident on private property involving Arrow employees or contractors, who is liable?	EIS Chapter 25, Section 25.6.2	Arrow is not in a position to offer legal advice. In the event that an incident were to occur, the specifics of the incident would need to be examined. Arrow has established incident reporting, emergency response and corrective action systems and procedures which will be further developed and implemented for the Surat Gas Project. These procedures will include appropriate systems for notifying affected and potentially affected parties (Chapter 25, Preliminary Hazard and Risk, Section 25.6.2, Commitment C171). The Petroleum and Gas (Production and Safety) Act 2004 (Qld) requires Arrow to report any incidents in writing to landholders within 24 hours of the incident occurring. Arrow will meet its legislative obligations for incident reporting.
R3085	S134	Arrow must guarantee in writing and uphold their 'no fracking' commitment. If not guaranteed in writing, Arrow must include an assessment of the impacts of fracking in the SREIS.	–	Arrow committed to enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079).
R3086	S134, S157	To ensure compliance with their commitment to no fracking at any point during the life of the project, 'no fracking' should be a condition of Arrow's project approval. If this condition is not provided, Arrow to include a fracking impact assessment in the SREIS.	–	EHP will assess the project as described in the project description presented in the Surat Gas Project EIS and revised in the SREIS, any subsequent significant alterations to the project would trigger a further assessment of these changes.
R3087	S004, S006, S024, S025, S026, S034, S036, S054, S069, S081, S083, S145, S162	The EIS does not describe how hydro-test water will be managed. Is the hydro-water in the holding ponds discharged to land or waterways? How will hydro-testing water be managed in a flood event? Quality of discharged hydro-testing water must be appropriate for the receiving environment so as not to cause environmental harm. Hydro-test water must have a SAR (sodium adsorption ratio) less than 6 in areas with clay content greater than 30%, as coal seam water can sterilize these soils.	EIS Chapter 15	EIS Chapter 15, Surface Water outlines management measures with regard to hydrostatic test water in Commitment C168, as follows: • Develop and implement a hydrostatic testing procedure prior to commencement of hydrotest activities that includes but is not limited to the following measures: – Conduct consultation with landholders and relevant regulatory authorities prior to sourcing and disposing of hydrotest water. – Avoid or minimise harmful chemical additives and reuse hydrotest water on adjacent pipeline sections where practicable. – Show that hydrotest water that is discharged or recycled for secondary uses meets relevant statutory water quality guidelines.
R3088	S024, S025, S026, S036, S054, S081, S083, S145, S146, S162	The EIS does not state the location of hydro-testing water holding dams, or the process of hydrotesting water discharge. • Are they small local ponds constructed in association with the gathering lines? • How is the hydrotesting water to be diverted to the holding ponds?	–	Where water quality permits, hydrostatic test water will be discharged to farm dams by agreement with the landholder. Where nearby to a Central Gas Processing Facility, water may be discharged to the utility dam at the facility. In some instances holding dams may be required. Their location will be agreed with landholder if not located on Arrow-owned or leased properties. Water will be transferred to holding dams by pipelines temporarily installed above ground from the hydrostatic test site to the dam. The size of the

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R3088	S024, S025, S026, S036, S054, S081, S083, S145, S146, S162	• Will dams of any kind be constructed on Good Quality Agricultural Land? Concerned that, in order for Arrow to hydrotest gathering lines for integrity, nearby ponds will be required to accept the water used for hydrotesting.		holding dams will depend on the length and diameter of pipe being tested but is not expected to exceed approximately 50 m by 50 m.
R3089	S024, S025, S026, S034, S036, S054, S069, S081, S083, S108, S110, S134, S143, S146, S150, S157, S158, S162	Clarification is required in regards to the number, spacing (including minimum distance between well heads) and density of the project's production wells, including whether in-fill wells may be drilled only where initial well spacing is 1,500 m or whether it is possible for in-fill wells to be drilled on an 800 m spacing. A query is also made as to whether these spacings account for right of ways. It is stated that in-filling of wells should not be undertaken in areas of strategic cropping land and that the EIS should consider impacts from in-fill wells with a commitment made to in-fill with prior landholder and regulatory approval. It is proposed that should environmental, social and existing land use constraints to well spacing exist, then in-filling should be prohibited in these areas.	SREIS Chapter 3	Arrow aims to be flexible in locating surface well pads to where they have minimum impact on agriculture industry practices in areas surrounding identified pad locations. The original EIS conceptualised that vertical wells would be drilled with a separation distance between wells averaging a minimum of 800 m across the project development area. The use of deviated drilling technology (with up to 12 well heads located on one well pad), may allow the surface well pad sites for multi-well pads to be separated over a distance in excess of 2,000 m where possible. The grid of production wells may be drilled in sequence, or in stages to enable learning from the performance of early wells with a wide spacing, before adding remaining wells to complete the grid (this historically has been referred to as infilling). Arrow has committed to not drill wells on IFL at less than an average grid spacing of 800 m. SREIS Chapter 3, Project Description, explains that the results of further exploration has seen Arrow reduce the estimated total number of wells from 7,500 to 6,500 which includes any infill wells drilled.
R3090	S014, S044, S081, S139	Will flare pits and drilling sumps be bunded and spilling prevented? What monitoring or controls will be put in place?	EIS Attachment 8	Flare pits and drilling sumps will be designed in accordance with relevant Australian and Queensland legislation and industry best standards. EIS Attachment 8, EIS Commitments Summary, indicates that Arrow has committed to the following monitoring and controls: <ul style="list-style-type: none"> • Store onsite materials in suitable containment systems constructed to industry standards and Australian standards (AS 1940-2004, The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2004a), and AS 3780, The Storage and Handling of Corrosive Substances (Standards Australia, 2008b) at a minimum). Maintain quality control and quality assurance procedures to monitor volumes and quantities. Bund aboveground storage areas to contain spills (Commitment C102). • Routinely inspect spill containment controls and spill response kits (Commitment C516).
R3091	S150	Queensland Murray Darling Committee supports the use of remote operation and monitoring of wells, but require clarification on the type of monitoring that will be done remotely e.g., will this monitoring assure the integrity of aquifers is not compromised, that there is no contamination of aquifers and no leaking of fugitive emissions? The	–	Each well type is designed, constructed, operated, maintained and finally sealed with specific well integrity considerations in mind for each of its life cycle phases. During production, wells are regularly checked and inspected to show that their integrity remains unaffected. This is done through: <ul style="list-style-type: none"> • Internal and external inspection to assess the corrosion rate. • Inflow test of wellhead valves. • Gas 'sniffer' test.

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R3091	S150	EIS states that the monitoring will include 'pressure and water flow rates' and that the wells will be visited regularly to inspect and maintain the surface facilities. How are the other aspects of the wells (listed above) monitored?		<ul style="list-style-type: none"> • Casing corrosion surveys. The frequency and details of those tests depend on the well type, its risk profile and history.
R3092	S134	To assist with site selection and to determine if the current monitoring program is effective, Arrow should provide further information on the performance and monitoring of their existing coal seam gas wells in the Surat Basin, and any impacts to land use identified.	EIS Chapter 12, and Chapter 14	EIS Chapter 12, Geology, Landform and Soils states that Arrow will conduct inspection and monitoring in accordance with environmental authority (EA) or EA amendment conditions and regulatory requirements, with EIS Chapter 14, Groundwater adding such requirements include those developed by the Queensland Water Commission in relation to groundwater drawdown and springs.
R3093	S099	Concern over use of closed circuit television monitoring at each well site. Potential loss of privacy and amenity if closed circuit television is not restricted to the well footprint.	–	Arrow will install and maintain CCTV cameras at its facilities as part of its security requirements. It may install CCTV cameras at wells and other field-based infrastructure e.g., pump transfer stations. The remote surveillance is required to monitor performance and maintain security at the location of the infrastructure. The focus of CCTV cameras installed for such purposes is fixed on the item of plant or equipment or on the enclosure where unauthorised entry is being monitored. The cameras are typically installed in a way that satisfies security and operating requirements but does not cause invasion of privacy particularly where located in proximity to residences.
R3094	S081	Will on-going monitoring and testing be done in regards to environmental monitoring at specific sites be undertaken?	EIS Chapter 12, and Chapter 17	EIS Chapter 12, Geology, Landform and Soils states that Arrow will conduct inspection and monitoring in accordance with environmental authority (EA) or EA amendment conditions and regulatory requirements. EIS Chapter 17, Terrestrial Ecology, states that Arrow will develop site-specific monitoring programs for threatened species and communities based on the identified risk to the conservation or maintenance of a viable population (Commitment C303).
R3095	S014, S044	Stakeholder requests that Arrow confirm if weekly well inspections will be required once telemetry has been established.	–	Production wells will have remote telemetry units that will integrate with the main control system at the respective central gas processing facility. The production wellhead sites will normally be unmanned but routinely visited by the area field operator according to pre-set schedules, e.g., for sampling, thermography, vibration analysis of auxiliary equipment, visual condition monitoring and gas leak detection. Production wells will be remotely operated and monitored for gas and water flow rates and gas pressure from the central control room. The well visit frequency will show that legislative requirements are met.
R3096	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S146, S150, S162	Arrow should disclose its monitoring and maintenance operations for vents, valves and drains associated with gathering pipelines; how frequently will regular inspections along the gathering line routes be conducted (weekly,	SREIS Chapter 3	<p>SREIS Chapter 3, Project Description explains that typical maintenance for gathering systems includes:</p> <ul style="list-style-type: none"> • Regular inspections of the gathering line routes to observe and manage vegetation, subsidence, erosion and to confirm appropriate bushfire protection. • Inspection and maintenance of valves, vents, pumps and

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R3096	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S146, S150, S162	monthly)? The relevant EIS appendices will need to be rewritten to account for these impacts (EIS appendices C, D, E, F, G, O).		associated instruments. The frequency and details of those inspections depend on its risk profile and history. SREIS Chapter 3, Project Description explains that Arrow's monitoring systems include automated overpressure protection systems on high-pressure pipelines, remote-controlled isolation valves on low-pressure gas and water pipelines at each of the well heads.
R3097	S099	No information provided on dimensions of medium pressure pipelines.	–	Detailed design will determine the dimensions of medium pressure pipelines should they be required i.e., where the length of a gathering system reduces the required delivery pressure at a central gas processing facility, necessitating the inclusion of a field compression facility to be connected to a central gas processing facility by a medium pressure gas pipeline.
R3098	S024, S025, S026, S036, S079, S081, S083, S162	What is meant by the term 'other infrastructure' in EIS Chapter 5, Section 5.8.2? Does 'other infrastructure' refer to wellheads?	EIS Chapter 5, Section 5.8.2 SREIS Chapter 3	The reference to other infrastructure in EIS Chapter 5, Project Description, Section 5.8.2 captured production wells, as well as water treatment facilities and accommodation camps. SREIS Chapter 3, Project Description provides an update on Arrow's preferred power supply option which does consider running overhead distribution lines (or underground cables), from a substation that is co-located with a central gas processing facility to the production wells, as indicated in EIS Section 5.8.2.
R3099	S157	The submitter is requesting that the location of the first 1,655 wells to be drilled, and their associated parcels be disclosed.	SREIS Chapter 3, Figure 3.7	SREIS Chapter 3, Project Description Figure 3.7 presents an updated sequence of development. In terms of potential properties that will be developed, only detailed reservoir engineering will refine the development area to the property level.
R3100	S099	Safety concern and economic disruption (to landholders) over co-locating fibre-optical cable in the same trenches as pipelines. There have been failures in other cables due to rodents, which require lengthy repairs.	–	Where telemetry systems fail for whatever reasons, monitoring and operation of the well will revert to manual control until the telemetry system is repaired. Landholders will be compensated for disruptions caused by project activities including the repair of fibre optic cables.
R3101	S099	Clarification sought on the use of wireless networks. Will Arrow use existing Telstra wireless network? If so, then an assessment of potential impacts to the existing network should be undertaken (currently overloaded service).	–	Arrow will require a communications network and use supervisory control and data acquisition (SCADA) and telemetry systems to monitor and control the infrastructure. This capability may be provided by dedicated networks or through third party networks. Reliance on third-party networks would involve discussions between Arrow and the service provider to ensure sufficient capacity is available and/or the capacity that needs to be provided. Arrow would not assume capacity was available given the importance of communications systems to the construction and operation of its facilities and associated infrastructure and operation activities.
R3102	S119	Skilled labour is mentioned in EIS Chapter 5, Table 5.5, what is the definition and occupational classifications?	EIS Chapter 5, Table 5.5	EIS Chapter 5, Project Description, Table 5.5 provides a breakdown of the skill requirements for project personnel across all phases of the project. A more detailed occupational split of key occupations identified that will be in highest demand include:

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R3102	S119			<ul style="list-style-type: none"> • Construction, distribution and production managers. • Engineering managers. • Architects, designers, planners and surveyors. • Engineering professionals. • Natural and physical science professionals (e.g., geologists). • Building and engineering technicians. • Fabrication engineering trades workers. • Mechanical engineering trades workers. • Electricians. • Electronics and telecommunications trade workers. • Miscellaneous technicians/ trades workers. • Stationery plant operators. • Construction/ mining labourers.
R3103	S119	Arrow state that their preference is to recruit locally. What is viewed as being local? Arrow to provide a clear definition.	EIS Chapter 5, Section 5.5.8	EIS Chapter 5, Project Description, Section 5.5.8, highlights Arrow's preference to provide employment to people sourced locally, which is defined as being within the Darling Downs regional area.
R3104	S119	Is there any staff training and development programs occurring in Tara, Cecil Plains, Millmerran and Goondiwindi? If no, is there a commitment to looking at Tara, Cecil Plains, Millmerran and Goondiwindi for staff training and development programs.	EIS Chapter 22, Section 22.8.2 SREIS Attachment 3, Section 2.5	<p>Arrow has in place a number of training and skills development programs for its workers and the community through apprenticeships, scholarships, vocational training, support for work readiness programs and pre-trade training. EIS Chapter 22, Social, Section 22.8.2 and SREIS Attachment 3, Social Impact Management Plan Update, provide details of Arrow's commitments and action plans supporting employment, skills, business, workforce and training. SREIS Attachment 3, Social Impact Management Plan Update, Section 2.5 details Arrow's commitment to undertake regular review of labour requirements and current skills sets to ensure that training strategies meet these needs (Commitment C352). Additionally Arrow will undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C598). Further to this Arrow is developing a policy identifying training pathways for students and school leavers to assist students in gaining employment upon graduation, which extend across the project development area including, Tara, Cecil Plains, Millmerran and Goondiwindi. Training opportunities for employees include:</p> <ul style="list-style-type: none"> • Vocational and trade training to allow employees the opportunity to gain nationally recognised qualifications. • Specialist training to show that employees' skills are up to date. • Graduate development program, which provides a planned development path for newly degree-qualified employees (Commitment C339). <p>Arrow acknowledges it has a shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently reduced and to</p>

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R3104	S119			contributing to the social and economic wealth of the communities in which it operates through its social investment program. Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367). Examples of education social investment initiatives that Arrow is currently undertaking in the region are:—Partnering with Dalby State High School. This partnership is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements.—Supporting the Ignition Project (Ignition), an initiative of the Queensland Police Service to address the increasing problem of youth boredom and inactivity in the Western Downs Region, inclusive of the townships of Dalby, Chinchilla and Tara. The initiative targets 11 to 19 year olds considered to be at risk.— Partnering with the Brisbane Broncos. This partnership has engaged over 1,400 students and residents in the Central Darling Downs region throughout 2012. It has delivered programs that focus on health, safety and education including the Brisbane Broncos Book Club, Coaching Clinics and Regional Fan Day. —Working with the Endeavour Foundation to deliver the Stepping Stones Positive Parenting Program, Latch On tertiary learning program for young adults with a disability and a school holiday respite program for children with disabilities.
R3105	S074	Arrow have been operating coal seam gas production facilities in the Surat Basin for 10 years, why is the proportion of residential operational workers for the proposed Project not based upon actual historical data?	EIS Chapter 5, Section 5.5.8	EIS Chapter 5, Project Description, Section 5.5.8 details Arrow's preference to provide employment to people sourced locally (within the Darling Downs regional area); however, due to the high demand by other coal seam gas proponents and low unemployment rates, Arrow recognises that labour will likely need to be sourced from further afield. Arrow's aim, in this regard, is to implement a hierarchy of preferred employment and contractor candidates based on the employees'/contractors' home or source location. This is further evidenced by Arrow's commitment to implement an Operations Workforce Policy preferring local residence for operations staff (Commitment C337).
R3106	S130	Requests that brine ponds do not become landfill once full of salt, and if so long term maintenance must be demonstrated.	EIS Chapter 12, Section 12.6.2	EIS Chapter 12, Geology, Soils and Landform, Section 12.6.2 explains that Arrow will excavate any saline material during rehabilitation of coal seam water dams or brine dams and select an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill) (Commitment C073).
R3107	S134	Arrow to identify potential alternative locations for suitably licenced landfill (i.e., other than Swanbank).	EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.7.5	The preferred brine management option is selective salt recovery, allowing beneficial use opportunities. This may be performed using a brine treatment facility referred to as a selective salt recovery plant which will either be co-operated by multiple coal seam gas industry proponents (producing multiple salt products) or by Arrow (producing single salt products). EIS Chapter 5, Project Description, Section 5.6.4 states that Arrow is consulting commercial

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R3107	S134			enterprises to investigate viable opportunities for the beneficial use of brine. As part of this process, Arrow will commission selective salt precipitation trials to: <ul style="list-style-type: none"> • Understand the chemical composition of the brine. • Identify methods to enhance precipitation of the brine. • Identify viable chemical processes to transform the brine into commercial products. Further information regarding the collaborative and Arrow-only selective salt recovery plant options is provided in SREIS Chapter 3, Project Description, Section 3.7.5.
R3108	S024, S026, S034, S036, S054, S069, S081, S083, S157, S162	EIS Chapter 5, Section 5.6.1 indicates that there are likely to be minimal impacts associated with the operation and maintenance of production wells, and that visits to the wells will be irregular. However, Arrow does not detail the cumulative impact of all visits to wells associated with workovers, inspections, maintenance of valve vents and drains, pigging etc. Arrow should provide a full summary of the real interruption and number of cumulative visits.	SREIS Chapter 3, sections 3.4.1 and 3.6.1	SREIS Chapter 3, Project Description, Section 3.4.1 describes the typical physical life cycle of a well site location/pad, including workovers and well plug and abandonment. Section 3.6.1 identifies that an average pump run life of six months to two years is expected over the course of the project, which Arrow will endeavour to maximise through technology improvements. Individual wells will show a variation around the average run life. This results from differences in geology (i.e., the amount of coal fines that may be drawn through the pump) and in the loads placed on the well pump system due to different well shapes (for deviated wells). Production wells will be remotely operated and monitored for gas and water flow rates and gas pressure from the central control room. The well visit frequency will show that legislative requirements are met. The introduction of multi-well pads will centralise inspection and maintenance activities to fewer locations.
R3109	S150	Submitter unclear what 'flushing' is with regards to downhole pipe maintenance and whether chemicals will be used to aid this flushing.	–	Flushing is a term used to describe a particular well maintenance activity whereby fluid (typically formation water in current operations) is circulated down the tubing of the well to clean out naturally occurring solids that have accumulated in the tubing.
R3110	S123	Request for information on maintenance programs or schedules for work required following natural disaster events.	EIS Chapter 25, Section 25.6.3	Arrow's incident and emergency management system requires that plans, equipment, training and other resources are identified, documented and maintained for all foreseeable emergency and crisis situations. These situations would encompass emergencies arising from both natural events such as earthquakes, and from events caused by people (EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3).
R3111	S099	Clarification required on the length of time daily well maintenance will continue for. The EIS states it will reduce to weekly when production stabilises. However, no information is provided on how long on average it will take for production to stabilise.	–	Well production stabilisation will be variable across the project and depends on factors such as the geology of well site. The well visit frequency will show that legislative requirements are met.
R3112	S051	Maintenance of valves, through vents and drains that vent gas into the atmosphere and the salty	–	Water collected through low-point drains will not be drained to the soil, but rather collected and diverted to the water gathering network for processing.

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R3112	S051	water to the ground. This contaminated water would pose an environmental hazard to the soil.		
R3113	S038	There is an express lack of detail as to the farmer's rights and would they need to be conceded in this area. Additionally concerned that well placement and maintenance will interfere with the continuation of the traffic controlled method of farming, and subsequently effective management of environmental issues pertaining to their property.	EIS Chapter 13, Section 13.1	EIS Chapter 13, Agriculture, Section 13.1 explains that the landholder is entitled to reasonable accounting, legal and valuation costs associated with negotiating a compensation agreement with the petroleum licence holder under the Petroleum and Gas (Production and Safety) Act 2004. The mandatory provisions of the Land Access Code (DEEDI, 2010a) prepared by the Queensland Government must be complied with. This act requires compensation arrangements to incorporate certain terms. Consideration for interference to farming activities through placement of project infrastructure will form part of any discussions for developing a conduct and compensation agreement.
R3114	S024	What is the usual duration of shut-down maintenance?	–	Arrow will operate and maintain plant and equipment in accordance with manufacturers' specifications to protect warranty provisions. Maintenance will comprise scheduled minor and major outages of plant and equipment with the frequency of outages specified in the warranty provisions, and following the warranty period, in accordance with Arrow's operation and maintenance program. It will also include repairs following unscheduled events or upset conditions. Minor maintenance outages are typically measured in hours up to a day. Major maintenance outages are typically several days but can extend over weeks depending of the scope of the activities required to satisfy the maintenance program for the particular item of plant or equipment.
R3115	S014, S044	How frequently is 'downhole water pump maintenance' required? And, what is involved i.e., heavy vehicles, number of personnel, and length of time?	SREIS Chapter 3, Section 3.6.1	SREIS Chapter 3, Project Description, Section 3.6.1 describes the typical physical life cycle of a well site location/pad, including workovers, downhole water pump maintenance and well plug and abandonment. that The frequency of workovers and downhole water pump maintenance is expected to range from six months to two years, which Arrow will endeavour to maximise through technology improvements. Individual wells will show a variation around the average run life. This results from differences in geology (i.e., the amount of coal fines that may be drawn through the pump) and in the loads placed on the well pump system due to different well shapes (for deviated wells). The introduction of multi-well pads will centralise inspection and maintenance activities to fewer locations. The workover and downhole water pump maintenance will take approximately seven days per well, with a crew of five people. A workover drilling rig is required for well maintenance, and any disturbance during workover operations will be progressively rehabilitated as soon as practicable.
R3116	S099	Concern that the proposed well maintenance will not be possible on heavy clay soil without gravel access tracks.	SREIS Chapter 3, Section 3.4.1	SREIS Chapter 3, Project Description, Section 3.4.1 describes that at this time it is envisaged that access and well site pad base for both single and multi-well pads remains undisturbed for life of well, to facilitate regular access for well intervention activities (i.e., well workovers). Access to a well site will

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R3116	S099			be via existing tracks where possible; otherwise, a track will be cleared and graded.
R3117	S162	There should be discussion around valve placement and signage as these can provide risks in the intensive cropping environment.	–	Valve placement and signage will be determined during the detailed front-end engineering design (FEED) phase, expected to commence in mid 2013.
R3118	S002, S003, S009, S018, S020, S024, S025, S026, S032, S034, S036, S037, S039, S053, S054, S055, S058, S059, S064, S065, S069, S070, S071, S076, S081, S083, S085, S088, S096, S097, S098, S108, S114, S139, S140, S143, S146, S149, S152, S154, S162, S167	The proponent must provide definitions and descriptions of marker posts, marker tape, trace wire and as-built- surveys. Photographs should accompany these descriptions. Concern over the use of marker posts, tape and trace wire proposed to identify the location of buried gathering lines; are marker posts placed immediately over the gathering line infrastructure, on either side of the buried infrastructure, at what distance are markers placed either side, how are markers situated for bends, turns and joins? EIS Chapter 13 and EIS Appendix F fail to consider the impact of statutory signposts and the various methods of marking the location of gathering lines on agriculture. Arrow must provide a detailed explanation of the impact from the use of such markers on intensive cropping land. Concerned that marker posts, marker tape, and trace wire will significantly impact on intensive cropping land use, be an obstacle to farming practices and may impede floodplain flows causing environmental and economic impacts. Arrow Energy must be forced to prioritise the use of markers that minimise impacts.	EIS Chapter 13, sections 13.4.6 and 13.4.8 SREIS Chapter 3	SREIS Chapter 3, Project Description, explains how tape and trace wire are used to identify the location of buried gathering lines beneath the surface, hence avoiding the creation of an obstacle on the surface. EIS Chapter 13, Agriculture, sections 13.4.6 and 13.4.8 included an assessment of the potential impacts that surface infrastructure would have to current land uses and overland flow. Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). The Code addresses safety performance, design, construction and testing of pipeline systems and places particular emphasis on jointing techniques and pressure test methods. Such pipeline systems include high point vents, low point drains, isolation valves and manifolds, some of which involve other materials. High pressure (steel) gas pipelines will be constructed, commissioned, maintained and rehabilitated in accordance with relevant legislation and standards which includes the Australian Standard 2885.1 (Australian Standards, 2012), Section 4.4.2 of which, explains the signage requirements for high pressure pipelines, stating that signs shall be placed at: both sides of public roads, railways and rivers, at each property boundary (and internal fence lines as appropriate), along vehicle tracks, at each change of direction, utility crossings (buried or above-ground), pipeline facilities and where signs marking the location of the pipeline are considered to contribute to pipeline safety by properly identifying its location.
R3119	S024, S025, S026, S036, S079, S081, S083, S162	What are the proponent's Occupational Health and Safety obligations regarding the erection of statutory signposts to identify the location of decommissioned wells?	–	Arrow will comply with the Code of Practice for Constructing and Abandoning of coal seam gas Wells in Queensland (DEEDI, 2011b) and legislative requirements for identifying abandoned wells. Signposts will not be erected to identify the location of decommissioned wells rather, wellhead markers that clearly identify the well as abandoned will be welded to the well casing. Wellhead casings from abandoned wells will be cut off at approximately 1.5 m below ground level. Abandoned wells will not be visible on the ground surface.
R3120	S079	Once the project is completed, will the markers or signs be able to be removed or will they have to remain?	EIS Chapter 5, sections 5.7.2 and 5.7.6	EIS Chapter 5, Project Description sections 5.7.2 and 5.7.6 explain that decommissioning of gathering lines and high pressure gas pipelines, respectively, will involve removal of surface infrastructure and signage.

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R3121	S119	Is the information shown in EIS Chapter 4, Table 4.5 'major projects underway or under construction in the Darling Downs' current? It appears to be old and out of date. Arrow to review and refresh.	EIS Chapter 4, Table 4.5	EIS Chapter 4, Environmental and Social Context, Table 4.5 was current at the time of writing the EIS and was based on project information that has been made publically available.
R3122	S134	Arrow to provide adequate detail regarding other major projects occurring in the project development area (including industrial areas, health and educational facilities) in order to provide a complete picture of the development of the area as per EIS Chapter 4, Table 4.5 'major projects underway or under construction in the Darling Downs'.	EIS Chapter 4, Table 4.5	The purpose of including Table 4.5 in EIS Chapter 4, Environmental and Social Context, was to identify projects in the area that were considered as part of the cumulative impact assessment, which identified any compounding impacts from multiple developments in the area (e.g., the cumulative impact on health and education service providers). Existing health and educational facilities would not exasperate a potential impact that project activities may have on the region.
R3123	S002, S003, S009, S018, S019, S020, S024, S025, S026, S032, S034, S036, S037, S039, S050, S053, S055, S058, S059, S064, S065, S067, S069, S070, S071, S076, S079, S081, S083, S085, S087, S088, S095, S096, S097, S098, S099, S108, S114, S130, S139, S140, S145, S149, S150, S152, S154, S158, S162, S167	Requests explanation of the pigging process including; <ul style="list-style-type: none"> • Footprint and equipment used. • Quality of pigging water. • Energy cost. • Composition of the pigging sludge waste and volumes produced. • Potential environmental impacts to landscape, vegetation and biodiversity, and community disruption. • Impacts from waste disposal and assurance of secure management for transport and storage of the pigging water. • Management measures for pigging water and sludge and its disposal. Concern that saline water pigged from gas pipelines will contaminate clay soils and result in permanent impacts to strategic cropping land. Landowners demand that Arrow guarantee there will be no escape of saline water as a result of pigging. 	SREIS Chapter 3	SREIS Chapter 3, Project Description clarifies that no pigging will be used in the gas and water gathering system. Pigging activities for the Surat Gas Project relate to the short, high-pressure gas pipelines that connect a central gas processing facility to the Surat Gas Pipeline (i.e., eight pipeline lengths of a couple of kilometres each). Chapter 3 goes on to explain that field compression facilities may be required when the length of a gathering system reduces the required delivery pressure at a central gas processing facility. A field compression facility will be connected to a central gas processing facility by a medium pressure, coated steel gas pipeline. Gas from field compression facilities will be saturated with water, which can collect in low points of the medium-pressure pipelines. This water would be removed by pigging. Chapter 3 further explains the role of the pig (pipeline inspection gauge) in medium and high pressure gas pipelines. Pigging stations (launching and receiving) comprise aboveground pipework that enables the pig to be launched or injected into the pipeline by gas and retrieved from the pipeline. Pigging infrastructure is housed within the facility security fence and operated as part of the facility. Water purged by pigging will be of the same quality of the coal seam gas water that is produced at the well or wells feeding the gathering system serviced by the field compression facility. It might contain minor levels of other contaminants e.g., coal fines that are entrained within the hydrated gas stream. There is no overhead in pigging as it simply uses gas pressure in the gas pipeline to push the pig through the pipe. The pig launching station would be on the pressurised (downstream) side of the compressor. Therefore there will be adequate pressure to launch and push the pig through the pipe to the receiving station at the central gas processing facility. Pig sludge will comprise water, coal fines and other impurities produced from the well. The water and sludge are collected in a chamber, which is periodically cleaned, and disposed to a regulated waste facility or treated at the central gas processing facility and disposed along with the other waste streams generated at the facility. Pigging stations are most likely to be

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R3123	S002, S003, S009, S018, S019, S020,			constructed at a central gas processing facility, with pigged water and sludge typically captured and treated at the central gas processing facility located downstream of the field compression facility.
R3124	S158	The final depth of pipelines agreed by Arrow and the landowner may or may not be a satisfactory, best practice approach and should be subject to an independently advised high standard of compliance.	EIS Chapter 5, Section 5.5.2	EIS Chapter 5, Project Description, Section 5.5.2 states that the depth of pipeline burial will conform to acceptable industry practices.
R3125	S134	Arrow to provide details on gas and water lines being located in the same trench to ensure stability.	EIS Chapter 5, Section 5.5.2	EIS Chapter 5, Project Description Section 5.5.2 states that 'separate gas- and water-gathering pipelines will be buried below ground in commonly excavated trench to reduce surface land use disturbance'. Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or relevant Australian standards, as revised from time to time (Commitment C444).
R3126	S015	Arrow states pipelines will be buried in a single trench, with valve stations, vacuum break facilities and drains which will require weekly inspections and annual routine maintenance. What depth will the pipelines be buried?	EIS Chapter 5, Section 5.5.2	EIS Chapter 5, Project Description, Section 5.5.2 states that as a minimum, the pipeline depth will be 750 mm from the top of the pipe. Landholders will be consulted to determine land use practices and pipelines will be buried to a depth that reduces risk of damage.
R3127	S079	Is there any buffering material added to underground pipeline trenches to alleviate movement?	–	Landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to a depth that reduces the risk of damage. Details will be negotiated with landholders and agreed upon by both parties under the terms of a conduct and compensation agreement. The depth of pipeline burial will conform to acceptable industry practices but will ultimately depend on the existing land use. As a minimum, the pipeline depth will be 750 mm from the top of the pipe.
R3128	S099, S146	Details have not been provided on the material of or diameter of pipelines (gas and water gathering) that traverse good quality agricultural land or strategic cropping land. Concern over potential impacts (from pipeline collapse or subsidence and subsequent erosion) if pipelines are larger than 232.9 mm in diameter. Concern over surface water flows along subsided pipelines causing major damage to land. Arrow should provide detail of what safeguards are in place to ensure pipelines will not deteriorate and how they would remedy subsidence in the event that it is caused from deteriorating pipelines.	EIS Chapter 25, Section 25.6.3	EIS Chapter 5, Project Description Section 5.2.2, explains that low-pressure pipelines will be 100- to 630-mm-diameter, high-density, polyethylene buried pipelines. Arrow will design, construction and commissioning gas and water gathering systems in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2, or relevant Australian standards, as revised from time to time (Commitment C444). The project will backfill in a manner that will promote successful rehabilitation, including capping of exposed subsoil with topsoil and replacement of the land surface to preconstruction levels to reduce trench subsidence and concentration of flow. Gas field infrastructure developed in cultivation paddocks will be designed to maintain the existing hydrologic and hydraulic regime of the site.

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R3129	S079	How will they ensure underground pipelines, especially high pressure pipelines, hold their integrity?	EIS Chapter 25, Section 25.6.3	Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2, or relevant Australian standards, as revised from time to time (Commitment C444). Arrow will construct high pressure gas pipelines in accordance with Australian Standard AS 2885, Pipelines–Gas and Liquid Petroleum (Australian Standard, 2008a).
R3130	S099	No information provided on design life of pipelines or how they will be installed to cope with shrink-well properties of self-mulching cracking clay soils.	–	Noted. Rigorous design standards complying with AS 4130:2009 (Australian Standards, 2009a) and APIA Code of Practice Upstream PE gathering networks coal seam gas industry (APIA, 2013) will be applied to water gathering pipelines to reduce the potential for failure. Arrow will also adhere to design and construction standards defined in AS 2885.1-2012 for medium and high-pressure gas pipelines.
R3131	S099	Assess potential impacts of pipeline leaks in clay soils.	–	Rigorous design standards complying with AS 4130:2009 will be applied to water gathering pipelines to reduce the potential for failure. Arrow is required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as part of a remediation action plan (RAP). A validation sampling program will be conducted to show that the site has been successfully remediated according to the objectives identified in the RAP.
R3132	S055	Subsidence over pipelines will require periodic maintenance which will likely result in disruptions and further soil structure damage.	EIS Chapter 13, Section 13.4.8	EIS Chapter 13, Agriculture, Section 13.4.8 identified two associated impacts from maintenance of pipelines including soil disturbance (caused by compaction from traffic and settling of pipeline trenches) and the loss of amenity (from contractors and employees accessing properties).
R3133	S141, S144	The installation of high pressure gas pipelines is not compatible with intensively irrigated farming practices due to the nature of impact from flood events on black soil plains and this will need to be taken into account in regard to the placement of the pipes due to the movement of the ground from shrinking and swelling from inundation of water.	EIS Chapter 25, Section 25.4.1, and Appendix S, Section 6.6	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1 notes that the high pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Section 6.6).
R3134	S146	The proponent should provide evidence that they can construct and operate pipelines on an intensively farmed land so that food production is not negatively impacted and soil erosion increased. The EIS fails to identify how pipelines will be installed across the flood plains and not cause erosion or subsidence issues. Accidents and erosion as a result of pipeline subsidence are a	EIS Chapter 13, and Appendix F	The importance of the Darling Downs for agriculture for food and fibre production is understood and recognised in EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report. The regional, state and national economies rely on both resources and consequently, Arrow is pursuing the Surat Gas Project on the basis that it coexists with agriculture. Arrow continues to engage and work with various committees to better understand how to integrate coal seam gas development with agricultural activities in the region. Arrow has shown at consultation and on its website that vertosols

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R3134	S146	real concern to farmers.		(black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years.
R3135	S147	Any proposed Arrow pipeline within an existing Ergon Energy easement will be subject to the existing conditions of the Ergon Easement.	–	Noted.
R3136	S158	The width of pipeline routes is unclear although this is important for gauging the impact on biodiversity. Also total length of pipelines should be stated to facilitate community assessment of overall impacts of clearing and other ongoing interference (such as low level noise, vibration, potential leakage, maintenance operations including and in addition to 'pigging') on native vegetation and biodiversity.	EIS Executive Summary, Section 5.1, and Chapter 5, Section 5.5.2	EIS Chapter 5, Project Description, Section 5.5.2 of the EIS states that 'a right-of-way (ROW) of up to 20 m will be prepared' and 'in environmentally sensitive areas, the ROW may be narrowed for short distances.' The discussion goes on to state that 'the location of the gathering pipelines will be informed by technical, environmental, social and landholder constraints. As described in the EIS Executive Summary, Section 5.1, coal seam gas field development typically proceeds on an incremental basis, with exploration and reservoir engineering respectively confirming the most productive areas and well density required to maximise recovery of gas. The actual locations of wells and production facilities are consequently, progressively identified and refined over the life of the project. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties) will also influence the final siting of facilities and infrastructure. For example, since publication of the EIS, exploration has allowed Arrow to relinquish tenure that was within the project development area, as it did not prove to be viable.
R3137	S002, S003, S009, S014, S018, S019, S020, S032, S037, S039, S042, S044, S050, S053, S055, S058, S059, S064, S065, S067, S070, S071, S076, S081, S085, S087, S088, S096, S097, S098, S108, S114, S139, S140, S149, S152,	Gathering lines must be buried at a minimum of 750 mm as determined by discussion with the landholder. On most farms these lines will be traversed by heavy machinery up to 30 tonnes, but should be future proofed and buried deep enough to account for even heavier weights as well as deep cultivation practices. What restrictions will gathering lines have on them in regards to intensive farming – rippers, weight, etc. Arrow to provide the maximum weight of vehicles that can be driven over gas gathering and water pipelines and all buried infrastructure within the project development area.	–	EIS Chapter 5, Project Description, Section 5.5.2 states that 'as a minimum, the pipeline depth will be 750 mm from the top of the pipe. Landholders will be consulted to determine land use practices and pipelines will be buried to a depth that reduces risk of damage.'

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R3138	S158	Impacts of voltage interference with fauna health and integrity have not been recognised or addressed.	<p>EIS Attachment 8, Appendix K, Section 11.1 and Tables 26 and 38</p> <p>SREIS Chapter 11, Section 11.4.5</p>	<p>EIS, Appendix K, Terrestrial Ecology Impact Assessment, Table 26 describes the impacts of power generation and supply through the construction of an overhead powerline network as having some of the potential impacts as described in Section 11.1. These impacts have been assessed within the EIS on listed fauna species (EIS, Appendix K, Terrestrial Ecology Impact Assessment, Table 38). These potential impacts were assessed against terrestrial ecology values in the EIS and did not present an unmanageable impact. Commitments presented in EIS Attachment 8, Commitments Summary were adequate to manage the potential impacts described. Species with updated sensitivity and residual impact assessment from the SREIS assessment are presented in SREIS Chapter 11, Terrestrial Ecology, Section 11.4.5. Overhead power lines supplying power to wells and facilities have the potential to increase bird strike mortality, however, birds are known to be able to cross structurally simplistic areas. Of the bird species assessed, migratory shorebird species have the potential for impact if powerlines are placed in areas of high bird activity (e.g., Lake Broadwater). Construction of infrastructure will be avoided around Lake Broadwater and therefore no impact is expected. If construction is to occur within the vicinity of areas frequented by migratory species (e.g., Long Swamp), the following commitment will be applied:</p> <ul style="list-style-type: none"> • Ensure Arrow's overhead distribution powerlines are visible when construction is planned in proximity to waterbodies frequented by an important population of listed migratory bird species. (Commitment C562).
R3139	S150	Concerned by the lack of detail Arrow has provided throughout the EIS on power generation facilities.	<p>SREIS Chapter 3, Section 3.4.5</p>	Further details in relation to power supply for the project can be found in SREIS Chapter 3, Project Description, Section 3.4.5.
R3140	S147	Early consultation with Ergon Energy is recommended to ensure Arrow's electricity needs can be clearly identified, demand on existing infrastructure can be accurately assessed, and new network infrastructure (if required) can be planned in advance. Ergon Energy must be consulted where pipeline routes and well and facility locations have the potential to impact on the operation and maintenance of Ergon Energy-owned electricity infrastructure. Any redesign of Ergon Energy infrastructure, required as a result of the proposal, must take into consideration servicing and maintenance access requirements for Ergon Energy personnel and equipment.	<p>SREIS Chapter 3, Section 3.4.5</p>	Arrow will consult with Ergon Energy on a range of matters including potential connection to the Ergon Energy distribution network, if required, and potential impacts on Ergon Energy infrastructure as a consequence of its construction, operation and maintenance activities. As outlined in SREIS Chapter 3, Project Description, Section 3.4.5, Arrow intends to use grid power sourced from infrastructure constructed and operated by the network service provider and distributed to its wells and facilities via Arrow owned and operated underground and overhead distribution power lines. Further details in relation to power supply for the project can be found in SREIS Chapter 3, Project Description, Section 3.4.5.
R3141	S150	Concerned that a full assessment has not been carried out to evaluate the impacts associated with	<p>SREIS Chapter 3, Chapter 7 and</p>	Preliminary impacts on current users as a result of the project's electricity demand have been investigated in conjunction with the transmission network

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R3141	S150	Arrow's demand on electricity and other energy sources. The project's electricity demands will impact on the current electricity infrastructure and by association, current users of this infrastructure in the project development area. Additionally if Arrow considers the demands on fuel to be significant, then this is also likely to impact on other users of these resources.	Chapter 10	provider. Where necessary, the transmission network provider will upgrade power infrastructure to meet current and future project load requirements. Impacts associated with the construction and operation of Arrow's electricity distribution infrastructure are further discussed in SREIS Chapter 3, Project Description; Chapter 7, Agriculture and Chapter 11, Terrestrial Ecology.
R3142	S123, S146	Arrow Energy must be forced to prioritise the use of methods of power supply that minimise impact ahead of commercial preference. Alternative power supplies (powerlines, substations) add to the impact on the landscape and potential day to day operations of farming. The need for additional infrastructure should be flagged in advance, and considered as part of the entire project. It is preferred that any additional infrastructure requirements be located in existing infrastructure corridors.	SREIS Chapter 3, Section 3.4.5	An advantage that Arrow will achieve from making connection with the Queensland electricity network and running underground cables or overhead distribution lines to its wells, is that this option would eliminate the need to have a gas-fed generator at each wellhead. With the underground cables installed within the same corridor as the gathering network, there is no additional disturbance and the air quality and noise emissions will be reduced as well, there will be fewer well site maintenance visits as the need to maintain the generators will not be required. Above ground power distribution to the wells will be assessed during detailed design, however it will not be implemented when it conflicts with current farming practices and equipment used (e.g., irrigators) Electricity transmission infrastructure required to connect supply points to the Queensland electricity grid will be subject to separate environmental approvals processes by the transmission network service provider. SREIS Chapter 3, Project Description, Section 3.4.5, explains that the alignment of transmission lines will be informed by physical, environmental, social and landholder constraints. The type, spacing and height of towers/poles will be determined during the detailed design, where span lengths and tower/pole height will be optimised to reduce the number of towers/poles and achieve the required safety clearances to the ground, roads, structures and vegetation. Farming practices and equipment (e.g., irrigators) will also be considered in the detailed design. Further details in relation to power supply for the project can be found in SREIS Chapter 3, Project Description, Section 3.4.5.
R3143	S024, S025, S026, S036, S081, S083, S162	What is the extent of the demand on energy sources, what quantities of these resources are expected to be used (e.g., fuel and energy sources) and how will this use of expected significant demand on energy sources impact on the energy infrastructure and other users of these forms of energy?	EIS Chapter 5 SREIS Chapter 3, and Chapter 5	EIS Chapter 5, Project Description explained that 10% of the export gas demand (97 TJ/day) was required to power the field. SREIS Chapter 3, Project Description explains Arrow's revised preference to power the field. Energy requirements based on a worst-case scenario for emissions to the air is also presented in SREIS Chapter 5, Air Quality. Preliminary impacts on current users as a result of the project's electricity demand have been investigated in conjunction with the Transmission Network Provider. Where necessary, the Transmission Network Provider will upgrade power infrastructure to meet current and future project loads requirements Impacts on current users as a result of the project's electricity demand will be investigated once the requirements for taking power from the Queensland electricity grid and distributing it to production wells, production facilities and

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R3143	S024, S025, S026, S036, S081, S083,			associated infrastructure have been further examined. These impacts will be assessed as part of separate environmental approvals processes by the transmission network service provider.
R3144	S024, S025, S026, S036, S054, S081, S083, S162	Regarding solar panels on production wells: <ul style="list-style-type: none"> • Why can production wells only be powered by solar panels 'where possible'? • What are the constraints to powering production wells by solar panels? • How many of the 7500 wells does the proponent anticipate will be powered by solar panels versus overhead distribution lines? 	–	Implementation of solar panels for operations refers to provision of an independent power supply for telemetry and communications. Production wells cannot be powered by solar panels because the load demand for the operation of the well is too high. Moreover due to the high starting currents and requirements for inverters, solar panels are generally not used for applications directly connected with an electric motor driven by an alternating current (AC motor). For the these reasons, the use of solar panels for the production wells is not feasible and their use will be limited for remote locations with small loads (e.g., telemetry and communications).
R3145	S054	Do solar panels come under 'other infrastructure'?	EIS Chapter 5, Section 5.8.2	EIS Chapter 5, Project Description, Section 5.8.2 Transmissions Lines was referring to wells and water treatment facilities with use of 'other infrastructure'. Solar panels will not be powered by distribution power lines.
R3146	S015	The footprint of 80 m by 150 m will be required to accommodate a power generation facility. When this is multiplied by the number of power generation facilities the result is a huge environmental impact. Despite the acoustic treatments, these will also have environmental impact.	SREIS Chapter 3	SREIS Chapter 3, Project Description explains Arrow's revised preferred power supply option, including the high voltage transmission lines to be constructed and operated by a transmission network service provider that will transmit power from existing substations or switchyards in the Queensland electricity grid to zone or facility substations. Zone substations will be established in the vicinity of each Central gas Processing Facility where multiple high voltage circuits are required for the connection to facilities and other zone substations. A typical of up to 330m by 280 m footprint for 132 KV and a 500mx 500m footprint for 275/132 KV combined is required to established a zone substation. The Arrow substations will be established within the footprint of a central gas processing facility. The establishment of the central gas processing facility has been assessed in the EIS.
R3147	S054	Are the solar panels included in the expected footprint of production wells? If not, how much extra footprint will be required?	EIS Chapter 5, Section 5.5.2	Production wells cannot be powered by solar panels because the load demand for the operation of the well is too high. Implementation of solar panels for operations, which have been included in the production well footprint estimate, refers to provision of an independent power supply for telemetry and communications.
R3148	S002, S009, S014, S018, S019, S020,	In the event that the project is approved, installation of new overhead power lines should be prohibited.	–	Noted.
R3149	S024, S026, S079, S081, S083, S146	What percentage of wells does Arrow estimate will be incorrectly installed? Arrow should detail how the integrity of the wells will not be compromised over time with respect to production wells, plugged	EIS Chapter 14	The process that verifies that wells are designed, constructed and maintained to preserve full production potential for design life is known as well integrity. The term integrity is used in the sense of ensuring the well is sound, unimpaired and complete. The wellhead systems used by Arrow are

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R3149	S024, S026, S079, S081, S083, S146	and abandoned wells, steel casings and cement plugs.		constructed of materials designed for gas production, and incorporate appropriate safeguards to maintain well integrity. The materials and products conform with Australian and international design standards. They are pressure-tested before installation, and inspected during regular scheduled maintenance program to show that leaks, if they occur, are identified and rectified early. Arrow will implement a well integrity management system during commissioning and operation of production wells (Commitment C143).
R3150	S031, S160	The location of wells within the Wandoan development region may impact on the submitter's property. Submitter unsure if any wells will be located on their property.	EIS Chapter 13	Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines). Arrow will clearly identify the outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures (Commitment C084). The location of wells and particularly, the associated access tracks and gathering lines, will also depend on outcomes of Area Wide Planning. This process aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties, and will also influence the location of wells and associated access tracks and gathering lines.
R3151	S034, S069	Do the production wells have to be located vertically over the coal seam gas source, or can the drilling be angled under fields to avoid agricultural disturbance?	EIS Chapter 3	SREIS Chapter 3, Project Description, introduces the concept of multi-well pad drilling which involves deviated wells, allowing up to 12 wells to be drilled from one central surface location. Anticipated benefits include a reduced footprint through use of common gathering lines and access tracks. The ability for Arrow to apply this technology is spatially constrained to those areas where the coal seams are at depths of greater than 400 m.
R3152	S108	The Environmental Authority conditions must insist that wells are located at the field boundary.	–	Noted.
R3153	S150	It is unclear from the EIS whether the progression of tenure applications will impact on the estimated final number of wells of 7500. Clarification is required.	SREIS Chapter 3	The final number of wells that Arrow will require is dependent on reservoir characteristics and gas demand. SREIS Chapter 3, Project Description, explains that the revised estimated number of wells that Arrow expects to drill is 6,500 (from the 7,500 presented in the EIS).
R3154	S014, S025, S044, S079, S081, S158, S159, S162	Stakeholder requests that Arrow recalculate the operational area to take into account the 'total operational area', including gravel access roads, and provide the formula for calculating in the SREIS.	EIS Chapter 5, Figure 5.4 SREIS Chapter 3, Section 3.4.1 and Figure 3.4	EIS Chapter 5, Project Description, Figure 5.4 presents the approximate footprint for a central gas processing facility (600 m by 250 m), integrated processing facility (800 m by 250 m) and associated water storages (1 to 2 km ²) and field compression facility (100 m by 50 m). SREIS Chapter 3, Project Description Figure 3.4 presents an updated central gas processing facility layout with a footprint of 350 m by 520 m. Section 3.4.1 introduces the concept of multi-well pads that Arrow will use to reduce their footprint through establishment of up to 12 wells at a central surface location. This approach will be achieved through implementation of a deviated well drilling technology. The SREIS explains that the size of the well site location will vary depending

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R3154	S014, S025, S044, S079, S081, S158, S159, S162			upon the number of wells to be drilled on a single location, the size of the rig required and individual topographical requirements. The traditional single well site may be up to approximately 100 m by 100 m (i.e., 1 ha) including an area for sediment and erosion control devices, while a multi-well pad containing up to 12 wells may be 200 m by 100 m inclusive of allowance for sediment and erosion control. Well sites will be assessed on an individual basis to reduce footprint as far as practicable.
R3155	S024, S025, S026, S034, S036, S069, S081, S162	There is a difference of 1,174 ha in the construction footprint described in EIS Chapter 5, Section 5.2.3 and EIS Appendix F, Section 6.2.	SREIS Chapter 3	SREIS Chapter 3, Project Description, rectifies the discrepancy and presents the well pad footprint for the construction and operation phases for single and multi-well pads. The construction phase footprint includes allowance for sediment and erosion control measures.
R3156	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050,	A condition should be applied to enforce Arrow to demonstrate the technical ability and willingness to adhere to the footprint sizes documented in the EIS, or adjust the footprint areas to more accurately reflect their operational requirements.	–	Noted.
R3157	S043, S049, S052,	Concerned the location of project infrastructure will set precedent for future projects.	–	Noted.
R3158	S108	DERM (now EHP) should require Arrow to present precise locations of infrastructure before any environmental conditioning if attempted.	–	Noted.
R3159	S075	At a community meeting in Millmerran, the community were not given any idea of what would or could be done with the toxic residue left in open pits and ponds.	EIS Chapter 12	Arrow has committed to excavating saline material during rehabilitation of coal seam water dams or brine dams and selecting an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill). If the saline material is toxic then it will be managed according to relevant standards and guidelines (Commitment C073).
R3160	S150	There is no measurement or discussion of radioactive substances such as radioactive tracer beads or strontium which would be expected.	–	Any radioactive materials generated by the project will be managed according to relevant standards and guidelines. Radioactive tracer beads are not proposed for the construction of wells.
R3161	S150	Concerned by the reference to 'radioactive wastes from integrity testing.' It is unclear if this waste is part of Arrow's fracking process and the use of radioactive tracer beads. Arrow should disclose all details pertaining to this radioactive waste and how it will be managed.	EIS Chapter 14	Any radioactive materials generated by the project will be managed according to relevant standards and guidelines. Arrow will enforce a no hydraulic fracturing (fracking) policy in the Surat Gas Project development area (Commitment C079).
R3162	S133	The EIS does not provide any details in relation to potential radiation waste material which may be generated by the project. Extraction of liquids or	–	Any radioactive materials generated by the project will be managed according to relevant standards and guidelines.

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R3162	S133	gases from wells can be accompanied by the build up of radioactive scales on the sides of pipes and pumping equipment, the release of radon, the release of contaminated formation water, and the generation of sludges and oily sands containing radionuclides. The proponent needs to be aware that the project has the potential to concentrate naturally occurring radioactive material which may cause occupational and environmental harm.		
R3163	S133	The proponent must identify those parts of the process where naturally occurring radioactive material (NORM) may be a hazard. The proponent should deal with NORM in accordance with the ARPANSA Safety Guide for the Management of Naturally Occurring Radioactive Material (2008) and the disposal of waste containing NORM in accordance with the Radiation Safety Act 1999.	–	Any radioactive materials generated by the project will be managed according to relevant standards and guidelines.
R3164	S150	The EIS must provide information on whether Arrow intends to reinject gas as a means of safeguarding the domestic gas supply. There are several potential impacts associated with gas re-injection that would require assessment.	–	Arrow does not propose gas reinjection for the Surat Gas Project.
R3165	S143	Right of way footprint is not defined (specifically the footprint required for all weather access tracks on black soils).	–	The right-of-way (ROW) required for high-pressure gas pipeline construction is up to 40 m wide. The right-of-way required for low-pressure pipelines is 20 m and medium-pressure pipelines has a ROW of up to 25 m. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. The footprint on black soils within a landholders' property will subsequently be determined through this process.
R3166	S014, S044, S081, S139	In relation to pipelines; will gas lines and water lines be in the same trench/ right-of-way (ROW)? What will be the width of ROW and what timelines will these be inaccessible to landholders? What restrictions will be placed on the ROW?	–	Gas and water gathering lines will be placed within the same trench and will utilise the same right-of way where practicable and is dependent on the final destination for each. The right-of-way (ROW) required for high-pressure gas pipeline construction is up to 40 m wide. The right-of-way required for low-pressure pipelines is 20 m and medium-pressure pipelines has a ROW of up to 25 m. Timelines and restrictions placed on the right-of-ways located on private properties will be discussed with the landholder during the negotiation and development of a conduct and compensation agreement.

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R3167	S014, S044	Stakeholder requests that Arrow state if landholders are required to keep the 25 m right of way clear at all times.	–	Any restrictions placed on the right-of-ways located on private properties will be discussed with the landholder during the development of a conduct and compensation agreement.
R3169	S058	How will Arrow mitigate issues pertaining to the greater right-of-way, burial depths and longer construction times related to high pressure gas lines?	EIS Appendix S, Section 3.6	As part of the Surat Gas Project high-pressure gas pipelines are only required for the short connection from a central gas processing facility to the Arrow Surat Pipeline (i.e., pipeline lengths of a couple of kilometres each, connecting the eight facilities). EIS Appendix S, Preliminary Hazard and Risk Assessment, Section 3.6 explains that for each location where the high pressure gas pipeline will be installed, a risk assessment study will be conducted in accordance with the requirements in the Australian high pressure pipelines code AS 2885. The study will consider the characteristics (e.g., geology) of the potential location through which the pipelines will pass, and the types of risks to and from the pipeline. The study will show that all possible risks are identified, evaluated and appropriately planned for to confirm appropriate management of any risks during the pipeline construction and operation.
R3170	S108	There is no indication that when subsidence occur on backfilled right-of-ways (ROWs) if there will be further remedial action carried out to fill and level to ROW.	EIS Chapter 12, and Chapter 25	Once the gathering system is installed, the ground will be compacted to a level consistent with the surrounding land use. Arrow has committed to backfill and rehabilitate excavations, particularly pipeline trenches and drilling sumps. Arrow will conduct backfilling in a manner that will promote successful rehabilitation, including capping of exposed subsoil with topsoil and replacement of the land surface to preconstruction levels to reduce trench subsidence and concentration of flow. Mounding of soils to allow for settling may be required in some areas. However, in laser-levelled paddocks, this may not be practicable, and backfilling should be carried out in consultation with the landowner (Commitment C071). As part of Arrow's gathering line maintenance program, Arrow has committed to conduct regular patrols and inspections of pipeline easements, including status of signposting, subsidence and of fire breaks (Commitment C427). Corrective measures to address identification of subsidence will be addressed on a case-by-case basis with consideration for the severity of the occurrence and the impacts. Actions may be given a high priority or deferred to the planned maintenance period to lower the impacts to the landholder from multiple mobilisations.
R3171	S051, S110	Site preparation details of right of ways required for gas and water gathering lines need to be provided. Rights of landholders are not understood nor are the types of activities that could be undertaken on these areas. Impacts to landholders and businesses are not provided.	–	Site preparation of a right-of-way for gas and water gathering lines will include vegetation removal and stockpiling, topsoil stripping and stockpiling and grading where required. In environmentally sensitive areas, the ROW may be narrowed for short distances. Markers will be placed along the route to identify the pipeline centreline. Temporary fencing may be established around sensitive areas occurring along the ROW to demonstrate they are not disturbed during construction. Arrow is committed to engaging with landholders as early as possible. Arrow will engage with the landholder at

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R3171	S051, S110			least six to twelve months notice prior to activities occurring on their property. A conduct and compensation agreement between Arrow and the landholder will be negotiated to reduce the impacts to the landholder and their businesses. Arrow is working together with landholders to understand their concerns and to demonstrate their work practices reduce impacts on land and existing agricultural activities.
R3172	S146	What is the definition of a right-of-way in the context of Arrow's gasfield development?	EIS Chapter 30	EIS Chapter 30, Glossary, defines right of way as 'the linear area within which a pipeline, road or railway is constructed'. In terms of Arrow's proposed infrastructure for the Surat Gas Project, right-of-way areas will be used for pipelines, roads, (overhead) distribution lines and access tracks, as railway is not proposed.
R3173	S051, S146	For right-of-way access, does the proponent have higher priority than the landholder at all times?	–	Conditions on access to right-of-ways will be negotiated and agreed upon between Arrow and the landholder through the development of a conduct and compensation agreement.
R3174	S079	Will there be a right-of-way from the production well fences?	–	A right-of-way will be required where the gas and water gathering line parallels the production well fence line.
R3175	S014, S044	Stakeholder requests that Arrow provide the maximum right-of-way distance for gathering line installation with EIS Section 5.5.2 stating up to 20 m and EIS Appendix F suggestion that it may range up to 25 m.	–	The right-of-way (ROW) required for high-pressure gas pipeline construction is up to 40 m wide. The right-of-way required for low-pressure pipelines is 20 m and medium-pressure pipelines has a ROW of up to 25 m.
R3176	S081	Fencing of sensitive areas during construction, temporary or not, can impact on land users. Describe the sensitive areas that occur along a right-of-way?	EIS Chapter 13, and Attachment 10	Temporary fencing may be established around sensitive areas occurring along the ROW to demonstrate they are not disturbed during construction. Sensitive areas refer to those identified in the EIS for avoidance, which are also shown in the EIS, Attachment 10, Preliminary Constraints Mapping. Constraints maps will be updated with the findings of the EIS and the SREIS and through identifying site-specific sensitivities. Arrow has committed to consult and agree with landowners on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) and clearly identify the outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures (Commitment C084).
R3177	S002, S003, S009, S018, S020, S032, S034, S037, S039, S050, S053, S055, S059, S064, S065, S069, S070, S071, S076, S085, S087, S088, S096, S097,	Details regarding the greater right of way, burial depths, longer construction times related to high pressure gas lines is inadequate in the EIS.	EIS Chapter 25, Section 25.4.1, and Appendix S, Sections 3.6 and 6.6	As part of the Surat Gas Project high-pressure gas pipelines are required for the short connection from a central gas processing facility to the Arrow Surat Pipeline (i.e., pipeline lengths of a couple of kilometres each, connecting the eight facilities). EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1 notes that the high pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Preliminary Hazard and Risk Assessment, Section 6.6). EIS Appendix S, Section 3.6 explains that for each

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R3177	S002, S003, S009, S018, S020, S032, S034, S037, S039, S050, S053, S055, S059, S064, S065, S069, S070, S071, S076, S085, S087,			location where the high pressure gas pipeline will be installed, a risk assessment study will be conducted in accordance with the requirements in the Australian high pressure pipelines code AS 2885. The study will consider the characteristics (e.g., geology) of the potential location through which the pipelines will pass, and the types of risks to and from the pipeline. The study will demonstrate that all possible risks are identified, evaluated and appropriately planned for to confirm appropriate management of any risks during the pipeline construction and operation.
R3178	S150, S157	The EIS needs to identify the proximity between the proposed infrastructure and all household dwellings, businesses and other sensitive receptors throughout the entire development area. The project must establish safe buffer zones between infrastructure and all household dwellings, businesses and other 'sensitive receptors' in the project area. The EIS should identify all workplaces and offices in the EIS as sensitive receptors and then subsequently re-assess potential impacts.	EIS Chapter 25, Table 25.3, and Chapter 30	Arrow will locate wells and infrastructure away from homes in consultation with landholders (minimum of 200 m). The EIS considered the worst-case scenario for potential impacts from air and noise emissions, as well as hazards, to establish the separation distance from wells, facilities and infrastructure that is required to meet statutory compliance limits at the nearest sensitive receptor. EIS Chapter 30, Glossary defines a sensitive receptor as an area or structure sensitive to a predicted environmental impact (usually from air emissions or noise), such as a dwelling; a library, childcare centre, kindergarten, school, college, university or other educational institution; a hospital, surgery or other medical institution; etc. In most instances, Arrow meets the statutory compliance limit at a distance less than that already committed to for avoidance of residences (200 m). EIS Chapter 25, Preliminary Hazard and Risk Assessment, Table 25.3, in the EIS specifies that the minimum distance required between production wells and residential land uses, is 30 m.
R3179	S054	The term 'sensitive receptors' does not describe that these can be dwellings.	EIS Chapter 30	EIS Chapter 30, Glossary, defines a sensitive place or sensitive receptor as an area or structure sensitive to a predicted environmental impact (usually from air emissions or noise), such as a dwelling.
R3180	S005, S024, S026, S036, S051, S054, S079, S081, S083, S134, S146, S160	It is of major concern that not all sensitive receptor locations have been identified. A check of Arrow's database would show that the postal addresses of some of the unidentified sensitive receptors are on file with the proponent. Given Arrow has identified how integral the identification of sensitive receptors is to the assessment of impacts, all sensitive receptors with the entire Project Description Area must be ground truthed prior to the specialist environmental impact assessment being undertaken. Are commercial places located on Arrow's sensitive receptor maps? If not, why? Sensitive receptors identified in EIS figures 7.2a, 7.2b and 7.2c should include Millmerran School, Millmerran Service Centre, and sporting facilities in Cecil Plains and Millmerran. The maps provided by	SREIS Attachment 2, figures 4.1a, 4.1b and 4.1c	In September 2009 potential sensitive receptors were identified within the project development area through digitization of points in a geographical information system (GIS), using available imagery (including the Department of Natural Resources and Mines' data from 2001 to 2006, at 2.5 m resolution). Where areas of the project development area were not covered by the acquired imagery, Google Earth imagery was used (and Google Earth was also used if it was determined to be the most current imagery). The assessment identified 3,907 sensitive receptors in the project development area. Using the most conservative approach, all identifiable buildings were marked as potential sensitive receptors. Additional sensitive receptors were identified during a 10 day road-side survey in October 2009. Since preparation of the EIS, Arrow has acquired high-resolution aerial photography and LIDAR data, which enabled Arrow to update Figures 4.1a, 4.1b and 4.1c of EIS Attachment 5, Environmental Management Plan, in relation to potential dwellings, ancillary infrastructure and industrial facilities. These figures also identify commercial places, schools, health care facilities, etc. Assessment of

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R3180	S005, S024, S026, S036, S051, S054, S079, S081, S083, S134, S146, S160	Arrow are misleading with regards to numbers and situation of farm homes. It will be very difficult for the Department of Environment and Resource Management to have any comprehension of the density of the population living on the flood plain east of Cecil Plains. Tong Park Piggeries is a declared significant development within the project area, one of the largest piggeries in the country, but was not identified in the EIS.		site-specific impacts to every sensitive receptor would not be feasible as part of the EIS. The range of potential impacts to sensitive receptors has been identified and mitigation and management measures proposed to address these impacts. Site-specific impacts over and above those identified in the EIS will be addressed through negotiations with directly affected receptors.
R3181	S131	The properties in Chinchilla, Dalby and Cecil Plains associated with a government department have been located within excluded areas. However, the department properties within Millmerran, 34-40 Margaret St, in particular, has not been identified being located within an excluded area. Although the site is located outside the Project Description Area other properties located outside the development area have been formally identified as excluded areas whilst other properties have not. The department suggests that the proponent clarify and identify on the map the properties that are included in the Surat Gas Project Development Area and whilst doing so, include 34-40 Margaret St, Millmerran within the excluded area.	–	Arrow activities for the Surat Gas Project will be restricted to the area bound by the project development area. Statutory compliance limits in relation to any noise, air and odour emissions or light sources, must be met at the nearest sensitive receptor (from where the project activities are taking place), regardless of the receptor's location in relation to the project development area boundary.
R3182	S150	Facilities that operate for 30 years, 24 hours a day, 7 days a week will have a major impact on any 'sensitive receptors', agricultural businesses, towns, residences and other human dwellings or services, regional ecosystems and their biodiversity existing in close proximity to those production facilities.	–	The EIS has considered the project life span as part of the assessment of the magnitude of potential impacts caused by project activities, a factor in determining the significance of an impact.
R3183	S157	Arrow must identify the areas, environmental values and receiving environment in a manner such that stakeholders are able to identify themselves within the project development area, because the lack of detail to date means that Arrow could respond by saying that we are not within the area of concern and that stakeholders have no legitimate interest in opposing the EIS.	SREIS Chapter 2	Any interested or affected party had the opportunity to make a formal submission on the EIS, regardless of whether they were located within the project development area (or area of concern). Further opportunities for interested and affected parties to have input to the ongoing approval processes is explained in SREIS Chapter 2, Project Approvals Update.
R3184	S157, S166	Arrow must provide more detailed mapping to show:	–	There is approximately 4,080 lot on plans located within the EIS project development area. All affected persons (and interested persons), were

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R3184	S157, S166	<ul style="list-style-type: none"> • All landholdings to be affected, including lot on plan description. • Identify all existing land uses with aerial photo bases at the scales required in the terms of reference. • All environmental values and their location. • Projected activities and maps identifying the location of infrastructure to the most detailed level possible – distinguishing between 'probable', 'likely' etc. • Locational information on Arrow's first five year plan, or preferably longer. • Reserve locations and associated decision making criteria. • Areas of the project that will not be affected at an appropriate scale. 		<p>notified in accordance with the EIS process under the Environmental Protection Act 1994 (see section 41). As the facility and infrastructure locations are not yet known, maps of affected persons' landholdings would show only topography and land tenure, without any relation to project site locations. Appendix D of EIS Appendix A, Planning Assessment, presented land use maps at the scale appropriate for the assessment, across the project development area. Environmental values and their location are described in EIS chapters 9 to 26 and SREIS chapters 5 to 15. The project development area within which project activities will occur and conceptual facility locations are presented in EIS Chapter 5, Figure 5.11, Conceptual location of production facilities. The SREIS identifies five properties on which Arrow will site four central gas processing facilities and one temporary workers accommodation facility during the first five years of development. An update to EIS Figure 5.11, which presents these property locations, is presented in SREIS Chapter 3, Project Description (see Figure 3.6). Gas reserves are refined through exploration. SREIS Chapter 3, Project Description explains that refinement of the gas reserves has resulted in the relinquishment of a number of sub-blocks, thus reducing the project development area by approximately 30%. Development planning within the project development area is also guided by potential environmental and social constraints as outlined in EIS Chapter 5 (see also Table 5.10) and EIS Attachment 10, Preliminary Constraints Maps, which include areas of the project that will not be affected by project activities.</p>
R3185	S034, S069	<p>If Arrow are going to insist on locating gas field infrastructure outside of cultivated areas, what distance will the infrastructure be from houses and sheds?</p>	<p>EIS Chapter 25, Table 25.3</p>	<p>Table 25.3 in the EIS specifies that the minimum distance required between production wells and residential land uses is 30 meters. Arrow will avoid locating wells and infrastructure within 200 m of residences.</p>
R3186	S005, S024, S025, S026, S036, S043, S049, S052, S054, S056, S061, S068, S071, S079, S080, S081, S083, S093, S143, S146, S155, S162	<p>Many towns within the project development area have fewer than 1,000 people. It needs to be stated what the minimum distance of each of the various types of project infrastructure to towns, both less than and greater than 1,000 people, and sensitive receptors will be.</p>	<p>SREIS Attachment 4</p>	<p>Project infrastructure, such as production wells and production facilities, will not be located in the towns that are in or adjacent to the project development area. However, supporting facilities, such as depots, stores and offices, may be located in or adjacent to those towns. Siting of project facilities and infrastructure will be at a distance from sensitive receptors (e.g., dwellings) that enable Arrow to meet legislated noise, air, vibration and safety requirements. These distances are site-specific as the surrounding land use and site-specific topographic and meteorological conditions affected the distances required. As a minimum, Arrow will locate infrastructure at a distance of 200 m from dwellings, in consultation with the landowner.</p>
R3187	S081	<p>Are there minimum separation distances between project infrastructure and other land use activities, particularly those involving combustible and explosive materials? What impact does this create</p>	<p>SREIS Chapter 13 and Attachment 4</p>	<p>The minimum distance between project infrastructure and other land uses will be determined with consideration for site-specific conditions and Arrow's legislative requirements, including compliance limits in relation to its generation of noise and air emissions and safety risks. EIS Appendix S,</p>

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R3187	S081	to agricultural values in the project development area?		Preliminary Hazard and Risk Assessment describes the risk criteria associated with various land uses (i.e., industrial, open space, commercial and sensitive) and how the buffer between the varying land uses and project infrastructure varies. Impacts to agricultural values in the project development area are described in EIS Chapter 13, Agriculture.
R3188	S134	Studies should have been completed earlier, enabling site selection to have occurred in EIS and residual impacts to be more accurately identified. Arrow to provide sufficient information regarding the expected release of final site selection, and detail the rationale behind the sites selected.	–	That exact location of all proposed infrastructure has not yet been determined and is not a specific requirement of the Terms of Reference.
R3189	S134	When will the proposed additional studies commence? Arrow to prioritise and fast-track proposed additional studies to enable accurate site selection.	–	Arrow are progressing various studies and detailed model iterations that may become available for presentation in the SREIS.
R3190	S157	Section 4.2.1.3 of the Terms of Reference clearly required the delineation of the gas resources within the project area, describing the location, quantity and quality of the resources and reserves within the project area, as well as: <ul style="list-style-type: none"> • Maps (at appropriate scales) showing the location and areal extent of the gas resources to be developed. • Location and boundaries of any project sites. • Location and boundaries of any other features that will result from the proposed production including water storage facilities and other infrastructure. • Location of any proposed buffers • Surrounding working areas. • Any part of the resource that may be sterilised by the proposed production operations or infrastructure. These requirements have not been met in the EIS. 	SREIS Chapter 3, Figure 3.6	The Department of Environment and Heritage Protection (then DERM) conducted a compliance check on the Surat Gas Project EIS and confirmed that with regard to the Terms of Reference, the EIS was adequate for public exhibition. Since publication of the EIS, exploration has allowed Arrow to relinquish tenure that was within the project development area, as it did not prove to be viable. The SREIS presents updated maps of the project development area. The SREIS Chapter 3, Project Description provides Figure 3.7 that shows the approximate development schedule and which drainage areas will be developed simultaneously. Arrow has identified properties within which to site four central gas processing facilities, two of which will be co-located with water treatment facilities. A property has also been identified for location of a temporary workers accommodation facility (TWAF) TWAF F. The exact locations of infrastructure within these sites have not been determined and the final siting of infrastructure will be informed by a constraints analysis. Figure 3.6 of SREIS Chapter 3, Project Description shows the location of the Arrow-owned properties in which the mentioned infrastructure will be placed. Landholders are involved in the development of production plans for their private property. These plans will include maps at the property scale and will contain detailed information specific to that property.
R3191	S157	The EIS did not meet the Terms of Reference for Section 3.1.2 which is non-compliant. In particular, there were issues with the following mapping requirement were not met: <ul style="list-style-type: none"> • Detailed mapping in terms of local context. • EIS figures 1.1, 4.13, 4.14 and 5.11 throughout 	SREIS Chapter 3	As the facility and infrastructure locations are not yet known, maps at a scale of 1:50,000 would show only topography and land tenure without any relation to project site locations. As such, these maps were not prepared for the EIS. The Department of Environment and Heritage Protection (then the Department of Environment and Resource Management) conducted a compliance check on the Surat Gas Project EIS and confirmed that with

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R3191	S157	the relevant EIS chapters are scaled at 1:1,250,000 instead of the minimum 1:50,000. • Maps were not presented with an aerial photo base which makes it impossible to identify the nature of the receiving environment, environmental values or local context.		regard to the Terms of Reference, the EIS was adequate for public exhibition. The SREIS presents five properties on which Arrow will site four central gas processing facilities and one temporary workers accommodation facility. For these sites, further fieldwork has been conducted and is presented in SREIS chapters 9 to 11. These chapters include figures identifying the findings and survey locations with newly acquired aerial photography as the base layer to these figures.
R3192	S157	Section 4.2.1.6 (Infrastructure) of the Terms of Reference requiring Arrow to indicate the locations of proposed gas and water pipelines, power lines and any other easements has not been met in the EIS.	EIS Executive Summary, Section 5.1	As described in the EIS Executive Summary, Section 5.1, coal seam gas field development typically proceeds on an incremental basis, with exploration and reservoir engineering respectively confirming the most productive areas and well density required to maximise recovery of gas. The actual locations of wells, gas and water gathering lines and production facilities are consequently, progressively identified and refined over the life of the project. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the location and length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan demonstrate catchment wide integration and balance needs of individual landholders with those of neighbouring properties) will also influence the final siting of facilities and infrastructure. Power line easements will be identified through a separate approval process.
R3193	S063	By stating the project should proceed, the EIS has violated the requirements of the Terms of Reference. The integrity of the EIS has been compromised.	–	Noted.
R3194	S157	The timeframes presented in the EIS are confusing. The EIS states that the project has a 35 year lifespan. There is no statement in the EIS as to why a 35 year project lifespan was selected. The timelines for water production rates however stops at 30 years without explanation. In contrast, EIS Chapter 6, Table 6.1 showing potential production wells (unconstrained by gas resources) is calibrated to 42 years.	SREIS Chapter 3, Section 3.4.1	As discussed in SREIS Chapter 3, Section 3.4.1, the expected project life is 35 years. Gas and water production estimates for the life of the project will vary as exploration results refine the understanding of the gas reserves and production data informs Arrow's understanding of dewatering rates.
R3195	S134	Arrow to identify how many of the five identified project phases will be operational concurrently at different locations within the project area. Arrow to provide sufficient detail regarding the timeframes for the five project phases.	SREIS Chapter 3, Section 3.1 and Figure 3.7	As per SREIS Chapter 3, Project Description, Section 3.1, instead of the five development areas the SREIS presents 11 drainage areas. Figure 3.7 shows the approximate development schedule and which drainage areas will be developed simultaneously.

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R3196	S109	Throughout the community consultation program, the community was advised that a decision on developing the coal seam gas deposits in the Cecil Plains area would not be made until 2023, when further information was available regarding the potential impacts to the Condamine Alluvium. The EIS states that Arrow will be proceeding as early as 2014 when this information would not be available.	EIS Appendix B, Appendix 37	At public consultation in May 2011 (EIS Appendix B, Consultation Report, Appendix 37), Arrow presented a timeline showing that the project construction and start up would begin in 2014. At public consultation in June 2010 (EIS Appendix B, Consultation Report, Appendices), Arrow made the statement that it doesn't expect the need to access IFL for development until around 2023, however planning needs to take place and access to land will be required for such activities as establishing groundwater monitoring bores. Arrow has committed not to develop on IFL until it has satisfactorily addressed community concerns which it is working through in various forums, principally the Arrow Intensively Farmed Land Committee (AIFL). Arrow continues to engage with the Condamine River flood plain community through a range of forums including the AIFL Committee, Arrow Surat Community Reference Group, Gas Fields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups.
R3197	S002, S003, S009, S014, S018, S019, S020, S032, S037, S038, S039, S044, S046, S050, S051, S053, S055, S059, S064, S065, S069, S070, S071, S076, S079, S081, S085, S087, S088, S095, S096, S097, S098, S108, S114, S130, S139, S140, S146, S152, S154, S158, S167	Landholders have been actively trying to reduce the number of overhead lines across their properties. Overhead transmission lines are not compatible with land use on the Condamine Floodplain or any other cropping land within the project area; rejects the suggestion of replacing gas driven engines with electric powered engines with consideration of impacts to safety, operational (applying chemicals by air and the use and movement of farming equipment) and flexibility reasons. The installation of lines which traverse our properties must be avoided. All new power lines should be located underground and buried to a suitable depth at which they will not interfere with farming operations. States there is a lack of detail regarding overhead transmission lines which makes it difficult for a land owner to assess the likely impacts of this project on their property. Requests Arrow provide details on: <ul style="list-style-type: none"> • The impact of overhead powerlines on all types of agriculture in the project area. • The impact of overhead power lines on a 800 m to 1500 m grid to agriculture, specifically on the operations of the landowner. • Clearing and energy impacts from the installation of power infrastructure. • Overhead line length; expects it will be considerable, as will the width of this line. • What will become of the infrastructure once the 	SREIS Chapter 3	SREIS Chapter 3, Project Description describes Arrow's revised preferred power supply option, including high voltage transmission lines which would be constructed and operated by a transmission network service provider. Under this arrangement, power would be transmitted from existing substations or switchyards in the Queensland electricity grid to zone or facility substations. Zone substations would then be established in the vicinity of each central gas processing facility where multiple high voltage circuits are required for the connection to facilities and other zone substations. A typical footprint of up to 330 m by 280 m would be required for 132 KV, and a 500 m by 500 m footprint for 275/132 KV, would be required to establish a zone substation. Electricity supplied to facility substations will be distributed to production wells, production facilities and associated infrastructure via a network of overhead power lines and/or underground cables. Underground cables to production wells will have a typical burial depth of 1.2 m, and be laid in the same corridor as the gas and water gathering systems. Above ground power distribution to production wells will be assessed during detailed design, however it will not be implemented when it conflicts with current farming practices and equipment used (e.g., irrigators). The installation of above ground and underground cables will be negotiated with landholders. Power generation, however, may be temporarily required in the initial phase of operation until production wells, production facilities and associated infrastructure are connected to the electricity grid. The SREIS has been updated to incorporate the national grid supply as the preferred power supply option, retaining self-generation in assessments where this presents a worst-case scenario (e.g., air emissions from gas fed wellhead generators). Electricity transmission infrastructure required to connect supply points to the Queensland electricity grid will be subject to separate environmental approvals processes by the transmission network service provider. The alignment of transmission lines will be informed by physical, environmental,

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R3198	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S108, S110, S146, S150, S162	More information is required on venting of gas and drainage of coal seam gas water including the location, design, frequency of occurrence along a pipeline and footprint, locations of release of venting gas and water from valves and, vent and drain points and measures to prevent environmental harm from vented gas and drained water. What are the anticipated quantities of released gas from vents and drains? How is accumulated water captured? If accumulated water is released, what are the impacts on environmental values including soil, agriculture and groundwater? How will methane vented from the high point vents be kept below flashpoint?	EIS Chapter 9, and Chapter 25 SREIS Chapter 3, Section 3.4.2	Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2, or relevant Australian standards, as revised from time to time (Commitment C444). The Code addresses safety performance, design, construction and testing of pipeline systems and places particular emphasis on jointing techniques and pressure test methods. Such pipeline systems include high point vents, low point drains, isolation valves and manifolds, some of which involve other materials. The front-end engineering design (FEED) process undertaken after completion of the EIS, is expected to commence in mid 2013 and will further refine project options and processes. The location design and frequency of valves, vents and drainage points will be determined during this phase. SREIS Chapter 3, Project Description further explains the components of the gas and water gathering systems with respect to: <ul style="list-style-type: none"> • Low point drains; installed to remove collected water and transfer it into the adjacent water gathering line with the surface facilities occupying approximately up to 5m by 5m. • High point vents: required along the system to release collected gas to the atmosphere and restore water flow, with surface facilities occupying approximately 3 m by 3 m. • Pump transfer stations: to increase the pressure of coal seam gas water collected in the gathering networks, as required to reach the water treatment plant or compression facilities. • Gas and water nodes at major watercourse crossings: for water collection from an adjacent gas header situated adjacent to a river crossing, either from

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R3198	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S108, S110, S146, S150, S162			<p>a low point drain or gas node. As per SREIS Chapter 3, Project Description, Section 3.4.2, coal seam gas water from low point drains will be captured and transferred into adjacent water pipelines. This water will be then be treated at the water treatment facility. In order to minimise the impacts on environmental values in relation to venting of gas and drainage of coal seam gas water, Arrow has committed to:</p> <ul style="list-style-type: none"> • Prevent venting and flaring of gas as far as practicable and where safe to do so (Commitment C016). • Install isolation valves on pipelines in accordance with relevant standards and industry practices (Commitment C445).
R3199	S026, S034, S036, S069, S081, S083, S162	Landholders with vents, valves and drains on their properties have reported that the volumes of water being released from low point drains have caused the ground to become saturated. Water has also been reported to flow across gravel roads.	EIS Chapter 13 SREIS Chapter 3, Section 3.4.2 and Figure 3.3	As per SREIS Chapter 3, Project Description, Section 3.4.2, coal seam gas water from low point drains will be captured and transferred into adjacent water pipelines. This water will be then be treated at the water treatment facility. Figure 3.3 depicts how water collected from low point drains are transferred into the adjacent water gathering line. Arrow's gathering system maintenance includes the inspection and maintenance of valves, vents, pumps and associated instruments. Landholders should report any issues or complaints to their land liaison officer. Arrow has committed to maintain the grievance process (complaint management system) for the community to register complaints, issues, comments and suggestions (Commitment C077). If a landholder suspects a pipeline is leaking coal seam gas water, they should contact Arrow immediately on 1-800-779-488 and they will send a maintenance crew to inspect the pipeline, and will keep the landholder informed of response plans.
R3200	S141, S144	High and low vent points located through the gathering network needs to have conditions applied to ensure there is no impact to surrounding soil and water resources.	EIS Attachment 8	Arrow will work in accordance with any conditions placed on the Surat Gas Project by government and respect regulatory requirements. Arrow has also developed numerous commitments in the EIS Attachment 8, EIS Commitments Summary, to reduce impacts to surrounding soil and water resources.
R3201	S123	The EIS says 'however it is assumed that the waste management infrastructure within the region is able to cope with any new developments. If not the Surat Gas Project will transport waste to another facility with adequate capacity.' The information contained in the EIS is vague and does not provide enough information to make an informed assessment.	SREIS Chapter 2, Section 2.3.2, and Attachment 5	<p>The brine management options being considered in the SREIS are as follows (in descending order of preference):</p> <ul style="list-style-type: none"> • Selective salt recovery at a joint industry facility. • Selective salt recovery at an Arrow-only facility. • Injection into a suitable aquifer. • Discharge to the ocean. • Disposal to landfill. <p>SREIS, Attachment 5, Coal Seam Gas Water and Salt Management Strategy, provides further details on the management framework for brine to be implemented for the Surat Gas Project. Disposal of brine to landfill is not Arrow's preferred option, however should this be required, brine will be transported to a regulated third party waste facility licensed to accept this material. Where management strategies that involve third party operators</p>

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R3201	S123			(such as licenced treatment or disposal facilities) are used, then those facilities will be required to operate in accordance with the conditions of their own (separately approved) environmental authorities. The third party operators would also be responsible for the environmental management requirements that are applicable to waste management facilities. The feasibility of these potential management strategies will be investigated and the chosen management options detailed in the Coal Seam Gas Water Management Plan for the Environmental Authority amendment application process described in SREIS Chapter 2, Project Approvals, Section 2.3.2. The management plan will include detailed brine impact assessments and management strategies. The management options for brine will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves.
R3202	S130	If camps are to be used it is requested that consideration is given to construction of a centralised sewerage disposal and treatment facility to augment existing town facilities.	–	Arrow will be independent of the public sewage infrastructure for construction purposes. Sewage treatment facilities will be installed at the accommodation sites. During the operations phase, Arrow has committed to connect wastewater and sewerage systems to sewers where locally present. Alternatively, Arrow will install wastewater treatment or reuse systems in accordance with AS/NZS 1547:2000, On-site Domestic Wastewater Management (Standards Australia, 2000); DERM guideline for managing sewerage infrastructure to reduce overflows and environmental impacts (DERM, 2010b); and Queensland water recycling guidelines (DERM, 2005) (Commitment C148).
R3203	S134	Arrow to provide more specific detail regarding greywater, stormwater and wastewater management, taking into account that tankered sewage or domestic wastewater is generally only accepted at Toowoomba's Wetalla Water Reclamation Facility, and only if generated within the regional council's boundaries.	–	Noted. Arrow will be independent of the public sewage infrastructure for construction purposes. Sewage treatment facilities will be installed at the accommodation sites. Liquid wastes (including grey water and sewage effluent), will typically be removed by tanker to licensed facilities for re-use, recycling or disposal. During the operations phase, Arrow has committed to connect wastewater and sewerage systems to sewers where locally present. Alternatively, Arrow will install wastewater treatment or reuse systems in accordance with AS/NZS 1547:2000, On-site Domestic Wastewater Management (Standards Australia, 2000); DERM guideline for managing sewerage infrastructure to reduce overflows and environmental impacts (DERM, 2010b); and Queensland water recycling guidelines (DERM, 2005) (Commitment C148).
R3204	S079	Who is responsible for weed and pest control within and around the fenced area and if it is Arrow then what chemicals will be used?	EIS Chapter 16 Chapter 17	Arrow will manage the weed and pest control within fenced areas, i.e., a well site, and has committed to develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Undertake species-specific management for identified key weed species at risk of spread through project activities (mesquite, parthenium, African lovegrass and lippia). Increase weed control efforts in areas particularly sensitive to invasion. The pest

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R3204	S079			management plan should include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (Commitment C188). In controlling weeds, Arrow has committed to limit the use of herbicides in the vicinity of watercourses or within riparian zones. Use non-toxic, non-persistent (i.e., biodegradable) herbicides to treat weeds, except on properties where organic or biodynamic farming is practised, for which the method of weed treatment is to be agreed with the landowner (Commitment C199).
R3205	S123	Department of Agriculture, Fisheries and Forestry requests that Arrow provide greater justification for well spacing and landscape sensitivity especially in strategic cropping land areas. If needed this should also include areas of further avoidance.	EIS Chapter 13 SREIS Chapter 3	SREIS Chapter 3, Project Description provides an update and further clarity around well spacing. The spacing between wells will vary according to the coal depth and coal permeability, however, well pads will be located to reduce impacts on agricultural industry practices in areas surrounding the pads. The EIS conceptualised that vertical wells would be drilled with a separation distance averaging a minimum of 800 m across the project development area. By using deviated production wells, well pad sites for multiple well pads may allow separation distances in excess of 2,000 m in some instances. This is a result of a commitments made in the EIS to 'investigate the opportunity to increase well spacing from 160 acres (65 ha) to 320 acres (129 ha) or greater to reduce the footprint on strategic cropping land' (Commitment C083), and to 'investigate alternative drilling technologies, such as using directional drilling to access coal measures, reducing gathering system pipe diameters and drilling multiple wells from one drill pad to potentially reduce the footprint on strategic cropping land' (Commitment C087). Arrow has committed not to drill wells on intensively farmed land at less than an average grid spacing of 800 m. The location of a well(s) is agreed with the landholder on who's property the well will be located on as part of a conduct and compensation agreement. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties) will also influence the final siting of facilities and infrastructure.
R3206	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S059, S064, S065, S070, S071, S076, S085, S088, S096, S097, S098, S114, S139, S140, S149, S152, S154, S167	The lack of detail around the number of wells, the grid spacing, and the location of other gas field infrastructure indicates that Arrow does not have a clear understanding of their development requirements.	EIS Executive Summary, Section 5.1	As described in the EIS Executive Summary, Section 5.1, coal seam gas field development typically proceeds on an incremental basis, with exploration and reservoir engineering respectively confirming the most productive areas and well density required to maximise recovery of gas. The actual locations of wells and production facilities are consequently, progressively identified and refined over the life of the project. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties) will

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R3206	S002, S003, S004, S006, S009, S018, S019, S020, S032,			also influence the final siting of facilities and infrastructure. For example, since publication of the EIS, exploration has allowed Arrow to relinquish tenure that was within the project development area, as it did not prove to be viable.
R3207	S081	What is the nature and extent of the environmental, social economic, reservoir characteristics and existing land use constraints? Has a constraints analysis been conducted for these constraints with regard to well spacings?	SREIS Chapter 3	In the first instance, an area must prove to be prospective through exploration to warrant Arrow developing a particular location within the project development area. For example, SREIS Chapter 3, Project Description will present parcels of land within the project development that have been relinquished by Arrow since publication of the EIS. Environmental, social and existing land use constraints will influence the final location of any wells (infrastructure and facilities), through conditioning of the project by EHP, commitments made by Arrow in the EIS (and SREIS) and through negotiation of conduct and compensation agreements with individual landholders. Area Wide Planning, which aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties, will also influence the location of wells and associated access tracks and gathering lines. A constraints analysis is conducted by Arrow at the design phase and then refined through discussions with landholders and site specific aspects.
R3208	S143	Require clarification on the ranges of production well spacing proposed. The text is confusing (800 m grid spacing and well densities of 65 to 135 per ha). Provide details if this range of estimates is to provide for other infrastructure or roads.	SREIS Chapter 3	SREIS Chapter 3, Project Description provides an update and further clarity around well spacing. Production wells will generally range from 300 m to 750 m vertical depth, depending on the depth of the coal seams. The spacing between wells will vary according to the coal depth and coal permeability, however, well pads will be located to reduce impacts on agricultural industry practices in areas surrounding the pads. The EIS conceptualised that vertical wells would be drilled with a separation distance averaging a minimum of 800 m across the project development area. By using deviated production wells, well pad sites for multiple well pads may allow separation distances in excess of 2,000 m in some instances. The grid of production wells may be drilled sequentially, or in stages, to take into account monitoring and review of performance of the initial wells with wide spacing, before adding remaining wells to complete the grid (a process known as infilling). Arrow has committed not to drill wells on intensively farmed land at less than an average grid spacing of 800 m. For each well, an approximate length of right-of-way is 2 km, with 1 km allocated for roads and access tracks and another 1 km allocated for gas and water gathering lines. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems.
R3209	S025, S081	Why has an indicative range been provided for an	SREIS	SREIS Chapter 3, Project Description, Section 3.4.1 provides an update and

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R3209	S025, S081	800 metre grid well spacing, when the calculations equate to a 65 ha or 160 acre spacing? If the range estimates are provided to allow for other infrastructure or rights of way, then these details need to be provided.	Chapter 3, Section 3.4.1	further clarity around well spacing. Production wells will generally range from 300 m to 750 m vertical depth, depending on the depth of the coal seams. The spacing between wells will vary according to the coal depth and coal permeability, however, well pads will be located to reduce impacts on agricultural industry practices in areas surrounding the pads. The EIS conceptualised that vertical wells would be drilled with a separation distance averaging a minimum of 800 m across the project development area. By using deviated production wells, well pad sites for multiple well pads may allow separation distances in excess of 2,000 m in some instances. The grid of production wells may be drilled sequentially, or in stages, to take into account monitoring and review of performance of the initial wells with wide spacing, before adding remaining wells to complete the grid (a process known as infilling). Arrow has committed not to drill wells on intensively farmed land at less than an average grid spacing of 800 m. For each well, an approximate length of right-of-way is 2 km, with 1 km allocated for roads and access tracks and another 1 km allocated for gas and water gathering lines. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems.
R3210	S014, S044, S150	Arrow should provide further information regarding well workovers: <ul style="list-style-type: none"> • How much time is required to complete a well workover? • What materials and heavy equipment will be used? • What are the risks to the receiving environment? • When and how will associated waste be managed? • What are the likely disruptions to farming activities? 	EIS Chapter 13 SREIS Chapter 15	A completion rig is typically used post initial well completion to perform well intervention activities, also known as workovers. Well interventions are used to repair or optimise the well and to maintain the wellbore integrity (for example repairing the artificial lift system by removing and replacing the pump). A completions rig comprises of a number of units that make up the rig itself with a complement of site offices, equipment and stores. During a well workover, additional large vehicles are required to enter and leave site to support operations. An average pump run life of two years is expected over the course of the project, which Arrow will endeavour to maximise through technology improvements. Individual wells will show a variation around the average run life. This results from differences in geology (e.g., the amount of coal fines that may be drawn through the pump) and in the loads placed on the well pump system due to different well shapes (for deviated wells). For multi-well pads, this does mean that a workover rig will be in attendance at the pad proportionately more often than if there was a single well. This is obviously offset in terms of overall footprint by requiring fewer surface locations for multi-well pads. The overall size and shape of completions rigs varies between manufacturers and capacity and functionality of the rig. For well interventions, the rig size required may be driven by the type of well intervention required and the availability of rigs to execute the operation. The workover frequency will vary for individual wells over the life of the wells. The time required to complete a workover will depend on type of workover required. The workover (and downhole water pump maintenance) will take

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R3210	S014, S044, S150			approximately seven days per well, with a crew of five people. The risks to the receiving environment for workovers have been assessed both quantitatively and qualitatively and is discussed in the SREIS Chapter 15, Preliminary Hazard and Risk. Wastes liquids will typically be removed by tanker to licensed facilities for re-use, recycling or disposal. Where suitable, drilling fluids will be re-used for the drilling of subsequent wells to reduce waste. Solid wastes (e.g., cleared vegetation, cut and fill material and drill cuttings) will be recycled and reused in site rehabilitation where possible, otherwise they will be removed off-site and to an appropriately licensed waste facility. The likely disruptions to farming activities are described in the EIS Chapter 13, Agriculture, and landholders impacted by workovers will be compensated through a negotiated conduct and compensation agreement between the landholder and Arrow.
R3211	S003, S004, S006, S009, S018, S019, S020, S024, S025, S026, S027, S032, S034, S036, S037, S039, S050, S053, S054, S055, S058, S059, S064, S065, S069, S070, S071, S076, S083, S085, S087, S088, S096,	Actual area required for well workovers is not clearly presented in EIS. Well sites are claimed to be only 10 m by 10 m, but during construction the area required is 85 m by 85 m. Regular workovers are required every 2 to 3 yrs and would require more than the 10 m by 10 m.	SREIS Chapter 3	The SREIS Chapter 3, Project Description has provided clarification that the operations footprint is consistent with the construction footprint. The similar footprint size considers the regular workovers required. The size of the well pad location will vary depending upon the number of wells to be drilled at a single location, the size of the drill rig required and individual topographical requirements. A single well site may be up to approximately 100 m by 100 m (i.e., 1 ha) including an area for sediment and erosion control devices, while a multi-well pad containing up to 12 wells may be 200 m by 100 m, inclusive of allowance for sediment and erosion control. In some cases, multi-well pads will occupy a smaller area depending on the type of drilling rig used and the number of wells installed. Well sites will be assessed on an individual basis to reduce footprint as far as practicable.
R3212	S024, S025, S026, S034, S036, S054, S069, S081, S083, S162	What area will be required for wellhead workovers? What area of wellhead footprint aggregate will be required and how frequently do some wells require maintenance?	SREIS Chapter 3, Table 3.2	The SREIS Chapter 3, Project Description explains that the area required for well workovers is consistent with the construction footprint, which is approximately 100 m by 100 m (i.e., 1 ha) for a single well site and up to 200 m by 100 m for a multi-well pad. Table 3.2 from the SREIS Chapter 3, Project Description provides revised estimated volumes of aggregate required for single well and multi-well sites for each of the 11 drainage areas. The workover frequency will vary for individual wells over the life of the wells.
R3213	S143, S162	The location and footprint of wells and design of gathering lines is not consistently represented throughout the EIS. There are in different chapters, well footprint areas assumed to be either 75 m by 75 m, 85 m by 85 m and 10 m by 10 m, used to determine the mitigating response. Different chapters depending on their specific topic, suggest wells to be positioned in an 800 m by 800 m grid, however are to be either 200 m or 300 m away	EIS Attachment 8 SREIS Chapter 3	Arrow recognises that each site proposed for a production well varies depending on the environmental, social and existing land use constraints and will influence the final location of any wells (infrastructure and facilities). The SREIS Chapter 3, Project Description has provided clarification that the operations footprint is consistent with the construction footprint. The similar footprint size considers the regular workovers required. Commitments made in the EIS Attachment 8, EIS Commitments Summary, identify areas that Arrow has committed to avoiding placement of infrastructure and identifies minimum distances from sensitive areas. The size of the well pad location will

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R3213	S143, S162	from sensitive receptors (houses) unless in a critically endangered bioregion (e.g. 11.3.21) when petroleum activities must be placed 800 m away from a sensitive receptor (road reserve, stock route). Yet it is preferred to have wells based close to roads to minimise the disturbance to farming. There are some tables that suggest avoiding being on the Jimbour floodplain at all. The design parameters of the gather lines is not clear either, including diameter, depth in soil, signage used and distance apart, valves and distance apart, availability for use of the ground for farming all being examples.		vary depending upon the number of wells to be drilled at a single location, the size of the drill rig required and individual topographical requirements. A single well site may be up to approximately 100 m by 100 m (i.e., 1 ha) including an area for sediment and erosion control devices, while a multi-well pad containing up to 12 wells may be 200 m by 100 m, inclusive of allowance for sediment and erosion control. In some cases, multi-well pads will occupy a smaller area depending on the type of drilling rig used and the number of wells installed. Well sites will be assessed on an individual basis to reduce footprint as far as practicable. As described in the EIS Executive Summary, Section 5.1, coal seam gas field development typically proceeds on an incremental basis, with exploration and reservoir engineering respectively confirming the most productive areas and well density required to maximise recovery of gas. The actual locations of wells and production facilities are consequently, progressively identified and refined over the life of the project. Once the location of a well(s) is agreed with the landholder on who's property the well will be located (as part of a conduct and compensation agreement), Arrow will be able to accurately describe the length (and in relation to access tracks, width) of associated access tracks and gathering systems. Area Wide Planning (that aims to incorporate individual farming plans into an integrated plan to balance individual needs of landholders with the needs of neighbouring properties) will also influence the final siting of facilities and infrastructure. For example, since publication of the EIS, exploration has allowed Arrow to relinquish tenure that was within the project development area, as it did not prove to be viable.
R3214	S024, S025, S026, S034, S036, S069, S081, S083, S150, S162	The EIS refers to a 'small safety exclusion zone' around established wells without offering detail regarding footprint size, reasons for its existence, and associated hazards and risks to humans and livestock.	EIS Chapter 5 Chapter 17 SREIS Chapter 15	The risks to the receiving environment for wells have been assessed both quantitatively and qualitatively and is discussed in the EIS Chapter 17, Terrestrial Ecology, and in SREIS Chapter 15, Preliminary Hazard and Risk. Completed well sites will be fenced and the design of the fence will be dependent upon the location, risk of unauthorised access and the results of a quantitative risk assessment.
R3215	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S086, S141, S144, S146, S150, S159, S162	Claimed the operational footprint was misleading in the EIS, as it failed to consider the regular workover requirements. Queries raised regarding the wellpad footprints, requesting clarification on the: <ul style="list-style-type: none"> • Maximum construction footprint. • Actual disturbance footprint over time. • Impact of the disturbance footprint over time. • Actual footprint of wellpads on the Condamine Flood Plain that require an 85 m by 85 m gravel hardstand at all times creating a watershed area such that soil conservation structures around the wellpad (to prevent erosion of the surrounding 	EIS Chapters 12 to 22 SREIS Chapter 3	The size of the well pad required for well installation and completions will vary depending upon the number of wells to be drilled at a single location, the size of the drill rig required and individual topographical requirements. SREIS Chapter 3, Project Description explains that a single well pad installation may require up to approximately 100 m by 100 m (i.e., 1 ha) including an area for sediment and erosion control devices, while a multi-well pad containing up to 12 wells may be 200 m by 100 m, inclusive of allowance for sediment and erosion control. In some cases, multi-well pads will occupy a smaller area depending on the type of drilling rig used and the number of wells installed. The SREIS Chapter 3, describes that after establishment of the well, post drilling and completions operations, the size of the well lease may be reduced dependent on a number of factors, including: <ul style="list-style-type: none"> • The location of the well.

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R3215	S014, S024, S025, S026, S034, S036, S044, S069, S079, S081, S083, S086, S141, S144, S146, S150, S159, S162	land), which would extend the wellpad footprint beyond 85 m by 85 m. • Ability to reduce the wellpad footprint on the floodplain after installation, given that the nature of the soil will make rehabilitation impossible between workovers.		<ul style="list-style-type: none"> • The type of land activities taking place in vicinity to the well. • Discussions with landholders. • The frequency at which well interventions are required through the life of the well. <p>In instances where a reduction in well lease is feasible, the size of the well lease may be reduced down to approximately 200 m² between well workovers. However, at the time when a workover rig (or plug and abandonment rig) is required for a well intervention, the size of the well lease would need to be brought back out to dimensions in line with the footprint required during completion activities. It is anticipated that in certain instances, particularly for the multi-well pads, the size of the pad at the time of drilling may remain in place for part or all of the duration of the well life. Well sites will be assessed on an individual basis to reduce footprint as far as practicable. In either instance, after final abandonment activities, each well site will be rehabilitated. The impacts on the disturbance footprint for wells have been discussed in the EIS in Chapters 12 to 22. Well sites will be assessed on an individual basis to reduce footprint as far as practicable. After final abandonment activities, each well site will be rehabilitated in accordance with the Code of Practice for Construction and Abandonment of coal seam gas Wells in Queensland.</p>
R3216	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S070, S071, S076,	Description of areas required for each well head does not describe the car parking areas needed, and the volumes of gravel that would be needed each time the areas are partially rehabilitated, and then expanded again for workovers etc.	SREIS Chapter 3, Table 3.3	Table 3.3 in SREIS Chapter 3, Project Description provides a revised estimate for aggregate volumes for single well and multi-well sites for each of the 11 drainage areas. It includes additional temporary aggregate required for the construction and workover footprint. The workspace required for workovers is a similar area to that required to establish the well, i.e., the revised estimate of up to 100 m by 100 m (or 1 ha) for a single-well pad and 100 m by 200 m (or 2 ha) for a multi-well pad. The workspace can accommodate parking for vehicles.
R3217	S079	How will the Government keep track of the footprint size at each drilling site, from the beginning to the end of the process over the whole project area?	EIS Chapter 12, Chapter 15, and Chapter 16	Arrow notes this question is directed to the government, however Arrow has committed to routinely monitor buffer zones and project footprint using satellite imagery (Commitment C509).
R3218	S159	Has other independent research been done to verify the figures provided by Arrow for well infrastructure footprints and disturbance areas?	EIS Chapter 13 SREIS Chapter 3	The SREIS Chapter 3, Project Description has provided clarification that a single well site may be up to approximately 100 m by 100 m (i.e., 1 ha) including an area for sediment and erosion control devices, while a multi-well pad containing up to 12 wells may be 200 m by 100 m, inclusive of allowance for sediment and erosion control. The footprints described above were determined through learnings of Arrow's existing operations, exploration activities and from trials conducted to minimise the footprint. Arrow has been committed to: <ul style="list-style-type: none"> • Reducing the overall footprint by investigating the opportunity to increase well spacing from 160 acres (65 ha) to 320 acres (129 ha) or greater to

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R3218	S159			reduce the footprint on strategic cropping land (Commitment C083). • Investigating alternative drilling technologies, such as using directional drilling to access coal measures, reducing gathering system pipe diameters and drilling multiple wells from one drill pad to potentially reduce the footprint on strategic cropping land (Commitment C087).
R3219	S099	Concern over impacts from pipeline joint failure due to shrink-swell properties of self-mulching cracking clay soils (inert gas or water leakage post decommissioning). Arrow should use inert material to fill all pipelines to mitigate or avoid subsidence.	EIS Chapter 5, Section 5.7.6	As set out in EIS Chapter 5, Project Description, Section 5.7.6, the Australian Standard AS 2885 for gas and liquid pipelines provides guidance on the abandonment of pipelines. Similarly, Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2, or the relevant Australian standards, as revised from time to time (Commitment C444). The code addresses safety performance, design, construction and testing of pipeline systems as well as pipeline abandonment, which requires that an abandonment plan (including a rehabilitation plan) be prepared.

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R4001	S005, S011, S072, S150, S161	The time available was inadequate for the public to read, understand and respond to an EIS of such magnitude. The process needs to be reviewed and changed to make it easier for a wider range of possible impacted people to respond and provide a better analysis of all the reports provided.	SREIS Chapter 4 and Appendix 1	Noted. Arrow appreciates that review of the EIS by project stakeholders and community members has been a significant undertaking. The public notification period for the EIS was extended from the standard statutory timeframe of 30 business days to 60 business days to enable the public more time to read and prepare submissions on the EIS. During this time, consultation was conducted at locations across the project development area to provide information on and respond to questions about the EIS. For further information, see SREIS Chapter 4, Consultation and Appendix 1, Supplementary Consultation Report.
R4002	S014, S044	Consultation is needed however in the instance of intensive cropping agricultural enterprises, consultation will be a full time job for at least one person within each agricultural enterprise. This will reduce the time landholders can dedicate to their own business interests, families and communities. The EIS underestimates the management overheads that integration will impose and it is clear that Arrow does not have the recognition and understanding that it claims to have.	EIS Chapter 22, Section 22.8.3	When conducting project activities on third-party properties, Arrow will develop and implement a compensation framework to 'add value' rather than just compensating for impacts (Commitment C081). Provision is made in the company's conduct and compensation agreement for the landholder's time in discussing terms of access.
R4003	S157	Most potentially affected people (i.e., landholders) are extremely busy and are unlikely to engage in direct dialogue until they would be able to identify themselves as a party likely to be impacted. Landholders have no way to identify whether their property is likely to be impacted.	EIS Chapter 6, Section 6.7	Sections 43 and 51 of the <i>Environmental Protection Act 1994</i> (Qld) require all registered property owners whose land is included in the EIS process to be provided written notification. In accordance with this requirement, Arrow conducted two in-excess-of 8,000 letter mail outs to all registered property owners within the project development area. The first mail out occurred in March 2010 when the draft terms of reference were released for public comment. The second mail out occurred in March 2012, when the EIS was placed on public display. Arrow will continue to engage potentially affected landholders as locations for project infrastructure are refined. This will occur over a number of years. In addition, stakeholder consultation and communication will be ongoing throughout the life of the project.
R4004	S024, S025, S026, S036, S054, S079, S081, S083	What does 'responded to concerns' mean, with respect to Arrow answering and responding to concerns raised by the community through the consultation program?	EIS Appendix B SREIS Appendix 1	EIS Appendix B, Consultation Report, described the first four phases of the Surat Gas Project public consultation process, held between September 2009 and June 2011. SREIS Appendix 1, Supplementary Consultation Report, describes consultation phases five and six, which extended from July 2011 to December 2012 since the publication of the EIS. During the course of consultation, issues including coal seam gas water management, potential impacts to groundwater, and impacts on intensively farmed agricultural land quickly came to the fore and generated extensive community discussion. As the phases of consultation progressed, Arrow sought to develop information, materials, and presentations for each

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R4004	S024, S025, S026, S036, S054, S079, S081, S083			consecutive round of consultation that focused on key community concerns raised during each previous round of consultation, and to provide an update on Arrow's progress towards resolving these concerns. Examples of responses include updating the community on the likely sequence of development of the project development area (which is continually undergoing refinement); information on 'make good' legislative requirements for groundwater; and establishing the Arrow Intensively Farmed Land Committee as a forum to discuss concerns about the coexistence of the project and farming activities or highly productive agricultural land.
R4005	S157	Arrow has not achieved the things described in the last paragraph in EIS Chapter 6, Section 6.2, regarding the community consultation program.	EIS Chapter 6, Section 6.2	<p>The last paragraph of EIS Chapter 6, Public and Stakeholder Consultation, Section 6.2 states: <i>'listening to the community and understanding their concerns has underpinned Arrow's approach to EIS consultation. Through the consultation program, Arrow has:</i></p> <ul style="list-style-type: none"> • <i>Provided information about the project to the community in a timely manner.</i> • <i>Answered questions raised by the community and responded to their concerns about the coal seam gas industry and the Surat Gas Project.</i> • <i>Worked towards creating a beneficially shared outcome for landholders, the community and Arrow.'</i> <p>Arrow has held community information sessions at regular intervals, as further project information has become available. During each round of consultation, Arrow has sought to develop information, materials and presentations that update the community on the company's progress towards resolving key concerns. Arrow is committed to developing good relationships with landholders and the community. Arrow has recorded verbal and written community comments at each consultation session and addresses each of these comments. Drop-in sessions have also been held, where the community has been invited to attend for less formal discussions.</p>
R4006	S025, S026, S054, S079, S081, S083	Does Arrow have a list of all concerns that have been raised by communities and members of various stakeholders? Please list all of the concerns that have been raised by communities and members of the various stakeholder groups that Arrow is a part of, and provide detail about those concerns that have been resolved to the satisfaction of stakeholders.	EIS Appendix B, sections 2.2.5, 3.2.4, 4.3.4 and 5.3.5 and Appendix 4 SREIS Chapter 18 and Chapter 19 and Appendix 1, sections 2.2.6 and 3.4.7	<p>EIS Appendix B, Consultation Report, sections 2.2.5, 3.2.4, 4.3.4 and 5.3.5 outline key community and stakeholder issues and concerns raised with Arrow. Appendix 4 of EIS Appendix B contains a record of questions and answers from Arrow's community information sessions up to June 2011. SREIS Appendix 1, Supplementary Consultation Report, sections 2.2.6 and 3.4.7 set out key community and stakeholder issues raised between July 2011 and December 2012, following the publication of the EIS. A total of 167 submissions were received on the EIS during the public notification period. Issues raised by the community have been responded to in SREIS Chapter 18, Submission and Issues Register and Chapter 19, Detailed Response to Issues.</p> <p>Arrow continues to engage with the stakeholders through a range of forums including the Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with</p>

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R4006	S025, S026, S054,			individuals and interested groups.
R4007	S066	More consultation needed with farmers/graziers by government agencies so that impacts of the coal seam gas industry are better understood by the government and their agencies.	–	Noted.
R4008	S074	The consultation process did not include contact with the agricultural industry representative bodies listed in EIS Chapter 6, Section 6.3. The economic impact assessment therefore does not accurately reflect the skills shortage experienced in this sector.	EIS Chapter 6, Section 6.3 and Appendix O, Section 5.6.1	Contact with a number of the agricultural industry representative bodies identified in EIS Chapter 6, Public and Stakeholder Consultation, Section 6.3 was made. Separate input was sought from a range of stakeholders as part of the preparation of EIS Appendix O, Economic Impact Assessment. These stakeholders included Southern Downs, Toowoomba and Western Downs regional councils and a range of industry and regional organisations as set out in the Summary of Stakeholder Consultation contained in EIS appendices B to O. This consultation identified the challenges filling agricultural positions in recent years with local labour moving to construction projects in the region (EIS Appendix O, Section 5.6.1).
R4009	S121	Consultation between Arrow and relevant parties regarding emergency situations is recommended.	EIS Chapter 25, sections 25.2.4 and 25.6.2.	As set out in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2, Arrow will develop emergency response plans in consultation with emergency services organisations. Plans will address required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans should include safe evacuation procedures, communication protocols (internal and to emergency services including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities and requirements for training (Commitment C424). Emergency Management Queensland and representatives of the various emergency services responsible for the project development area were also consulted to determine potential response measures to be considered in the risk assessments undertaken for the EIS (EIS Chapter 25, Section 25.2.4).
R4010	S150	Natural resource management organisations are well placed to represent their catchments, and achieve policy and legislative positions that balance developments with sustainable natural resource management. The opportunity for regional communities and organisations to assist the EHP (formerly DERM) Petroleum and Gas Unit should be provided, with EIS and EA application assessments, drafting model conditions and broader policy development.	–	Noted.

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Issue No.	Submission No.	Issue	Reference	Responses
R4011	S157	There is a limit to how landholders can respond to the EIS and have meaningful input with such a lack of information available to them in the EIS.	–	Noted. The EIS presents a high level assessment of the environmental values associated with the project development area. Most landholders will be particularly concerned with the location of infrastructure and impacts to their properties, the specifics of which are not yet known. Once Arrow has identified private property as a possible site for project activities, project personnel will only access land in accordance with DEEDI's Land Access Code, Section 24A of the <i>Petroleum and Gas (Production and Safety) Act 2004</i> and Arrow's land access rules and protocols (Commitment C365).. At each stage, wherever possible, Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Infrastructure placement will be subject to a conduct and compensation agreement entered into with landholders, which would include specific access conditions. Following the completion of the EIS process, Arrow requires the grant of an environmental authority (EA) or an amendment of an EA and the grant of a Petroleum Lease (PL) before it can proceed with the development. Further details of major infrastructure will be set out in statutory information requirements as described in the EHP Guideline 'Application requirements for petroleum activities' to accompany EA or EA amendment application(s). The grant of an EA or EA amendment will be subject to public notification by the Queensland Government.
R4012	S157	Landholders were not consulted by technical specialists.	EIS Chapter 6, Section 6.4.1 and Appendix P, Section 2.5	Noted. Extensive landholder consultation was not undertaken by technical specialists. Some landholders participated in focus groups for the Social Impact Assessment (see EIS Appendix P, Social Impact Assessment, Section 2.5) held during 2009, however most consultation undertaken for technical studies took the form of discussions with representatives of regional councils, government departments and representative agencies, and community organisations and groups. Stakeholder consultation has been outlined in the respective technical studies appended to the EIS.
R4013	S160	Arrow should consult with owners and operators of intensive livestock operations in the project development area.	EIS Chapter 13, sections 13.4.6 and 13.6.5	Prior to works commencing on any property, Arrow will undertake detailed consultation as part of the conduct and compensation agreement process. Arrow acknowledges the issues associated with intensive livestock operations, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076).
R4014	S161	Arrow should have made contact and consulted with key organisations in the Millmerran community so a more open discussion on the matter could have been had. [Note: Arrow assumes by 'the matter' the submitter means the project, and the	EIS Chapter 6, Section 6.7	A number of Millmerran community organisations are included on Arrow's Consultation Manager database. All received invitations to Arrow's community information sessions. The database was updated following each round of community consultation to include contact details for new attendees in order to provide them with notification of opportunities to express their issues or

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Issue No.	Submission No.	Issue	Reference	Responses
R4014	S161	risks and instability the submitter is concerned the project could introduce in the region].		concerns with the project.
R4015	S014, S044	Arrow's intention to 'properly address concerns' has been disappointing so far and it is noticeable that their commitment to 'engage with landholders at least 6 to 12 months prior to production drilling' is not included in the EIS commitments attachment. Commitment C370 'communicate with landowners at least three months before any activities take place on private property' has reduced consultation time considerably from six to 12 months.	EIS Attachment 8	Arrow aims to provide six to twelve monthly updates on field development planning to the communities in which it operates. This will provide communities with the opportunity to receive the latest information on likely development timeframes. In addition, Arrow will communicate with landholders at least three months before any activities take place on private property (Commitment C370).
R4016	S014, S044	The facilitator engaged by Arrow to run the session further inflamed the community by answering questions on Arrows behalf and telling people attending the session they 'don't know what they're talking about' and remarking about family connection between several people who were asking questions.	–	Noted.
R4017	S014, S044	The conversion of a portion of the floodplain from an authority to prospect to a petroleum lease without informing the community when given opportunity during the previous two consultation sessions further eroded the community's trust. We are well aware it is not a legislative requirement, but considered it necessary as Arrow had been informed by the community they had a responsibility to be transparent.	–	Noted.
R4018	S014, S044	Failure to make acceptable progress in resolving landholders' issues while evidently pushing ahead with gaining approval to develop in this highly sensitive area has further inflamed the community. Be assured that the majority of landholders on the Condamine River floodplain remain strongly opposed and outraged by Arrow's proposals. Requests the supplementary report to the EIS include details of community consultation sessions held during October 2011 and May 2012.	SREIS Chapter 4 and Appendix 1	Noted. SREIS Chapter 4, Consultation, and SREIS Appendix 1, Supplementary Consultation Report, describe consultation sessions held since July 2011.
R4019	S081	The conclusions of the Consultation Report need to be amended to properly reflect the state of the	SREIS Chapter 4 and Appendix 1	SREIS Chapter 4, Consultation, and SREIS Appendix 1, Supplementary Consultation Report, describe consultation sessions held since July 2011.

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Issue No.	Submission No.	Issue	Reference	Responses
R4019	S081	relationship between Arrow and communities today. While it is possible that other communities in the project development area have improved relations with Arrow, this is certainly not the case for the Cecil Plains community.		
R4020	S081	If there are varying attitudes to Arrow depending on location, then all of the different attitudes and their locations must be provided.	EIS Chapter 6 and Appendix B. SREIS Chapter 4 and Appendix 1	The issues raised at each of the community sessions up to June 2011 are set out in EIS Appendix B, Consultation Report, Appendices and summarised in EIS Chapter 6, Public and Stakeholder Consultation. Issues raised at consultation sessions held during October 2011 and April 2012 are reported on in SREIS Chapter 4, Consultation, and SREIS Appendix 1, Supplementary Consultation Report.
R4021	S081	Although difficult to define, as a working definition, the present research describes the public interest as the stake that the community at large has in public affairs. It is difficult to determine whether the project is compatible with the public interest standard criteria given the difficulty that exists in defining the term. There is a lack of rigour in the public and stakeholder assessment chapters, and a lack of data and findings which could conclude that in the absence of evidence, the project is not compatible with the public interest. Further, the public interest would have to encompass other factors, such as economic and environmental considerations, over a range of different scales (global, national, regional and local).	EIS Chapter 6, Appendix B, Appendix O and Appendix P and Chapter 21 and Chapter 22 SREIS Chapter 4 and Chapter 14 and Appendix 1	The sustainable development of Queensland's resources is in the public interest of both Queensland and Australia, as it provides broad benefits in terms of economic development and diversification of industry. These benefits will assist in reducing the impact of drought in the Darling Downs region. Arrow recognises the concerns that the community has in relation to the project but is working with the community and landholders to resolve how their interests can be considered and addressed through, planning, design, construction and operation of the project. The economic and social impacts of the project are discussed in EIS Chapter 21, Economics and Chapter 22, Social and SREIS Chapter 14, Social.
R4022	S087	Dealings with Arrow have generally been positive however the difference between the operations to date and the full operational proposal are great and the possible impacts both short and long term are huge.	SREIS Chapter 4 and Appendix 1	Arrow acknowledges that the Surat Gas Project is a major expansion of its current operations. While the scale of the development is larger, the majority of potential impacts are localised to areas where infrastructure is placed. Through the adoption of management and mitigation measures set out in the EIS, potential impacts that could arise from the project are considered manageable.
R4023	S110	The submitter disagrees with Arrow using the police force to enforce its rights to bring drilling equipment onto the floodplain.	EIS Chapter 6 SREIS Chapter 4	Noted. Arrow's preference is to negotiate access via conduct and compensation agreements with all landholders.
R4024	S157	Arrow has much ground to make up in the Millmerran community if it is to participate in stakeholder consultation throughout the life of the project.	EIS Chapter 6 SREIS Chapter 4	Noted. Arrow is committed to building long-term mutually beneficial relationships with the community. Stakeholder consultation and communication will be ongoing throughout the life of the project.

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Issue No.	Submission No.	Issue	Reference	Responses
R4025	S147	As the project is refined and energy needs (where not self-sufficient) are identified, the proponent should negotiate electricity supply arrangements by applying in writing or by phone. Should the development require permanent electrical distribution infrastructure for its ongoing operations (e.g., pad mounted transformers for valve stations, scraper stations, gas compressors, control centres or test points), early contact with Ergon Energy (i.e., prior to detailed design) can ensure any requirements are accounted for in a timely and efficient manner.	–	Noted.
R4026	S147	Should Arrow identify changes to Ergon Energy infrastructure that are required as part of the development, those changes are to be made with Ergon Energy's consent and at the proponent's expense (unless otherwise agreed to by Ergon Energy). Any redesign of Ergon Energy infrastructure required as a result of the proposal must take into consideration servicing and maintenance access requirements for Ergon Energy personnel and equipment. Where fencing prohibits access to and along infrastructure, gates must be supplied and installed at the proponent's expense.	–	Noted.
R4027	S014, S044, S051, S108, S110	Arrow's commitment of waiting until 2023 to access land to the east of the Condamine River was taken in good faith and now Arrow is knocking on doors. The community is severely disappointed that they are seeking project approval over the Condamine River floodplain with not one of the major issues addressed. The community vocally expressed their level of concern (at Arrow's community information session held in May 2012) and are of the firm opinion that Arrow's loosely worded commitments are worthless. The supplementary report to the EIS should include an explanation of how Arrow will properly address the Condamine River floodplain community's concerns.	EIS Chapter 6 SREIS Chapter 4	Noted. Arrow aims to provide approximately six to 12 monthly updates on field development planning to the communities in which it operates. This will provide communities with the opportunity to receive the latest information on likely development timeframes. As Arrow explained during community consultation sessions, at that time the indicative field development planning indicated a timeframe of approximately 2023 for production development east of the Condamine River. It was also noted that detailed planning needs to take place, which may change the timeframes associated with development of all areas within the Surat Gas Project area, as further results relating to exploration become available. Further, it was noted that access to land (including east of the Condamine River) will be required for such activities as establishing groundwater monitoring bores, and water supply pipelines for the substitution of allocations. Arrow continues to engage with Condamine River floodplain stakeholders through a range of forums including the Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions

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Issue No.	Submission No.	Issue	Reference	Responses
R4027	S014, S044, S051,			and ongoing consultation with individuals and interested groups.
R4028	S014, S044	The supplementary report to the EIS should include a commitment that Arrow will not seek to conduct any further exploration or production on the Condamine River floodplain until the issues have been resolved to the community's satisfaction.	EIS Chapter 6 SREIS Chapter 4	Arrow is working with the community to better understand how development may occur on the Condamine River floodplain and is actively working through a range of issues of most concern to the community, via initiatives such as the Arrow Intensively Farmed Land Committee and Area Wide Planning.
R4029	S025	The submitter has requested of Arrow the water quality data of treated coal seam gas water on several occasions over the last 12 or more months. As yet, this information has not been forthcoming, even though promised. Therefore, water users have no confidence that the water will be of a suitable quality for their purposes.	–	The information requested has been distributed to selected landholder groups in the Surat Basin via the Area Wide Planning process.
R4030	S032	The submitter has concerns with the consultation process and the responses to date. A reply to an earlier submission was only the word 'granted' which they were disappointed in because of all the financial pressures and stress that has given their families. It feels like the decision is already made and that submissions are a waste of time. Would like a personal reply that includes how conditions applied to Arrow would totally negate the submitter's concerns.	SREIS Chapter 18 and Chapter 19	Noted. Arrow's responses to the issues raised in submissions on the EIS are outlined in SREIS chapters 18 and 19. Consideration of Arrow's responses, assessment of the EIS and development of conditions are carried out by the EHP in accordance with the <i>Environment Protection Act 1994</i> .
R4031	S139	A short discussion paper was prepared by the submitter raising issues regarding the practical application of the substitution strategy, to which Arrow has not yet responded.	–	Arrow has met with the Central Downs Irrigators Limited to discuss these issues and to work through key concerns and issues to enable practical solutions to be determined. Arrow will continue to work with stakeholders to develop the framework for substitution.
R4032	S139	A paper was prepared by the submitter covering some of the topics the committee would need to resolve before landholders could gauge the true impact of the project on irrigated agriculture. To date, there has been no response to this paper, and the EIS fails to adequately address the concerns.	–	Arrow has established the Arrow Intensively Farmed Land Committee and recently begun an Area Wide Planning process with several communities within the Surat Basin. These groups have been working collaboratively to address concerns of development activities on intensively farmed land, including irrigated agriculture. The work of these groups will continue and the outcomes will be incorporated into the development framework for the project.
R4033	S157	Despite the submitter's attempts to explain to Arrow the nature of their business, they only had (very limited) further contact (in relation to the Surat Header Pipeline).	–	Noted. The Surat Header Pipeline is not within the scope of this EIS, and its approval is being sought separately.

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Issue No.	Submission No.	Issue	Reference	Responses
R4034	S014, S044	Submitter requests the supplementary report to the EIS explain exactly what 'additional studies were added in response to issues of concern that were raised by stakeholders.'	EIS Appendix B, Section 1.3 and Appendix F	EIS Appendix F, Agricultural Report, was specifically commissioned by Arrow in response to concerns raised by landholders and the community about coexistence of coal seam gas and agricultural activities on intensively farmed land.
R4035	S015	It is stated that development planning will be guided by environmental and social constraints, including landowner preferences. Most consultation must be done with the landowners.	SREIS Attachment 7	Noted. In accordance with the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld), Arrow will negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation.
R4036	S046	When discussing water treatment facilities and the use of reverse osmosis as a technology, the EIS states that Arrow will continue to investigate new and emerging technologies. There is concern that the EIS appears to leave the way open for further changes without a system for public consultation and accountabilities before other techniques can be introduced.	–	As project planning is refined, alternate technologies may be investigated to improve efficiencies and/or potentially reduce environmental impacts. Following the completion of the EIS process, Arrow requires the grant of an environmental authority (EA) or an EA amendment, before it can proceed with the development. Any significant change to the project throughout the life of the project will also require an EA amendment. The Queensland Government will publicly notify the proposed grant of EA amendments and consider public submissions before issuing amended EEAs
R4037	S079	Does coal seam gas infrastructure go through community consultation assessment before infrastructure construction begins and if not, why?	EIS Chapter 2 and Attachment 4 SREIS Chapter 2	Following the completion of the EIS process, Arrow requires the grant of an environmental authority (EA) or EA amendment, and the grant of petroleum lease(s)(PLs) before it can proceed with the development. The application for EA or EA amendment will require Arrow to provide details of the major infrastructure (such as locations of major facilities) proposed, The Queensland Government will publicly notify the proposed grant of the amendment and consider public submissions before issuing the amended EA. In addition, a conduct and compensation agreement must be negotiated with landholders upon whose properties infrastructure is proposed, which would include consideration of the location of all infrastructure and specific access conditions.
R4038	S089	Together with the lack of truly local representation at a political level, the result is that the EIS process is neither properly consultative nor democratic.	–	Noted.
R4039	S137	The submitter would like consultation with stakeholders and planning and cooperation between proponents to develop adequate environmental offsets.	SREIS Attachment 6	Arrow may investigate opportunities to coordinate environmental offsets in the Surat Basin should the opportunity arise, however, Arrow's approach to offsets is in accordance with both State and Commonwealth Government offset policies.
R4040	S150	Community engagement, disclosure of information and public consultation must meet community	–	Noted.

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Issue No.	Submission No.	Issue	Reference	Responses
R4040	S150	expectations for a more enduring and direct role in the planning, decision making and implementation of natural resource policies and activities as they relate to coal seam gas projects.		
R4041	S150	Arrow's consultation process still needs improving to ensure timely and adequate notification of proposed developments. Public engagement that is timely, meaningful and relevant, and is conducted appropriately for each stakeholder will encourage and facilitate active public consultation.	EIS Chapter 6 SREIS Chapter 4	Noted. Arrow has sought to provide regular information to the community on the planning of the project, with rounds of consultation held approximately every six to 12 months during the EIS process. Also in 2012, Arrow established a Community Information Centre in Dalby to provide landholders and other interested persons with a local point of contact for information about the project.
R4042	S150	It is recommended that EHP (formerly DERM) create trigger maps which highlight to the proponents the key stakeholders potentially affected by the EIS and its associated environmental authority (EA) activities, or those who have an interest in the region or area likely to experience some kind of impact. These maps would then oblige the proponent to notify the stakeholders in the area of their EIS and EA applications. It is recommended that meetings are conducted to coordinate a consultation process that better engages natural resources management organisations and the communities and stakeholders they represent or serve.	–	As part of the <i>Environmental Protection Act 1994</i> (Qld) (EP Act) EIS process, Arrow must provide written notice to: <ul style="list-style-type: none"> • 'Affected' persons, as defined in Section 38 of the EP Act, which include all registered properties owners in the project development area. • 'Interested' persons, as defined in Section 41(3)(b), which may include unincorporated community or environmental bodies with financial or non-financial interest in the local government area in which the project is planned. Given the size of the project development area, this involved two in- excess-of 8,000 letter mail outs. The first mail out occurred in March 2010 when the draft terms of reference were released for public comment. The second mail out occurred in March 2012, when the EIS was placed on public display. Arrow engages with relevant natural resource management organisations on a regular basis. These include the Department of Natural Resources and Mines, Department of State Development, Infrastructure and Planning and Condamine Alliance. In addition, a key objective of the consultation program undertaken for the project has been to facilitate broad engagement and participation in the consultation process.
R4043	S150	It is recommended that EHP (formerly DERM) initiate a discussion paper or public forums that seek input from the public and regional communities on the mining and energy industry, and how community consultation can be best facilitated within a regional partnership and collaborative process to determine best industry practices within Queensland's catchment areas and regions.	–	Noted.
R4044	S150	Arrow and the whole of the coal seam gas industry have not to date created effective mechanisms for Aboriginal involvement in the planning and	EIS Chapter 23, Section 23.9	Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project area. Both ILUAs address Aboriginal involvement in the management of Aboriginal cultural heritage. Negotiations

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Issue No.	Submission No.	Issue	Reference	Responses
R4044	S150	management of culturally significant sites and natural resources affected by coal seam gas operations.		for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People.
R4045	S150	The Regional Caring for Country Plan is a mechanism available to Origin that delivers vision and direction for the planning and management of Aboriginal cultural resources throughout the region.	–	Noted.
R4046	S157	It is entirely inappropriate for the onus to be placed on landholders to speculate and waste resources on legal and other experts to thoroughly examine 6,000 pages of material on the chance that their property may potentially be impacted.	–	Noted.
R4047	S157	The difficulty responding to the EIS is that landholders are unsure as to the nature and extent of the potential impacts on landholder operations. Are landholders to assume the worst-case scenario i.e., 800 m well grid spacing, and all other types of infrastructure will be located on their property? What would be a profitable arrangement of infrastructure on individual properties? Landholders cannot justify the expense of conducting their own geological/hydrological surveys without fully understanding the likely impacts of Arrow on their property.	–	Arrow will seek to acquire land on which to place production facilities, water treatment and power generation facilities, or enter into long term lease arrangements for the use of the land. The EIS provides an impact assessment of the typical infrastructure that would be contained on landholders' properties within the Surat Basin. This provides sufficient detail to understand the broad implications of the project; however, additional information and assessment (including public consultation) will be presented after the EIS process, when environmental authority and petroleum lease approvals are sought. Further detailed information will be available during negotiation of conduct and compensation agreements, which will seek to address the impacts on each parcel of affected land, including location of infrastructure, access conditions and the compensation framework for these activities to occur. Wherever possible, Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation.
R4048	S157	The submitter has had no contact from technical specialists, nor have there been adequate attempts to address the submitter's particular situation. Their particular situation (as the owner of an intensive farming operation) is not even identified in the EIS.	EIS Chapter 13, Section 13.4.6 and 13.6.5 and Appendix P, Section 2.5 SREIS Chapter 4 and Appendix 1.	Noted. The EIS presents a high level assessment of the environmental values and impacts associated with the project. Extensive landholder consultation was not undertaken by technical specialists. Some landholders participated in focus groups for the Social Impact Assessment (see EIS Appendix P, Social Impact Assessment, Section 2.5) held during 2009, however most consultation undertaken for technical studies took the form of discussions with representatives of regional councils, government departments and representative agencies, and community organisations and groups. Arrow acknowledges the issues associated with intensive livestock

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Issue No.	Submission No.	Issue	Reference	Responses
R4048	S157			operations, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). In addition, detailed consultation with each landholder will be undertaken as part of the conduct and compensation agreement process, prior to works commencing on any property.
R4049	S157	Letters sent to landowners throughout the project development area is not an adequate approach.	EIS Chapter 6 and Appendix B SREIS Chapter 4 and Appendix 1	Sections 43 and 51 of the <i>Environmental Protection Act 1994</i> (Qld) require all registered property owners whose land is included in the EIS process to be provided written notification. In accordance with this requirement, Arrow conducted two in-excess-of 8,000 letter mail outs to all registered property owners within the project development area. The first mail out occurred in March 2010 when the draft terms of reference were released for public comment. The second mail out occurred in March 2012, when the EIS was placed on public display. In addition, landholders received invitation letters to Arrow's community information sessions, as part of the broader consultation program described in EIS Chapter 6, Stakeholder and Community Engagement and Appendix B, Consultation Report, and SREIS Chapter 4, Stakeholder and Community Engagement and Appendix 1, Supplementary Consultation Report. In the case of seeking access to properties, Arrow must contact affected landholders and where required negotiate conduct and compensation agreements prior to commencing project activities.
R4050	S157	The current EIS approach could be seen as a means of actually avoiding the need to engage with the community. Extensive community consultation is only of value where it involves genuine disclosure and dialogue with directly affected parties, not representative groups.	–	Noted. The overriding intent of the stakeholder consultation program was to facilitate broad engagement and participation in the consultation process. In excess of 3,000 invitations were sent to stakeholders listed on Arrow's Consultation Manager database in advance of each community information session. Throughout the consultation process, Arrow has sought to provide the community with the most up-to-date information on the project, the planning of which is undergoing continual refinement. Arrow has also held drop-in sessions, which facilitated one-on-one conversations with stakeholders.
R4051	S157	The EIS is the most dynamic form of community consultation as it allows expression in writing by those most directly affected.	–	Noted.
R4052	S157	The lack of transparent data regarding the coal seam gas proponents' field development sequence taints all the reports based on this information e.g., the EISs and underground water impact report. Stakeholders cannot be clear about the level of information held by the coal seam gas proponents,	EIS Chapter 5, Section 5.3.1 and Chapter 8 SREIS Chapter 3, Section 3.5	High level information on the field development sequence was included in EIS Chapter 5, Project Development, Section 5.3.1. Updated information, which reflects Arrow's ongoing understanding of the gas resource and field development sequence, has been presented in SREIS Chapter 3, Project Description, Section 3.5. As described in EIS Chapter 8, Environmental Framework, Section 8, coal

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Issue No.	Submission No.	Issue	Reference	Responses
R4052	S157	what has been revealed to the regulator, and what data has been determined as correct. Stakeholders cannot determine if the regulator is aware of information being withheld by the proponents. Stakeholders therefore have no ability to independently assess the veracity of the claims made by the proponents or the regulator.		seam gas resources are extensive requiring widespread development to recover the resource. The yield from target coal seams is variable across the resource. This leads to uncertainty about the number, timing and location of wells required to dewater the coal seams and extract the gas. Prior to consideration of social and environmental constraints, selection of the ideal location of infrastructure required to treat the coal seam gas water and process the gas is also uncertain, being driven by exploration results and optimisation of well placement and water and gas gathering systems. The EIS therefore presents a high level assessment of the environmental values and impacts associated with the project. When it comes to specific infrastructure placement, Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses wherever possible.
R4053	S032	The submitter questions Arrow's credibility as there are numerous occasions where they have changed their responses to the community. For example, at a community session held in Cecil Plains, Arrow was asked if they were prepared to use law enforcement agencies to force access to their farms and they said they would not. Currently, Arrow has a request to the Queensland Police to assist in accessing farms within the next 8 weeks.	-	Noted. Arrow's preference is to negotiate access via conduct and compensation agreements with all landholders.
R4054	S057	Community consultation undertaken by Arrow has failed to address the majority of concerns raised by the community. Those concerns that did draw conclusive statements have since been withdrawn by Arrow, causing a general lack of faith in any commitments made.	SREIS Attachment 4	Arrow continues to engage with the community through a range of forums including the Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups. During consultation Arrow has made a number of commitments to the community, which are set out at Arrow's website at http://www.arrowenergy.com.au/community . Further, Arrow has made a range of commitments as part of the EIS process, which can be found in SREIS Attachment 4, Commitments Update.
R4055	S088	A large amount of material regarding community consultation outcomes are not reflected in EIS Chapter 6, including the abandonment of previous commitments.	EIS Chapter 6 and Appendix B SREIS Chapter 4 and Attachment 4 and Appendix 1	EIS Chapter 6, Public and Stakeholder Consultation, provides a summary of the consultation program undertaken to June 2011. Further details are provided in EIS Appendix B, Consultation Report. SREIS Chapter 4, Consultation, and SREIS Appendix 1, Supplementary Consultation Report, describe consultation sessions held since July 2011. Arrow continues to engage with the community through a range of forums including the Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups. During consultation Arrow has made a number of commitments to the

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R4055	S088			community, which are set out at Arrow's website at http://www.arrowenergy.com.au/community . Further, Arrow has made a range of commitments as part of the EIS process, which can be found in SREIS Attachment 4, Commitments Update.
R4056	S110	Arrow has not provided responses to the community regarding retracting previous commitments. The community require honest information regarding the impacts to the floodplain, confirmation of ability to rehabilitate impacts and provide responses to issues with existing and future agricultural practices. Approval of the project should exclude the floodplain to the east of the Condamine River in ATP 683; until Arrow meets its previously made commitments to the community.	–	Arrow continues to engage with the community through a range of forums including the Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups. During consultation Arrow has made a number of commitments to the community, which are set out at Arrow's website at http://www.arrowenergy.com.au/community . Further, Arrow has made a range of commitments as part of the EIS process, which can be found in SREIS Attachment 4, Commitments Update.
R4057	S157	This EIS process is so disappointing as the community has gone to great lengths to be kept informed.	EIS Chapter 6, Section 6.7	Arrow has sought to provide regular information to the community on the planning of the project, with rounds of consultation held approximately every six to 12 months during the EIS process. Also in 2012, Arrow established a Community Information Centre in Dalby to provide landholders and other interested persons with easy access to information about the project.
R4058	S086	Coal seam gas water must be treated as a community asset and the community should have the right to say what happens to it.	SREIS Attachment 5	Coal seam gas proponents are expected to develop strategies for coal seam gas water management in line with the Queensland Coal Seam Gas Water Management Policy (December 2012). The objective of the policy is to encourage the beneficial use of coal seam gas water in a way that protects the environment and maximises its productive use as a resource. Arrow's coal seam gas and water management strategy (SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy) aligns with this policy document.
R4059	S119	The proponent is encouraged to contact relevant parties during evaluation of the ocean outfall pipeline option for advice regarding the need for operational works approvals.	–	Noted. This is an option only and Arrow is currently not progressing approval for an ocean outfall.
R4060	S121	The submitter requires ongoing consultation regarding the following: • Proposed time frames associated with commencement of the various construction and operational periods throughout the life of the project. • Maps outlining the precise locations of the major infrastructure components with GPS locations in the project area.	EIS Chapter 25, Section 25.6.2 SREIS Attachment 4	As noted in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2, Arrow will select locations for project infrastructure with full consideration of and allowance for the buffer zones indicated by the qualitative risk assessment (Commitment C419). Furthermore, Arrow will develop emergency response plans in consultation with emergency services organisations (see Commitment C424). Arrow aims to provide approximately six to 12 monthly updates on field development planning to the communities in which it operates. This will provide communities with the opportunity to receive the latest information on

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R4060	S121	<ul style="list-style-type: none"> • Site inductions for staff at surrounding stations. • Any changes, restrictions, limitations on road infrastructure during this period. • Location of work camp facilities, including evacuation and access map for the facility. • Location of first aid facilities and medical facilities within any work camp facility. • The outline of the roster format of the workforce and the impacts on the social environment of the camps. • Notification of any work proposed that may impact on telecommunications infrastructure and communication links between the Ambulance Communication Centre and ambulance facilities and/or vehicles. • Notification of any road diversion, or other closures to the Ambulance Communication Centre for any impact upon provision of emergency facilities. 		likely development timeframes.
R4061	S125	The submitter requests to be kept informed on the progression of the project.	–	Stakeholder consultation and communication will be ongoing throughout the life of the project. Consultation sessions are advertised and letters of invitation sent to all persons listed on Arrow's Consultation Manager database. Community members can request to have their details placed on the database. Furthermore, a Community Information Centre has been established in Dalby with staff available during business hours to respond to the community's questions and concerns.
R4062	S126	The submitter requests to be provided with any updated information to ensure awareness of any potential impacts the project will have on surrounding schools or health of students.	EIS Chapter 25 and Appendix S	Noted. A preliminary hazard and risk assessment is presented in EIS Appendix S, Preliminary Hazard and Risk Assessment, and is summarised in EIS Chapter 25, Preliminary Hazard and Risk. Further risk assessments will be undertaken as facility locations are refined. Stakeholder consultation and communication will be ongoing throughout the life of the project.
R4063	S136	The submitter requests that Arrow continues its engagement in the current quarterly coal seam gas security forums.	–	Noted.
R4064	S166	Arrow Energy have not and will not answer questions raised by the community. So how can we trust them to negotiate honestly with us?	EIS Chapter 6, Section 6.4 and Appendix B SREIS Chapter 4 and Appendix 1	The questions raised and Arrow's responses at each community session up to June 2011 are set out in EIS Appendix B, Consultation Report, Appendices and summarised in EIS Chapter 6, Public and Stakeholder Consultation. Issues raised at consultation sessions held in October 2011 and April/May 2012 are reported on in SREIS Chapter 4, Consultation, and SREIS Appendix 1, Supplementary Consultation Report. Arrow continues to engage with the Condamine River floodplain community through a range of forums including the Arrow Intensively Farmed Land

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R4064	S166			Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups.
R4065	S146	It is requested that Arrow publicly disclose all standard operating procedures for review.	–	Noted.
R4066	S136	The opportunity to engage with Arrow concerning access to new radio communications towers planned for construction should be made available.	–	Noted.
R4067	S157	It is requested that the submitter will continue to see information from Arrow, both in the EIS, and at community information sessions, however, there is no meaningful insight into how Arrow may seek to progress in specific areas. This discourages attendance at information sessions, and delegates sent to the sessions are unable to report back with any concrete information due to the complete lack of locational context. Until Arrow provides meaningful identification and a genuine attempt to inform the public with meaningful data or even location specific decision-making constraints, the reality of the implications for any community will not be accurate.	EIS Chapter 5, Section 5.3.1 and Chapter 8 SREIS Chapter 3, Section 3.5	High level information on the field development sequence was included in EIS Chapter 5, Project Development, Section 5.3.1. Updated information, which reflects Arrow's ongoing understanding of the gas resource and field development sequence, has been presented in SREIS Chapter 3, Project Description, Section 3.5. Arrow appreciates that stakeholders are seeking specific details of the location of wells and infrastructure, the details of which are not available. This is due to the progressive nature of the development. As described in EIS Chapter 8, Environmental Framework, Section 8, coal seam gas resources are extensive requiring widespread development to recover the resource. The yield from target coal seams is variable across the resource. This leads to uncertainty about the number, timing and location of wells required to dewater the coal seams and extract the gas. Prior to consideration of social and environmental constraints, selection of the ideal location of infrastructure required to treat the coal seam gas water and process the gas is also uncertain, being driven by exploration results and optimisation of well placement and water and gas gathering systems. The EIS therefore presents a high level assessment of the environmental values and impacts associated with the project. Arrow will further engage potentially affected landholders and the community as locations for project infrastructure are progressively refined. Stakeholder consultation and communication will be ongoing throughout the life of the project.
R4068	S014, S044	Landholders were extremely frustrated by the lack of progress in Phase 3 of consultation.	EIS Appendix B, Section 4.1	Noted. As described in EIS Appendix B, Consultation Report, Section 4.1, phase three consultation activities commenced in July 2010 and continued through to December 2010. This phase included Arrow's takeover by a joint venture between Royal Dutch Shell and Petrochina which delayed some EIS activities and extended the EIS timeline. As a result, significant results from technical studies were not available to present to the public. Rather, the focus of this phase was to update the community on progress of commitments made in May 2010, and the manner in which Arrow intended to continue to address the community's key issues and concerns.

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Issue No.	Submission No.	Issue	Reference	Responses
R4069	S074	Submitter wishes to have further consultation during the production of the Supplementary EIS.	–	Noted. All persons with an interest in the project are able to register with Arrow for project updates. Contact details are provided on Arrow's website.

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Issue No.	Submission No.	Issue	Reference	Responses
R5001	S002, S003, S004, S005, S006, S009, S011, S015, S018, S019, S020, S024, S026, S031, S032, S034, S036, S037, S038, S039, S041, S050, S053, S054, S055, S059, S064, S065, S069, S070, S071, S072, S076, S079, S081, S085, S088, S096, S097, S098, S099, S108,	The identification of environmental values is flawed due to the size of the project development area, and that Arrow's understanding of the environment is bias towards the areas in which they currently operate (which does not extend across the entire project development area). The limitations of the EIS caused by lack of specific details undermine the capacity for the community to understand and assess the full environmental impact of the project.	EIS Chapter 7, Section 7.1 SREIS Chapter 2, Section 2.3	The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state, national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined. Following the completion of the EIS process, further approvals are required, including the amendment of Arrow's existing project environmental authority (EA) or application for EA(s). This is envisaged to be a staged process over the life of the project. As each new stage of gas field development or facility is planned, progressive EA amendment applications or new EA applications will be made to encompass these activities (SREIS Chapter 2, Project Approvals, Section 2.3).
R5002	S134	The EIS should include strategic cropping land under the 'natural environment' category of the environmental framework.	SREIS Chapter 2, Section 2.4.1	Potential strategic cropping land is currently identified in Arrow's geographic information system (GIS) but not as a constraint. Validated strategic cropping land (SCL) will be maintained in the GIS and will inform site and route selection. Arrow notes that any resource activities that will have a permanent or temporary impact on SCL or potential SCL must be assessed under the <i>Cropping Land Act 2011</i> (Qld). A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the Strategic Cropping Land Act 2011 and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R5003	S157	The submitter understands the importance of individual land access agreements, but this approach also makes apparent the critical need for the EIS to properly identify existing land use and sensitive receptor mapping so that landholders can more fully understand the context around their property and also neighbouring properties.	EIS Attachment 10, figures A10.2 to A10.10 SREIS Chapter 7, Section 7.6.1 and Attachment 2	Subject to property accessibility, the location of residences and other sensitive receptors (e.g., businesses, schools, churches) has been ground-truthed in the area of Arrow's Dalby Expansion Project. Beyond this area, other potential housing and sensitive receptors locations (shown in EIS Attachment 10, figures A10.2 to A10.10) were determined through analysis of publicly available, 2004 aerial imagery. Arrow has since acquired and reviewed high resolution aerial imagery over the project development area and updated figures are presented in SREIS Attachment 2, Strategic Environmental Management Plan. Arrow has commenced a process of Area Wide Planning which incorporates feedback from individual landholders into an integrated plan across neighbours and catchment areas. This planning aims to balance individual needs of landholders with the needs of neighbouring properties as detailed in SREIS Chapter 7, Agriculture, Section 7.6.1.
R5004	S159	In the EIS it is not made clear how the constraints	EIS	The method for constraints analysis is outlined in EIS Chapter 8,

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Issue No.	Submission No.	Issue	Reference	Responses
R5004	S159	identified for the various themes are combined.	Chapter 8, Section 8.4	Environmental Framework, Section 8.4. The analysis of constraints is done using a Geographic Information System (GIS). Datasets or layers for each relevant environmental aspect are compiled in the project GIS. The analysis is performed by assigning numeric values to the attributes or information about the spatial data contained in the layers. The numeric values reflect the level of constraint with higher values equating to higher levels of constraint. Two analyses are performed. The first involves determining the level of constraint posed by each environmental aspect. The second evaluates the cumulative effect of combining certain layers e.g., all nature conservation related environmental aspects. To avoid distorting the output of the cumulative analysis, numeric values based on a logarithmic scale are used for the levels of constraint. This means that areas of lower constraint do not sum to produce a higher constraint when that level of constraint is not supported by the analysed information.
R5005	S146, S150, S157	If Arrow Energy has failed to identify environmental values (e.g., groundwater values, sensitive receptors, agricultural practices, land use etc.) then the environmental framework they have developed will not protect those environmental values and the environmental controls that Arrow has developed for project activities will not be appropriate to the constraints imposed by the environmental values.	EIS Chapter 7, Section 7.5.6 and Chapters 9 to 26 SREIS Attachment 4	The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state, national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined. Where applicable, these measures are set out in the Avoidance, Mitigation and Management Measures sections of EIS chapters 9 to 26 and also SREIS Attachment 4, Commitments Update.
R5006	S133, S157, S160	The proponent must identify the sensitive receivers, including workplaces (offices and intensive animal enclosures) close to all proposed gas heads, processing facilities (including compression processing facilities).	SREIS Chapter 3 and Attachment 2	A sensitive receptor is an area or structure sensitive to a predicted environmental impact (usually from air emissions or noise). Classification of a sensitive receptor is decided on a case by case basis, dependant on whether it may be impacted by the project activities. Sensitive receptors are dissimilar to affected persons which are defined as all registered properties owners in the project development area. Mapping of houses identified within the project development area are presented in SREIS Attachment 2, Strategic Environmental Management Plan. Throughout the project life as new development areas are proposed, Arrow will identify sensitive receptors within the vicinity of the proposed project facilities. Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (see Commitment C084).
R5007	S079, S134	Arrow's adaptive management framework is completely unacceptable. Arrow to provide more	EIS Chapter 14, Section 14.6.1	The adaptive management framework is a state government accepted approach. It allows the state government to monitor the coal seam gas

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R5007	S079, S134	detail on the adaptive management framework and the ability for early inclusion of research outcomes and best practice methodologies.		industry and instigate change where required through best practice environmental management which can be implemented as technologies develop over time. In practice, environmental licences issued to coal seam gas operators can be amended to take into account new research, monitoring or modelling which suggests the potential for unintended or unexpected impacts on the environment. For further information, refer to the www.ehp.qld.gov.au website.
R5008	S108	As per a publication by Randall (2011), Risk and Precaution, Cambridge University Press, ordinary risk management approaches are unsuitable when an unknown potential catastrophic and irreversible impact is a potential or even a likely outcome. Make good provisions and adaptive management cannot rectify or compensate for such an event.	EIS Chapter 7, Section 7.5.6 and Attachment 8 SREIS Attachment 4	Arrow uses the hierarchical approach of avoid, minimise, manage and offset to protect identified values and achieve environmental protection objectives. Specific mitigation and management measures are set out as commitments in the EIS and SREIS (see SREIS Attachment 4, Commitments Update). Commitments may be generic, and applied to a range of project activities, or they may be specific to an area, location or activity. Commitments will be incorporated and implemented through Arrow's health, safety and environmental management system and will help inform environmental management plans and the conditions of the environmental authority. The adaptive management framework will be applied to key aspects of the project, which require best practice management strategies to evolve over time.
R5009	S145	A precautionary approach should be taken in relation to approving coal seam gas developments, and should also be applied to proposed measures to address uncertainty and manage risk.	EIS Attachment 7, Section 4.2	Noted. The precautionary principle is integral to the methods used to assess environmental and social impacts in the EIS. These include significance based assessment that assumes all identified impacts will occur. This worst case scenario is then examined to determine what measures are required to avoid or reduce the magnitude of impacts. Key project risks to the environment have been identified as well as compliance of project activities (and their emissions) with statutory limits and guidelines. These assessments were informed by extensive studies carried out by technical specialists to inform project planning and design. In adopting these methods and approaches, the EIS has effectively integrated the key provisions of the precautionary principle including putting in place mitigation measures to effectively avoid and reduce serious environmental impacts as well as providing for monitoring of impacts and review of measures as more information becomes available. EIS Attachment 7, Ecologically Sustainable Development, Section 4.2 provides further details of how the precautionary principle has been taken into account through the EIS process.
R5010	S150	Are communication towers included as key components of the infrastructure? If not - why not? If so, what is their impact going to be on the natural resources and communities of the region (e.g., air quality, biodiversity, vegetation, soils, floodplain function, electromagnetic radiation)?	EIS Chapter 5, Section 5.2.7 SREIS Attachment 7, Section 1.1	EIS Chapter 5, Project Description, Section 5.2.7, describes supporting infrastructure required for the project, including telecommunications systems. Communication towers may be developed as supporting infrastructure, in which case towers are likely to be constructed within facilities sites, outside hazardous areas. Further details of facilities will be provided with the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment in accordance with EHP Guideline

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R5010	S150			<p>'Application requirements for petroleum activities'. <i>Telecommunications Act 1997</i> (Qld) approvals are discussed in SREIS Attachment 7, Legislation and Policy Update, Section 1.1. Regarding impacts, facilities will be integrated into the landscape setting where screening is not practicable, considering building and structure colour, texture and lines. Arrow will use matt and low-glare finishes two shades darker than the prevalent shading of the site, having regard to sun angles throughout the day and year and to the harvesting of crops, where practicable. Arrow will consider camouflage paints or finishes in highly sensitive landscapes (Commitment C268).</p>
R5011	S150	The EIS fails to give confidence that the site selection framework is being promoted in all the project's proposed operations and activities.	<p>EIS Chapter 8, Section 8.5.2 SREIS Chapter 3, Section 3.5</p>	<p>The approach to site selection implemented through the environmental framework (described in EIS Chapter 8, Environmental Framework) is fundamental to Arrow's field development planning. SREIS Chapter 3, Project Description provides an update of the project and the conceptual field development. Of note is the identification of potential sites for four central gas processing facilities and one temporary workers accommodation facility under this framework. Arrow will need to apply for an environmental authority (EA) or EA amendment for additional project infrastructure. Statutory information requirements to support the application will be provided in accordance with EHP Guideline 'Application requirements for petroleum activities'.</p>
R5012	S150	Adaptive management must not be used as a substitute for committing to specific mitigation measures in order to cover a situation where Arrow are not sure how to mitigate a negative environmental impact.	<p>EIS Chapter 7, Section 7.5.6 and Attachment 8 SREIS Attachment 4</p>	<p>Arrow uses the hierarchical approach of avoid, minimise, manage and offset to protect identified values and achieve environmental protection objectives. Specific mitigation and management measures are set out as commitments in the EIS and SREIS (see SREIS Attachment 4, Commitments Update). Commitments may be generic, and applied to a range of project activities, or they may be specific to an area, location or activity. Commitments will be incorporated and implemented through Arrow's health, safety and environmental management system and will help inform environmental management plans and the conditions of the environmental authority. The adaptive management framework will be applied to key aspects of the project, which require best practice management strategies to evolve overtime.</p>
R5013	S150	The EIS needs to indicate how many years a study needs to be carried out before it can be ascertained the significance of an impact. Appropriate design responses are not the only option available to Arrow to address impacts; avoiding development in a specific area or outside buffer zones may be more appropriate than a design response.	<p>EIS Chapter 8, Section 8.4</p>	<p>The parameters of each study, including duration, are designed in accordance with the Surat Gas Project EIS Terms of Reference and other key guidelines as described in the methodology for each study. Arrow's constraints mapping methodology, outlined in EIS Chapter 8, Environmental Framework, Section 8.4, presents the environmental framework used to inform site and route selection for coal seam gas infrastructure. This framework identifies constraints to development and environmental management controls (e.g., buffers, thresholds, trigger levels)</p>

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R5013	S150			to address identified constraints. The level of environmental constraint provides an indication of the project activities that could occur in a particular area, subject to the application of appropriate environmental management controls. They also provide an indication of the project activities that should be avoided in a certain area. These areas are deemed 'no go' areas. Where constraints mapping identifies an area best suited for development, environmental controls are applied in the hierarchical approach of first avoid, mitigate, manage and offset. The hierarchical approach allows for flexibility in how impacts will be addressed.
R5014	S150	The reasons offered for uncertainty undermine the purpose of the EIS. The details or information not provided by Arrow are absolutely essential because of the project location and the significant impacts the project will have on social and environmental values, both site specific and cumulative.	EIS Chapters 9 to 26 SREIS Chapter 3, Figure 3.6 and Chapters 5 to 15	The potential project impacts are discussed in EIS Chapters 9 to 26. To adequately assess the potential impacts to the project development area, baseline assessments were undertaken across the project development area to determine existing environmental values and areas of highest sensitivity and/or risk. Modelling and impact assessments were then undertaken at these sites to establish worst-case outcomes within the project development area. Modelling worst-case impacts has allowed Arrow to determine potential impacts from project activities and suitable management measures, regardless of facilities placement. Since the publication of the EIS, properties have been identified on which four central gas processing facilities and a construction camp may be placed (SREIS Chapter 3, Project Description, Figure 3.6). Further discussion of the environmental values specific to these sites are contained in SREIS chapters 5 to 15 (as applicable).
R5015	S157	Arrow's approach to purchase parcels of land leaves the landholder negotiation approach to the identification of site specific constraints, values and impacts null and void.	–	To clarify Arrow's intention with regard to infrastructure placement: Arrow will seek to acquire land on which to place production facilities and water treatment facilities, or enter into long term lease arrangements for the use of land. Arrow will seek to enter into conduct and compensation agreements for the placement of production wells, gas and water gathering systems and associated access tracks on third-party land. Activities on third-party land will include discussion and agreement on where coal seam gas infrastructure should be located on the property, and will take into consideration existing and proposed farm management practices and plans.
R5016	S157	The adoption of an adaptive management regime may have suited earlier coal seam gas projects in less sensitive areas; however, Arrow's project development area encompasses an area far more sensitive to the potential impacts (e.g., valuable soils, irrigation and agricultural activities).	EIS Chapter 7, Section 7.5.6 and Attachment 8 SREIS Attachment 4	Arrow uses the hierarchical approach of avoid, minimise, manage and offset to protect identified values and achieve environmental protection objectives. Specific mitigation and management measures are set out as commitments in the EIS and SREIS (see SREIS Attachment 4, Commitments Update). Commitments may be generic, and applied to a range of project activities, or they may be specific to an area, location or activity. Commitments will be incorporated and implemented through Arrow's health, safety and environmental management system and will help inform environmental management plans and the conditions of the environmental authority.

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R5016	S157			The adaptive management framework will be applied to key aspects of the project, which require best practice management strategies to evolve overtime.
R5017	S157	The general conditioning sought by Arrow (e.g., adoption of criteria limits and the application of the framework approach) is inappropriate for a project of this magnitude.	EIS Chapter 7, Section 7.5.6 and Attachment 8 SREIS Attachment 4	Conditions and criteria set by the administering authority are based on best-practice environmental management. Specific mitigation and management measures are set out as commitments in the EIS and SREIS (see SREIS Attachment 4, Commitments Update). Commitments may be generic, and applied to a range of project activities, or they may be specific to an area, location or activity. Commitments are designed to meet and/or exceed best practice environmental management and prescribed criteria and will help inform the conditions of the environmental authority.
R5018	S134	Significance assessment approach underestimates the potential magnitude of impacts on traffic because it is based on Arrow's current (production) operations.	EIS Chapter 7, Section 7.2.3, Chapter 19, Table 19.2 and Appendix M, Section 9.1 SREIS Chapter 12 and Appendix 9	Vehicle trips associated with Arrow's existing construction and operational activities were used to aid calculations for EIS Appendix M, Roads and Traffic Impact Assessment (e.g., 50 heavy vehicles per production well and 91 light vehicles per construction well). However, the magnitude of impacts was modelled based on the proposed Surat Gas Project development schedule (EIS Appendix M, Appendix C). Traffic modelling has been revised for the SREIS; see SREIS Chapter 12, Roads and Traffic and SREIS Appendix 9, Supplementary Roads and Transport Assessment.
R5019	S079	The EIS has been written so generalised that it is hard to understand the severity of the impacts between all of the various land uses i.e., grazing land, high intensive cropping land, piggeries and feedlots, dairy, horticulture, fruit growing, vineyards, timber production etc. Each land use will be impacted differently depending on the nature of the operation.	EIS Chapter 13 and Appendix F	The purpose of Appendix F, Agricultural Report was to identify the substantive issues that need to be considered and would be impacted by the proposed development. The agriculture report adequately addresses this objective in that it identifies the types of farming activities and the major constraints those activities might pose on coal seam gas development. The agriculture report was presented to the Arrow Intensively Farmed Land Committee in advance of its publication in the EIS. The specific issues of planning and operating infrastructure will be addressed with individual landholders through the negotiation of a conduct and compensation agreement.
R5020	S089	The EIS has been strategically beneficial to Arrow and needs to be independently verified prior to decisions on the project being made.	–	The decision to approve and condition the project is undertaken by the chief executive following consideration of the standard criteria, in accordance with <i>the Environmental Protection Act 1994</i> .
R5021	S104	Generally concerned over entire EIS process in which companies are monetarily influenced to assure the EIS is approved.	–	Noted.
R5022	S150	The assumption that each activity can be undertaken in 'a similar manner' and with 'appropriate environmental controls' without site specific scientific analysis indicates a lack of	EIS Chapter 8 SREIS Attachment 4	In the majority of cases, most potential impacts are known and understood, and as such standard mitigation measures can be applied. The environmental framework (EIS Chapter 8, Environmental Framework) is formulated on the basis that certain environmental values are both highly sensitive and

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R5022	S150	understanding that does not account for the potential for impacts on less sensitive ecosystems to result in an ecosystem becoming highly sensitive.		especially vulnerable to change, and their protection requires the implementation of site-specific management controls. Arrow will conduct pre-clearance surveys to identify any additional areas that may need to be avoided (Commitment C220).
R5023	S150	Although adaptive management can play a positive role in environmental impact assessments and addressing cumulative impacts, the methodology must be correctly and appropriately applied.	EIS Chapter 14, Section 14.6.1	The adaptive management framework is a state government accepted approach that allows the government to monitor and regulate the coal seam gas industry over time. Changes can be made as the project proceeds based on evolving environmental management practices, improved information and technologies. In practice, environmental licences issued to coal seam gas operators can be amended to take into account new research, monitoring or modelling which suggests the potential for unintended or unexpected impacts on the environment.
R5024	S157	Any approval of the project by the regulator would be based on a flawed EIS and Environmental Management Plan. The EIS and Environmental Management Plan fail to adequately inform the decision maker.	SREIS Attachment 2	The EIS was developed to meet the prescribed Terms of Reference in accordance with the <i>Environmental Protection Act 1994</i> (EP Act). The SREIS presents further information on the project, including that requested by EHP and additional baseline data and assessment of impacts of activities for four potential central gas processing facility sites and a temporary workers accommodation facility site. The SREIS also includes a strategic environmental management plan (SREIS Attachment 2, Strategic Environmental Management Plan). The EIS and SREIS will be considered by EHP against standard criteria as set out in the EP Act.
R5025	S150	The technical assessments and methodology supporting the EIS should be independently peer reviewed where they did not adopt statutory environmental values and instead defined their own values. If values have not been correctly identified, impacts may be underestimated or ignored.	–	Noted. Arrow is not required to provide independent review of the technical studies completed for the EIS. This matter rests with the government if they choose to do so. Technical studies completed for the EIS and SREIS were commissioned by Arrow and undertaken by qualified specialists. The commitments and management measures set out in the EIS and SREIS to avoid and limit potential impacts of the project are based on the recommendations from these specialists, with regard to best practice environmental management.
R5026	S134	Sensitivities rated as high in EIS Chapter 7, Section 7.2.1, Table 7.1 should be referred to in legislation, not just a statutory register.	EIS Chapter 7, Table 7.1 and Chapter 17, Section 17.4	The registers referred to in EIS Chapter 7, Impact Assessment Method, Table 7.1 refer to recognised or statutory state, national or international registers that are relevant to the environmental aspect being considered. Statutory registers are those with a basis in international, federal or state law and provide the mechanism for listing of an environmental value, such as a species, ecological community or wetland. The protection requirements associated with that listing are set out in the relevant convention, act or regulation. Table 7.1 presents model criteria for determining sensitivity of a given environmental value. Each of the technical specialists further refined these criteria for their study. For example, a listing of a species and communities under the <i>Environmental Protection and Biodiversity Act 1999</i> (a 'statutory

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R5026	S134			register'), is included in the sensitivity criteria for high sensitivity developed for the terrestrial ecology studies and associated impact assessment (EIS Chapter 17, Terrestrial Ecology, Section 17.4).
R5027	S134	Arrow to address the avoidance principle (introduced in EIS Chapter 7, Section 7.2). This should be further explored in order to address high sensitivity values. Need to align Section 7.2 with Section 7.5.6.	EIS Chapter 7, sections 7.2 and 7.5.6	The avoidance principle is discussed in EIS, Chapter 7, Impact Assessment Method, Section 7.5.6. Arrow's management approach is based on the hierarchy of first avoid, then minimise, manage and finally offset for adverse impacts of the project to bring impacts down to the minimum practical. This hierarchy is implemented in the Surat Gas Project environmental framework to achieve the environmental protection objectives through field design, construction methods, operating and maintenance procedures, and decommissioning methods.
R5028	S134	Diagram should be used to illustrate the information regarding project planning steps described in EIS Chapter 8, Section 8.5.2 and will complement figures 8.1 and 8.2.	SREIS Chapter 3, Section 3.5	Noted. Additional information on the project schedule is included in SREIS Chapter 3, Project Description, Section 3.5.
R5029	S134	Arrow to provide details of land to be avoided in site planning in addition to those in EIS Executive Summary, Table 5, Environmental and Social Design Specifications on page 20.	EIS Chapter 8, sections 8.4, 8.4.2 Chapter 17, Section 17.6.1 SREIS Chapter 3, Figure 3.1, Chapter 9, Chapter 11 and Attachment 8	Areas to be avoided, or 'no go' areas, are identified in the constraints mapping methodology in EIS Chapter 8, Environmental Framework, Section 8.4. This framework identifies constraints to development and environmental management controls (e.g., buffers, thresholds, trigger levels) to address the identified constraints. The level of environmental constraint ('no go', highly constrained, moderately constrained and least constrained areas) provides an indication of the project activities that could occur in a particular area, subject to the application of appropriate environmental management controls. The constraints also provide an indication of the project activities that should be avoided in a certain area. These areas are deemed 'no go' areas. The preliminary list of no go areas is included in Chapter 8, Section 8.4.2 and is discussed further in relevant chapters of the EIS. For example, EIS Chapter 17, Terrestrial Ecology identifies 'no go' areas that are of extremely high sensitivity in terms of terrestrial ecology values (Section 17.6.1) and will be avoided. SREIS Chapter 11, Terrestrial Ecology provides an update to this assessment based on project description refinements and the results of further field surveys that have been carried out in the project development area. The constraints mapping has also been updated and is presented in SREIS Attachment 8, Constraints Mapping Update. Note that Arrow has surrendered a number of sub-blocks of its petroleum tenements back to the government. These areas are identified in SREIS Chapter 3, Figure 3.1. It should also be noted that EIS Executive Summary, Table 5, Environmental and social design specifications of Arrow's HSEMS, has been updated with regard to surface water discharge, as per SREIS Chapter 9, Surface Water.

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R5030	S145	The EIS states that Arrow has already developed a standard operating procedure for site and route selection, but these are not provided.	EIS Chapter 8, Section 8.4 SREIS Attachment 8	The procedure for identifying site and route selection is the Environmental Framework discussed in EIS Chapter 8, Environmental Framework, Section 8.4. Arrow's Environmental Framework outlines constraints to development in the Surat Gas Project. The level of environmental constraint provides an indication of the project activities, such as well and pipeline infrastructure that could occur in a particular area, subject to the application of appropriate environmental management controls. They also provide an indication of the project activities that should not occur in a certain area. These areas are deemed 'no go'. SREIS Attachment 8, Constraints Mapping Update provides an update to the constraints mapping in the EIS.
R5031	S150	The region's communities seek certainty where it is warranted such as an EIS assessment of a major coal seam gas mining project in a world renowned agricultural area, and accept uncertainty where it occurs because of lack of scientific knowledge.	SREIS Chapter 3, Figure 3.1 and Chapters 5 to 15 and Appendices 2 to 13	Noted. Since the publication of the EIS, Arrow has continued to refine the project description. Arrow has also surrendered a number of sub-blocks of its petroleum tenements back to the government. These areas are identified in SREIS, Chapter 3, Project Description, Figure 3.1. The SREIS consequently presents further information on the project, including a refined sequence of field development. SREIS Chapter 3 also identifies changes to the project activities since the EIS was published and information on the potential locations of four central gas processing facilities, two water treatment facilities and a temporary workers accommodation facility. Other aspects of the project description have also been refined and relevant changes assessed by technical specialists. The specialist study reports completed for the SREIS are included as Appendices 2 to 13, with the findings summarised in SREIS Chapters 5 to 15.
R5032	S123	The existing wells and/or approval for the Dalby Expansion Project should be shown on submitted maps. Any information from projects (i.e., operations around Tipton) regarding the performance, impacts on agriculture, soils and water and the solutions to help mitigate can be useful information when assessing this project.	EIS Chapter 1, Figure 1.5 and Chapter 5, Section 5.3	Noted. EIS Chapter 5, Project Description, Section 5.3 provides information on Arrow's existing gas fields, facilities and infrastructure. Existing production facilities are located at Daandine, Kogan North, Stratheden, and Tipton West. EIS Chapter 1, Introduction, Figure 1.5 identifies these locations. Arrow's experience as a coal seam gas operator has been drawn on to support the EIS studies and model potential impacts from project activities.
R5033	S134	The assumption that mitigation and management measures are effective is misleading, especially when considering impacts on agriculture and groundwater, where the mitigation strategies outlined have not yet been trialled. Arrow to reassess the significance of impacts without this assumption in place.	EIS Chapter 7 and 9 to 26	The impact assessment method as set out in EIS Chapter 7, Environmental Impact Assessment, first presents assessment of potential impacts prior to any mitigation measures, and reassessment for residual impacts with mitigation measures in place. Both findings are presented in EIS Chapters 9 to 26. This is a recognised approach to impact assessment. The proposed mitigation and management measures are based on specialist technical advice, best practice environmental management, compliance with regulatory regimes and Arrow's experience to date as a coal seam gas operator.

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R5034	S079	As Arrow is still testing and researching (problems on black soil land such as drilling without contamination, water and brine management, access to black soil sites in all conditions) and these findings are not in the EIS currently, and the identification and severity of the impacts are not known, do we get a chance to see the results of their ongoing research/ results?	SREIS Chapter 7, Section 7.6.2 and Chapter 5 to 15 and Attachment 4	Arrow has only recently commenced its first agricultural demonstration using coal seam gas water on its Theten property in late December 2012. The site has been set up in advance of project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the ANZECC guidelines which outline specific soil and water parameters. Arrow provides updates on work at Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure. Arrow is also researching ways to reduce impacts on intensively farmed land and demonstrate its gas well and drilling technology at the Surat Tek Park, located on Arrow's Theten property. Project demonstrations currently underway include multi-well pad drilling and pitless drilling (SREIS Chapter 7, Agriculture, Section 7.6.2).
R5035	S157	Desktop studies and targeted field studies across such a large project development area were used by the technical specialists to draw conclusions in relation to specific areas that were not the subject matter of any of those studies.	EIS Chapter 8 SREIS Chapters 5 to 15	Noted. As set out in EIS Chapter 8, Environmental Framework, typical construction, operation and maintenance activities are known. The project development area was the subject of desktop studies by technical specialists to build an environmental baseline. Using this information, and knowledge of the project description, targeted field surveys were carried out to supplement existing information. These assessments and the associated constraints mapping process (described in EIS Chapter 8, Environmental Framework), ascertained areas of high to low sensitivity to change and/or risk to the environment. These sensitivities were carried forward into the technical assessments and provide a sound basis for the development of measures to avoid and limit potential impacts. Further field studies have been completed for the SREIS; see SREIS Chapters 5 to 15. Site-specific surveys will also be carried out, as required, for selected sites prior to construction.
R5036	S159	Impact reduction is restricted to severity and duration rather than repair and restoration.	EIS Chapter 7, Section 7.2.2 and Table 7.2	The magnitude of an impact is a function of geographical extent, the duration of the impact (if it is short, medium or long term) and the severity of the impact which is an assessment of the scale or degree of change from existing conditions (EIS Chapter 7, Impact Assessment Method, Section 7.2.2). The magnitude of an impact is assessed as high, moderate or low by applying the model criteria. Model criteria for ranking the magnitude of an impact are set out in Table 7.2. These model criteria were refined for different environmental values by the technical specialists. The criteria in Table 7.2 capture the concepts of repair and restoration of impacts. For example, impacts that are potentially irreversible (and therefore cannot be mitigated through restoration for example) are rated as high and

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R5036	S159			impacts that can be ameliorated with targeted environmental controls (including restoration and rehabilitation after decommissioning) are rated as moderate. Low magnitude impacts are those that are temporary and can be addressed through standard environmental management measures. As the sensitivity of an environmental value remains constant, mitigation measures aim to reduce the magnitude of impacts and focuses on impacts rated as high and medium. In many cases, an effective way to reduce the impact is through rehabilitation following decommissioning. Each of the impact assessment chapters in the EIS identify measures to be implemented during decommissioning of facilities (and rehabilitation after construction has ceased) that reduce the significance of potential impacts.
R5037	S150	Appropriate application of the EIS process has not been undertaken, nor has best scientific process been applied with respect to the ability of the technical studies to produce multi-criteria constraints that inform potential impacts on identified ecosystems and environments.	SREIS Attachment 4 and 8	Technical studies completed for the EIS and SREIS were undertaken by qualified specialists, using recognised impact assessment methods, guidelines and standards as appropriate to their discipline. The mitigation and management measures presented in the EIS have been updated in SREIS Attachment 4, Commitments Update to take account of refinements to the project description and additional field and other technical studies completed since the EIS was published. Furthermore, the constraints mapping presented in the EIS has been updated (SREIS Attachment 8, Constraints Mapping Update) to take account of all available information and provide a sound basis for planning field development and site selection for project facilities.
R5038	S046, S157, S162	Arrow would not be required to undertake the comprehensive individual site assessment more suited to other development projects, Arrow's boarder approach has defeated the intent of the EIS and the ability for there to be sensible scrutiny and public input.	SEIS Chapter 3 and Chapter 5 to 15.	While site-specific locations for project activities and infrastructure were not known at the time the EIS was prepared, baseline assessments were undertaken across the project development area to determine existing environmental values and areas of highest sensitivity and/or risk. The modelling and impact and risk assessments undertaken for the EIS established worst-case outcomes within the project development area. Modelling worst-case impacts has allowed Arrow to determine potential impacts from project activities and suitable management measures, regardless of facilities placement. The project description has been further refined since the EIS was published and is presented in SREIS Chapter 3, Project Description. Potential locations have also been identified for four central gas processing facilities and a temporary workers accommodation facility. The findings of site-specific assessments for these sites are presented in SREIS Chapters 5 to 15 and the technical reports in the Appendices to the SREIS. As further sites are identified, statutory information requirements will also be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s).
R5039	S134	Additional information to be provided regarding	SREIS	An update of the field development program is provided in SREIS Chapter 3,

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R5039	S134	timeframes for steps in gas field planning.	Chapter 3, Section 3.5	Project Description, Section 3.5.
R5040	S157	The division of the project development area into five development regions, and the associated project phasing should be conducive to developing a separate environmental authority for each of these areas and capturing the variable environments across each, especially before moving into ATP 683.	SREIS Chapter 3, Section 3.2	Noted. Field development planning has advanced since preparation of the EIS, with the project development area being separated into 11 drainage areas (SREIS Chapter 3, Project Description, Section 3.2). Note that Arrow has surrendered a number of sub-blocks of its petroleum tenements back to the government. These areas are identified in SREIS Chapter 3, Figure 3.1. Statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental amendment application(s). It is expected that environmental authority conditions will address any high risk activities proposed in sensitive areas.
R5041	S157	Text presented in EIS Chapter 27, Section 27.1 acknowledges the uncertainty associated with the project and related impacts. This begs the question as to why the project should proceed (especially in ATP 683) with so much yet to be understood. Arrow makes no effort to identify what steps it has taken to identify areas for development. Arrow commits to a series of additional studies, but does not explain why the project approval and expansion activities cannot wait until after the completion of these scopes of work.	EIS Chapter 27, Section 27.1 SREIS Chapter 3, Figure 3.6 and chapters 9 to 12	Since the publication of the EIS, Arrow's understanding of gas reserves has continued to develop, leading to refinement of the development sequence. Furthermore, potential locations for four central gas processing facilities and a temporary workers accommodation facility have been identified (see SREIS Chapter 3, Project Description, Figure 3.6.) Findings of investigations of these sites are discussed in SREIS chapters 9 to 12. The timing of additional studies has not yet been determined. Some are occurring now, some have just been completed (i.e., in the case of the SREIS), others cannot be started as final locations have not been selected and as such the study areas are not yet defined. Project approvals and some studies are an ongoing parallel process.
R5042	S150, S157	The EIS is flawed because it cannot present the specific details of the infrastructure and facilities required for the construction, operations and decommissioning stages of the project. The EIS can therefore not assess the total environmental impact. No attempt is made to identify specific properties that may be impacted even within the next 5 to 10 year period, not a categorisation of 'possible', 'probably' or 'likely' lots to be affected by infrastructure and activity. Instead, the adopted EIS method seeks to propose principles of constraint and 'nominal' separation distances rather than properly identifying the receiving environment or even attempt the requirement of the terms of reference to define the local context (EIS Chapter 3, Section 3.1.2).	EIS Chapter 5, Section 5.3.1 SREIS Chapters 3 and 8	At the time the EIS was prepared, the types of construction, operation and decommissioning activities were understood, and a conceptual sequence of development presented, based on Arrow's understanding of its gas reserves (EIS Chapter 5, Project Description, Section 5.3.1). The specific location of infrastructure was unknown. Since the publication of the EIS, Arrow's understanding of gas reserves has continued to develop, leading to refinement of the development sequence. Furthermore, potential locations for four central gas processing facility and a temporary workers accommodation facility have been identified. Investigations of these sites are discussed in SREIS chapters 5 to 15, where applicable. While site-specific locations for project activities and infrastructure were not known at the time the EIS was prepared, baseline assessments were undertaken across the project development area to determine existing environmental values and areas of highest sensitivity and/or risk. The modelling and impact and risk assessments undertaken for the EIS established worst-case outcomes within the project development area. Modelling worst-case impacts has allowed Arrow to determine potential impacts from project activities and suitable management measures, regardless of facilities placement.

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R5042	S150, S157			In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined.
R5043	S157	Arrow's adoption of project constraints conveys to the community an intention to avoid development altogether in some areas (perhaps creating community confidence), however no sensible criteria for circumstances where avoidance would occur is provided.	EIS Chapter 8, Section 8.4 SREIS Attachment 8	EIS Chapter 8, Environmental Framework outlines constraints to development in the Surat Gas Project. The level of environmental constraint provides an indication of the project activities that could occur in a particular area, subject to the application of appropriate environmental management controls. The framework also provides an indication of the project activities that should not occur in a certain area. These areas are deemed 'no go'. The constraints mapping has been updated for the SREIS and is included in SREIS Attachment 8, Constraints Mapping Update.
R5044	S134	The use of the avoid-mitigate-manage hierarchy of mitigation measure is supported by Toowoomba Regional Council.	–	Noted.
R5045	S079	Do the public and project stakeholders get a chance to comment on the results of Arrow's testing and research prior to project approval?	–	Arrow will report the results of trials on its website when these are available and present results in the various forums in which it participates. Further to this, information as required under the EHP Guideline 'Application requirements for petroleum activities' will be supplied to accompany its environmental authority (EA) or EA amendment application(s), which will be publicly notified.
R5046	S079	Do coal seam gas infrastructure plans have to be assessed by any government (including local government) bodies before any infrastructure can be constructed?	–	Project plans must be submitted to the administering authority as part of an application for an environmental authority (EA) or EA amendment.
R5047	S014, S044	It is difficult to believe that all of the experts chosen to assess the projects impacts had a 'detailed understanding of the existing environment, and past experience with similar projects in the region.' Landholders in this region have willingly shared their knowledge and expertise with Arrow, yet this information has failed to be taken into account in the assessment process.	EIS Chapter 8, Section 8.4.3	Arrow will continue to consult with landholders through the development of the project. As noted in EIS Chapter 8, Environmental Framework, Section 8.4.3 ongoing community consultation will help to inform the update of the constraints mapping and environmental management controls proposed. These controls will be detailed in the statutory information as required in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany its environmental authority (EA) or EA amendment application(s).
R5048	S118	Concerned there is no standard methodology in Queensland for assessment of cumulative impacts as part of the EIS process and that there are no specific requirements in the legislation as to how cumulative impacts should be addressed.	EIS Chapter 28, Section 28.2	Noted. The technical specialist studies adopted relevant methodologies within their disciplines to assess cumulative impacts (as presented in EIS Chapter 28, Cumulative Impacts). In the absence of a standard methodology, experience and guidance from elsewhere was used in the assessment. For the assessment, cumulative impacts are defined as changes to the environment that are caused by an action in combination with other past, present and future human actions (Hegmann et al., 1999). Cumulative impact

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R5048	S118			assessment is only possible where there is sufficient information available to inform the assessment and the need for any additional mitigation measures; the level of information available may vary across projects and for each environmental value being assessed.
R5049	S119, S133, S150	Arrow should adopt the accepted definition of cumulative impacts (outlined in Franks et al., 2010 or USEPA, 1999) and provide an adequate assessment against an accepted definition and criteria. There is also a lack of consistency in the approach to cumulative impacts between the various sections of the report. A uniform list of projects would enable a far better understanding of the total cumulative effect on the region.	EIS Chapter 28, Figure 28.1	There is no standard methodology in Queensland for the assessment of cumulative impacts as part of an EIS and there are no specific requirements in the legislation as to how cumulative impacts should be addressed. For the purposes of the assessment presented in EIS Chapter 28, Cumulative Impacts, cumulative impacts are defined as changes to the environment that are caused by an action in combination with other past, present and future human actions (Hegmann et al., 1999). EIS Chapter 28, Figure 28.1 identifies the other projects considered by Arrow in the cumulative impact assessment for the project. Cumulative impact assessment is only possible where there is sufficient information available to inform the assessment and the need for any additional mitigation measures; the level of information available may vary across projects and for each environmental value being assessed.
R5050	S134, S150	The EIS fails to fully consider the cumulative impact that this project and all other production facilities of other mining companies, also proposing to operate for 30 or more years, 24 hours a day, 7 days a week. The majority of cumulative effects would occur only if construction of developments coincided, which renders the findings of the assessment conservative. As projects are progressing through phases, potential cumulative impacts could change or be eliminated altogether. Arrow should reconsider their statement regarding the assessment being conservative as for some environmental assets, the loss of value through permanent means (e.g., clearing), would be compounded by multiple projects regardless of whether construction phases coincide.	EIS Chapter 28	The EIS includes cumulative assessments of impacts in the project development area based on information available on the existing and planned projects in the same area (EIS Chapter 28, Cumulative Impacts). Cumulative impact assessment is only possible where there is sufficient information available to inform the assessment and the need for any additional mitigation measures. Arrow has and will continue to consult and coordinate with other operators and local councils in the project development area where there is potential for overlap of activities.
R5051	S119	Sections 305 and 306 of the Petroleum and Gas Act requires preparation of a coal seam gas statement for any coal mining leases affected to address the impact of any coal seam gas project on coal mining leases.	EIS Chapter 2, Section 2.1	Arrow will comply with the requirements of relevant legislation including section 305 and 306 of the Petroleum and Gas (Production and Safety) Act (2004).
R5052	S137, S159	The combined effect of all the projects in the area will have a large impact within the Surat Basin. Whose responsibility is it to manage cumulative	EIS Chapter 28, Figure 28.1	EIS Chapter 28, Cumulative Impacts, Figure 28.1 identifies the other projects considered by Arrow in the cumulative impact assessment for the project. The EIS includes cumulative assessments of impacts in the project

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R5052	S137, S159	impacts? An overall plan that lessens unnecessary duplications are needed which result in greater efficiency in dealing with most environmental issues.		development area based on information available on the existing and planned projects in the same area. Cumulative impact assessment is only possible where there is sufficient information available to inform the assessment and the need for any additional mitigation measures. Industry operators are responsible for the mitigation and management of impacts that arise from their activities. Arrow has and will continue to consult and coordinate with other operators and local governments in the project development area where there potential for overlap of activities.
R5053	S050, S123, S162	Arrow should display existing projects in the area in its mapping, to allow for cumulative assessment. It is also noted in EIS Chapter 4, Figure 4.15, there is a mine proposed or constructed at Jimbour. At this stage this project has been mothballed, and has been since the declaration of strategic cropping land. The proposed mine has not been considered in the cumulative impacts chapter or throughout the EIS, thus not allowing for considerable cumulative impacts on the Jimbour floodplain.	EIS Chapter 4, Figure 4.15 and Chapter 28, Figure 28.1 SREIS Chapter 3, Figure 3.1	Figure 4.15 in EIS Chapter 4, Environmental and Social Context presents an overall picture of past and current activities in the region. EIS Chapter 28, Figure 28.1 identifies the existing and planned projects considered relevant for the cumulative impact assessment for which sufficient information was available to inform the assessment and need for any additional mitigation measures. It should be noted that since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.
R5054	S050, S162	It should be noted that Tarong Energy had plans to construct a pipeline across the Jimbour Plain. Construction was not implemented after their preliminary tests to determine constructability of the pipeline, on the black cracking clay soils, was decided against. This was largely due to the soil properties and erosion difficulties that would provide extra costs and a high risk of large environmental damage.	–	Noted. The effectiveness of the proposed environmental management controls in addressing the identified impacts is being investigated through trials and case studies that are currently focused on rehabilitation of black soils (vertisols and Dermosols) and construction methods for work on those soils. Arrow has shown at consultation and on its website that vertisols (black soils) can and have been successfully rehabilitated and restored to their former use. The layout, design and construction methods used to install production wells and access tracks on vertisols will consider site-specific conditions and the outcome of landholder negotiations on particular farming practices.
R5055	S106, S110, S143	Concerns over the impact already being inflicted by existing coal seam gas companies on the northern third of the proposed project development area. Commencement in 2030 in the Wandoan development region after existing producers begin closing down their operations is the only likely acceptable development of coal seam gas.	SREIS Chapter 3, section 3.2 and 3.5 and Figure 3.1	Field development planning has advanced since preparation of the EIS, with the project development area being separated into 11 drainage areas (SREIS Chapter 3, Project Description, Section 3.2). The revised conceptual development sequence and timing is set out in SREIS Chapter 3, Section 3.5. Statutory information requirements will be developed and provided to government in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental amendment application(s).
R5056	S046, S134, S150, S159	The cumulative constraints analysis does not capture all relevant information, including the area's long term viability.	EIS Chapter 28	The cumulative assessment presented in EIS Chapter 28, Cumulative Impacts takes into account the potential impacts of existing and planned projects in or adjacent to the project development area. The level of

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R5056	S046, S134, S150, S159			assessment is constrained by the information available on other projects, which is often not publicly available. The administering authority will assess and decide the project approval in accordance with the standard criteria defined in the EP Act. This includes consideration of cumulative environmental impacts.
R5057	S079	Does Arrow have to update the Government on the findings of their testing and research?	–	The SREIS incorporates the findings of the additional technical studies undertaken since the EIS was published. Arrow will routinely publish the results of trials it is carrying out in the Surat Basin on its website. Local government representatives also participate in forums, such as the Arrow Surat Community Reference Group, where these activities are discussed.
R5058	S157	It is inappropriate for Arrow to use the EIS process to place the onus on landholders for the identification of the receiving environment, environmental values and suitable mitigation measures – this information should be gathered by the proponent/applicant.	EIS Chapter 7, Section 7.1 and Chapters 9 to 26 SREIS Chapter 3, sections 3.2 and 3.5 and Attachment 4	The EIS does not place the responsibility for identifying the environmental values or mitigation measures on landholders. Environmental values have been identified for all areas that will or have the potential to be impacted by the project. Environmental values for each discipline have been defined and identified by technical specialists, having regard to the definitions provided in the Environmental Protection Act 1994 (Qld), statutory guidelines or relevant policy. Where definitions were not provided, specialists defined values based on their experience and accepted practice (EIS, Chapter 7, Section 7.1). The existing environment (baseline assessment) and environmental values for each discipline are presented in section 3 of each EIS chapter (EIS Chapters 9 to 26). Baseline assessments were undertaken by specialists across the project development area to determine areas of highest sensitivity and/or risk. Modelling and assessments were then undertaken at these sites to establish worst-case outcomes within the project development area. Commitments and management measures were then proposed by specialists based on accepted best practice environmental management. The SREIS presents additional information on the project activities and planned field development (SREIS Chapter 3, Project Description), including further field studies and modelling. The mitigation measures proposed in the EIS have also been reviewed and an updated list provided in SREIS Attachment 4, Commitments Update. Arrow will provide statutory information as required in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany its environmental authority (EA) or EA amendment application(s).

Table 19.6 Air Quality

Issue No.	Submission No.	Issue	Reference	Responses
R6001	S011	The air quality chapter and technical report do not comply with Section 4.6.1 of the TOR as no actual air quality monitoring was undertaken, either to establish a baseline or for modelling impacts. This has been done as a desktop study and the data used is from a very limited number of places, the majority of which are outside the project development area and are therefore of questionable relevance.	EIS Chapter 9, sections 9.2.1 and 9.3.4 and Appendix C, Section 5	Section 4.6.1 of the Terms of Reference (TOR) does not specify that air quality monitoring must be undertaken, however it requires sufficient data on local meteorology and ambient levels of contaminants be gathered. This TOR requirement was satisfied utilising air quality monitoring data from the Department of Environment and Heritage Protection (EHP) Toowoomba and Flinders View monitoring stations. Monitoring data from these stations set the baseline for the project development area is considered conservative (i.e., 'worst-case'), due to industrial and urban land use around Toowoomba and Flinders View, which typically produce higher air pollutant concentrations than those in rural areas (EIS Appendix C, Section 5). Consequently, the monitoring data used to set the baseline for the air quality impact modelling / assessment contains higher background air pollutant concentrations than expected in the project development area (EIS Chapter 9, Air Quality) leading to higher predicted cumulative impacts. This approach is common and accepted practice in evaluating air quality impacts.
R6002	S036, S150	The Surat Basin and other key rural areas within regional Queensland must be supplied air quality monitoring stations as a matter of urgency.	EIS Chapter 9, sections 9.2.1 and 9.3.4 and Appendix C, Section 5	Noted. Air quality monitoring, including the installation and operation of monitoring stations in Queensland, is a key role of EHP. Monthly and annual air quality reports are available from EHP for existing stations.
R6003	S005, S011, S143, S150	No air quality monitoring stations are present within the project development area and there is little baseline air quality data for this area which affects the ability to measure potential impacts on ecology and people. It is recommended that specific baseline air quality monitoring is conducted over the project development area. The proponent must ensure that sufficient data is collected from a number of representative points within the project area, to produce a report that can be regarded with some level of confidence. Monitoring and revised modelling should be submitted for review prior to any project activities being approved.	EIS Chapter 9, sections 9.2.1 and 9.3.4 and Appendix C, Section 5 SREIS Chapter 3 and Chapter 5	Air quality monitoring, including the installation and operation of monitoring stations in Queensland is a key role of EHP. The data obtained from EHP's Toowoomba and Flinders View monitoring stations were used for the air quality assessment in the EIS. Use of monitoring data from these stations to set the baseline for the project development area is considered conservative (i.e., 'worst-case'), due to industrial and urban land use around Toowoomba and Flinders View, which typically produce higher air pollutant concentrations than those in rural areas. (EIS Appendix C, Section 5). Consequently, the monitoring data used to set the baseline for the air quality impact assessment contains higher background air pollutant concentrations than expected in the project development area (EIS, Chapter 9, Air Quality). The absence of air quality monitoring stations within the project development area would only be a concern if the area was expected to have a higher level of contaminants than Toowoomba or Flinders View. As with the company's existing operations, Arrow will be required to report on the project's air emissions including the results of air quality monitoring in accordance with relevant legislation including National Pollutant Inventory (NPI) reporting and any licence conditions. The air quality assessment prepared for the SREIS (see SREIS Chapter 5, Air Quality and Appendix 2, Air Quality) involved a qualitative assessment of the changes to the project description, including the reduction in number of wells and production facilities, the inclusion of multi-well pads, and the use of

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R6003	S005, S011, S143, S150			<p>electricity and temporary power sources to run central gas processing facilities. Site-specific air quality modelling will be undertaken once site locations are known (see Commitment C001).</p> <p>In the case of the potential production facility sites identified in SREIS Chapter 3, Project Description, further modelling will be undertaken during detailed design, when specific facility locations are determined.</p>
R6004	S011	<p>Desktop data used was from a limited range and primarily from locations external (and atypical) to the project development area. Appendix C, Sections 3.1.1 and 3.1.2 of the air quality technical report use locations outside of the project development area and thus do not accurately reflect the project airshed. For example, Toowoomba is a poor choice of location for data as it is on top of the Dividing Range and it has very different elevation, climate, wind patterns, etc. to the project development area. Pittsworth, Goondiwindi and Taroom are all included as monitoring points when establishing the existing environment for rainfall and temperature; however those towns lie outside of the project development area and Pittsworth's climate is significantly different from that of the project development area.</p>	<p>EIS Chapter 9, Section 9.3 and Appendix C, sections 3.1.1, 3.1.2, 3.1.3 and 3.1.4</p>	<p>The Terms of Reference (TOR) requires that sufficient data be gathered on local meteorology and ambient levels of air contaminants. This TOR requirement was satisfied using:</p> <ul style="list-style-type: none"> • Nearby Bureau of Meteorological station (BOM) data for long-term climate data. • Air quality monitoring data from EHP's Toowoomba and Flinders View monitoring stations for ambient levels of dust, sulfur dioxide (SO₂) and carbon monoxide (CO). • The Air Pollution Model (TAPM) modelling for localised meteorology. • The Air Pollution Model – Chemical Transport Model (TAPM-CTM) modelling for background regional air quality of oxides of nitrogen (NO_x) and ozone (O₃). <p>TAPM is now widely used and has been extensively validated to support its use as a standard tool in air quality assessment.</p> <p>EIS Appendix C, Air Quality Assessment examines climate data and summarises data for rainfall (Section 3.1.1), temperature (Section 3.1.2), wind (Section 3.1.3) and evaporation (Section 3.1.4). This data was supplied to provide a long-term climate summary for the project development area, based on decades of weather observations, to take into consideration year-to-year variations. Such observations are generally only available from long-term BOM monitoring stations. The only suitable BOM station within the project development area is the Dalby Airport. Miles Constance Street station is just outside the project area. Climate data from three additional BOM stations (Pittsworth, Goondiwindi, and Taroom) were presented in Appendix C, Section 3.1 to provide a broader understanding of climate for the large and elongated project development area. Goondiwindi is outside the southern project boundary, Taroom outside the northern project boundary, and Pittsworth is further east. Pittsworth is also more elevated as noted in EIS Appendix C. While there are some differences between the stations, these stations nevertheless show similar climate characteristics.</p> <p>However, climate data presented in Appendix C3.1 was not used for the EIS air quality modelling assessment. Guidelines direct that the three dimensional meteorological and air dispersion model, The Air Pollution Model (TAPM), may be used to generate meteorology for areas where there are no observations (DEC, 2005). Climate data for the air quality modelling was therefore obtained using the TAPM meteorological model, which was run specifically to model localised meteorology for the project development area.</p>

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R6004	S011			<p>For existing air quality, there were no monitoring stations located in the project development area. Two approaches were therefore used to estimate values. For regional air pollutants including O₃ and NO_x, the regional air quality model, TAPM-CTM (TAPM with the Chemical Transport Model), were used to estimate background concentrations, while for dust, SO₂ and CO, air quality data (not meteorological data) from Toowoomba and Flinders View was used. The values sourced from Toowoomba are most likely a conservative representation of the existing concentrations in the study area, due to the higher emissions of the identified pollutants in that area, irrespective of terrain and climate differences.</p> <p>As with the company's existing operations, Arrow will be required to report on the project's air emissions including the results of air quality monitoring in accordance with relevant legislation including NPI reporting and any licence conditions.</p>
R6005	S143, S150	Regional air quality issues must be assessed in relation to the cumulative impact of all Arrow's operations in the project development area, all mining and energy operations in the region, and all agricultural and other industries in the region.	EIS Chapter 28, Section 28.3.1 and Appendix C, sections 7.1, 7.2 and Appendix B	<p>EIS Chapter 28, Cumulative Impacts and EIS Appendix C detail the cumulative impacts of the project and existing and future approved projects on a regional scale. Sections 7.1 and 7.2 of EIS Appendix C discuss the regional and localised impacts respectively including background levels determined from the regional air quality assessment results.</p> <p>Appendix B of EIS Appendix C sets out the emission sources used in the cumulative air quality modelling. Overall, the emission sources list is comprehensive and includes 96 sources. These sources are made up of future approved projects, oil and gas extraction, coal mines, electricity production and other industrial emissions, including agricultural industries and fuel storage and distribution depots.</p>
R6006	S011	Nine potentially significant emission sources (future approved projects for which insufficient information was available) were not included (Appendix B1 within EIS Appendix C, Air Quality Impact Assessment) thus a high level of uncertainty exists about the magnitude of cumulative impacts. There should be further investigation and inclusion of these nine emission sources prior to project approval in order to meet the requirements of Section 4.6.2 of the TOR.	EIS Chapter 9, Section 9.2.1 and Chapter 28, Section 28.3.1 and Appendix C, Appendix B	<p>EIS Chapter 28, Cumulative Impacts and EIS Appendix C detail the cumulative impacts of the project and existing and future approved projects on a regional scale. Third party projects were included in the assessment where information on those projects was in the public domain. All projects and operations for which information was available were included (96 sources). The results of the cumulative study prepared for the EIS, which incorporated these 96 sources, indicate that the project development area is far from constrained and the Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) will not be exceeded.</p>
R6007	S024, S026, S036, S081, S083, S133	Air quality, including cumulative impacts of multiple projects and emission sources under worst-case environmental conditions, must be considered in this EIS.	EIS Chapter 9, Section 9.4 and Chapter 28, Section 28.3.1 and Appendix C, Section 6.3.3 SREIS Chapter 5, sections 5.2 and	<p>The air quality impact assessment examined cumulative impacts of 96 emission sources, including future approved projects, oil and gas extraction, coal mines, electricity production and other industrial emissions (including agricultural industries and fuel storage and distribution depots) under worst-case environmental conditions.</p> <p>The air quality impact assessment considered worst-case scenarios and baseline conditions. For the purpose of the Surat Gas Project EIS, monitoring</p>

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R6007	S024, S026, S036, S081, S083, S133		5.6 and Appendix 2, Section 5.1	<p>data from EHP's Toowoomba and Flinders View was satisfactory to establish a conservative ('worst-case') baseline for the air quality impact assessment. The meteorological model, The Air Pollution Model (TAPM), was used to generate surface meteorological conditions across the project development area using worst-case meteorological modelling data. Localised emissions of nitrogen oxides (NOx), volatile organic compounds (VOCs) and particulate matter were modelled assuming typical maximum emission rates and continuous power generation or flaring as a worst-case scenario. Modelling of the Surat Gas Project cumulative regional scenarios included the 96 emission sources as well as the emissions from all of Arrow's 18 production facilities operating simultaneously at maximum compression across the entire project development area. This scenario provides a theoretical worst-case scenario as it does not take the staging of development into consideration.</p> <p>The revised project description presented in SREIS Chapter 5, Air Quality, Section 5.2, envisages up to 14 facilities (comprising up to eight central gas processing facilities and six field compression facilities) in a staged development. Consequently, as discussed in SREIS Chapter 5, Air Quality, Section 5.6 and SREIS Appendix 2, Air Quality, Section 5.1, the predicted impacts on a regional scale are less than those assessed in the EIS.</p>
R6008	S150	The conceptual locations of wellheads and production facilities to inform the air quality impact assessment are not adequate for an EIS process.	<p>EIS Chapter 5, Section 5.2 and Chapter 9 Section 9.2.1</p> <p>SREIS Chapter 3, Section 3.5</p>	<p>While specific facility and well locations are not yet known and will be developed in consultation with landholders, the type and scale of the development, including construction, operation and maintenance activities, are known. Modelling has been undertaken on this basis for the air quality impact assessment in accordance with best practice methods, with modelling results demonstrating that emissions from the project can meet Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives. Arrow has committed to conduct site-specific air quality modelling once site locations are known to show that project-related air emissions meet EPP (Air) objectives at the nearest sensitive receptor.</p> <p>In the case of the potential production facility sites identified in SREIS Chapter 3, Project Description, further modelling will be undertaken during detailed design, when specific facility locations are determined.</p>
R6009	S150	A peer review of the Chemical Transport Model (CTM) and the findings relied upon by Arrow is required.	<p>EIS Chapter 9, Section 9.2.1 and Appendix C, sections 4.4.2.1 and 4.4.2.2</p>	<p>Noted. The Air Pollution Model (TAPM) and Chemical Transport Model (CTM) are widely used models and have been extensively validated to support their use as standard tools in air quality assessment. EHP is presently in the process of developing model guidelines for the use of TAPM-CTM within the state of Queensland.</p>
R6010	S011	Section 7.1.1 of the Air Quality Impact Assessment highlights that the results of modelling are not of sufficient quality to assess the impacts of air quality	<p>EIS Appendix C, Section 7.1.1</p>	<p>Section 7.1.1 of SREIS Appendix C states '[a]s there is little data available on the air quality properties in this region of Queensland (i.e. used to configure the model in that region), the model results should not be considered as</p>

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R6010	S011	and cannot be used to inform decisions on the acceptability of the project.		<p>definitive predictions regarding future ground level concentrations. Rather, the results should be used more as an indication of relative concentrations, and therefore, of areas for prioritisation of air quality management initiatives for the region.'</p> <p>This statement does not state that results are of insufficient quality to assess the impacts of the project on air quality and the methods used in the study to predict air quality impacts are consistent with best practice. In particular, current meteorological models are able to quite accurately simulate local and regional conditions. One of the models used routinely for the purpose of generating meteorological data for air quality assessments is The Air Pollution Model (TAPM). This model was developed in the 1990s by Commonwealth Scientific and Industrial Research Organisation (CSIRO) specifically so that air quality assessments could be done without the need for on-site measurements. TAPM and other meteorological models are now widely used for this purpose and provide reliable input information for air quality modelling. Such models have been extensively validated to support their use as standard tools in air quality assessment.</p>
R6011	S015	There is no certainty in such statements as 'theoretically possible worst case' and 'actual design worst case' and 'coal seam gas contains only trace quantities of sulfur and carbon monoxide (CO) and are not expected to be generated at concentrations that may be harmful to human health'. With regard to good air quality, people will not be reassured.	<p>EIS Chapter 9, Section 9.4</p> <p>SREIS Chapter 5, Section 5.5</p>	<p>Noted. The project will be required to meet applicable air quality guidelines and criteria. The air quality impact assessment carried out for the EIS (EIS Chapter 9, Air Quality, Section 9.4) has shown that the guideline limits can be achieved. Further assessment undertaken for the SREIS, presented in SREIS Chapter 5, Section 5.5, supports this conclusion.</p> <p>Site-specific air quality modelling will also be undertaken once site locations are known to demonstrate that project-related air emissions meet Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives at the nearest sensitive receptor (Commitment C001).</p> <p>Furthermore, as with the company's existing operations, Arrow will be required to report on the project's air emissions including the results of air quality monitoring in accordance with any environmental authority (EA) conditions. EA conditions relating to ongoing monitoring of air emissions are set so that air quality objectives in the EPP (Air) are met on an ongoing basis.</p>
R6012	S015	There is no assurance that the Environmental Protection Policy (Air) 2008 (Qld) objectives will be met or that air quality will not be affected adversely.	<p>EIS Chapter 9, Section 9.4</p> <p>SREIS Chapter 5, Section 5.5</p>	<p>The separation distances set out in EIS Chapter 9, Air Quality, Section 9.4, determined through air quality modelling, are determined so that Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives can be met at sensitive receptors. Further assessment undertaken for the SREIS, presented in SREIS Chapter 5, Section 5.5, supports this conclusion.</p> <p>Site-specific air quality modelling will be undertaken once site locations are known to demonstrate that project-related air emissions meet EPP (Air) objectives at the nearest sensitive receptor (Commitment C001).</p> <p>Furthermore, as with the company's existing operations, Arrow will be required to report on the project's air emissions including the results of air quality monitoring in accordance with any environmental authority (EA)</p>

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R6012	S015			conditions. EA conditions relating to ongoing monitoring of air emissions are set so that air quality objectives in the EPP (Air) are met on an ongoing basis.
R6013	S133	If the air quality is in excess of any human health and well-being criteria, the proponent must provide reasonable and practicable mitigation measures.	EIS Chapter 9, sections 9.4.3 and 9.6 and figures 9.6 and 9.7	Modelling of the air emissions from production facilities was conducted for the EIS and indicates that central gas processing facilities (with and without water treatment facilities) should be located a minimum of 225 m and 175 m respectively from sensitive receptors (e.g., residences) to meet guideline nitrogen dioxide (NO ₂) concentrations. In practice, larger separation distances are required to meet noise criteria than to meet air quality criteria. Therefore separation distances will mean that Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives for the project protection of human health and wellbeing are met at nearby residences. Volatile organic compounds (VOCs) are not emitted from the project in significant quantities. Therefore separation distances greater than those required to comply with NO ₂ criteria are not required to remain below VOC regulatory guidelines. Similarly, there are no significant impacts from sulfur dioxide (SO ₂), carbon monoxide (CO), particulate matter, odour, or dust deposition.
R6014	S133	The proponent has not identified water storage dams and/or brine water storage dams as potential sources of various air emissions such as VOCs (volatile organic compounds) and odour. The proponent needs to assess and take into account emissions from water storage dams and/or brine water storage dams when assessing both regional and localised air emissions. Appropriate methodologies must be utilised to generate emission factors from those dams and mitigation measures identified if pollutant levels are shown to exceed human health and well-being criteria.	EIS Chapter 5, Section 5.5.1 and Chapter 9, Section 9.4.3 and Appendix C, sections 5.2, 6.1.2 and Table 6.1	Limited air emissions are expected from water storage dams. Coal seam gas contains only trace quantities of sulfides (the main potential source of odour) and entrained coal seam gas is removed from the water prior to treatment and storage. Quantities in dams are expected to be minimal and no exceedence of guideline levels is anticipated. Volatile organic compounds (VOCs) will not be added to the groundwater during the well construction process. Arrow's preference is to use an inert, water-based drilling fluid largely comprised of fresh water and 2 to 3% of salts. A small amount of bentonite (a clay-based product) may be added to coat the borehole (EIS Chapter 5, Project Description, Section 5.5.1). The only VOCs present in the groundwater will be naturally occurring. Odour does not currently present an issue at Arrow's existing, operating water treatment facilities or dams.
R6015	S027	Excessive odour levels may arise at nearby residences due to traffic accessing infrastructure regularly.	EIS Chapter 9, Section 9.3.3	While odorous compounds are contained in vehicle emissions, impacts are generally confined to the immediate vicinity (within metres) of vehicles or roadways. Odour can be emitted from unburnt fuel (mostly during cold starts), engines that produce smoke from burning traces of lubricant oil, poor combustion (poor tuning), reactions between sulfur in fuel and emissions control catalysts, and evaporation of spilt fuel. Vertical exhausts typical for heavy vehicles help direct emissions away from the ground and assist in rapid dispersion. Emissions will also be reduced by proper tuning and maintenance of vehicles. It is uncommon for road traffic to be the source of complaint about odour and

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R6015	S027			traffic odour is not expected to represent anything other than a low risk of any noticeable impacts capable of causing annoyance, particularly if the separation from roads is tens of metres or more.
R6016	S024, S026, S036, S038, S069, S081, S083, S143	How will odours be managed so that they do not cause a nuisance or harm to sensitive receptors?	EIS Chapter 9, Section 9.6	Hydrogen sulfide (H ₂ S) is a key source of odour; however, as stated in EIS Chapter 9, Air Quality, Table 9.1, no significant impacts are expected from the project as hydrogen sulfide is present only in trace quantities in the gas stream. Flaring destroys hydrogen sulfide and unplanned releases are expected to be infrequent and it is not anticipated that odour will cause nuisance from these activities. Separation distances between project infrastructure and sensitive receptors (to meet noise and air quality criteria) will also reduce the potential for odours to constitute a nuisance or cause harm. Arrow has committed to manage odours so that they do not cause a nuisance or harm to sensitive receptors (Commitment C017).
R6017	S143	No information or impact assessment has been provided on long term exposure to odours such as hydrogen sulfide. It is believed that hydrogen sulfide will cause nuisance and potentially health impacts.	EIS Chapter 9, Table 9.1 and Appendix C, Section 4.3.7	EIS Appendix C, Section 4.3.7 notes that long-term exposure to odour may cause some physical symptoms that are related to stress, and the affected person may become particularly sensitive to the odour. Hydrogen sulfide is a key source of odour; however, as stated in EIS Chapter 9, Air Quality, Table 9.1, no significant impacts are expected from the project as hydrogen sulfide is present only in trace quantities in the gas stream. Flaring destroys hydrogen sulfide and unplanned releases are expected to be infrequent and it is not anticipated that odour will cause nuisance from these activities. Separation distances between project infrastructure and sensitive receptors (to meet noise and air quality criteria) will also reduce the potential for odours to constitute a nuisance or cause harm.
R6018	S024, S026, S036, S081, S083	Temperature inversions, which would be considered poor environmental conditions, have been inadequately accounted for. Where is the data to support the statement that temperature inversions occur relatively frequently over the northern portion of the study area? Please provide this data.	EIS Chapter 9, Section 9.3.1	The effects of inversions on air quality were fully accounted for in the air quality modelling carried out for the EIS (EIS Chapter 9, Air Quality, Section 9.3.1). The temperature inversion strength and height was estimated via meteorological modelling with The Air Pollution Model (TAPM) and the effect of inversions on air quality was modelled with TAPM-CTM (i.e., TAPM with the Chemical Transport Model) and Ausplume. Based on the modelling output, inversions are assumed to occur relatively frequently over the northern portion of the project development area. Modelling provides the best means of investigating how temperature inversions affect pollution dispersion and this approach is considered to be best practice.
R6019	S011	Disputes location descriptions and distances given in the air quality impact assessment, e.g., Oakey has been used in the report as a point located central to the project and is not actually in the	EIS Appendix C, Section 4.4.2.1	Guidelines direct that the three dimensional meteorological and air dispersion model, The Air Pollution Model (TAPM), may be used to generate meteorology for areas where there are no observations (DEC, 2005). Given the sparsity of meteorological monitoring stations across the region, TAPM

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R6019	S011	project area. One point outside the project area is not sufficient to represent conditions in the entire project area air shed.		was used to generate surface meteorological data for areas where little or no data existed. For further detail on the model, see EIS Appendix C, Air Quality Impact Assessment, Section 4.4.2.1. Typically a minimum of one year of meteorological data is acceptable as a model input. The data must also adequately represent worst-case meteorological conditions for the region, and should be considered representative of a typical year with respect to climatic averages. The year 2008 at Oakey was selected as representative of long term averages and representing worst-case meteorological conditions, after comparison with meteorological data for Oakey, Dalby, Miles, Goondiwindi, Pittsworth, and Taroom for the years 2006 to 2010. TAPM-generated meteorological data was then used to provide a range of likely conditions across the northern, central and southern regions of the project development area.
R6020	S150	It is recommended that Arrow be required to assess venting and flaring coal seam gas against an air quality objective determined by the appropriate governing body.	EIS Appendix C, Section 7.2 SREIS Appendix 3, Section 3.5.4	The flaring assessment presented in EIS Appendix C, Air Quality Impact Assessment, Section 7.2 considered the maximum ramp-up flaring (72 TJ/day) emissions as well as upset condition flaring rates (10, 30 and 150 TJ/day). Flaring was assumed to be continuous during the modelling period. This was considered conservative as ramp-up is typically three months prior to the commissioning of facilities and upset condition flaring is intermittent during the operational phase. The application of the separation distances will ensure that Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives for all pollutants will be met at sensitive receptors. Coal seam gas consists of methane, CO ₂ and N ₂ . More information on venting is provided in SREIS, Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.5.4.
R6021	S079, S104	What pollution control measures are required and/or used during flaring events? There is concern over flaring which releases pollution into the air which can cause many health problems.	EIS Chapter 9, Section 9.6 and Appendix C, Section 7.2	Flaring produces a number of air pollutants including carbon monoxide (CO), oxides of nitrogen (NO _x), volatile organic compounds (VOCs) and particulate matter with an aerodynamic diameter of 10 microns or less (PM ₁₀). Flaring has been included in the localised (near-field) assessment with results presented in EIS Appendix C, Air Quality Impact Assessment, Section 7.2. The application of the separation distances will ensure that Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives for all pollutants will be met at sensitive receptors. Arrow has committed to prevent venting and flaring of gas as far as practicable and where safe to do so (Commitment C016).
R6022	S048	There is concern over the impacts from dust pollution due to the increased traffic on private roads on properties and mining roads.	EIS Chapter 9, Section 9.6	Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012).
R6023	S143	More information is requested on long term impacts from dust on human health (particularly those with	EIS Chapter 9, Section 9.6 and	Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects

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R6023	S143	existing respiratory conditions).	Appendix C, Section 4.3.6	(Commitment C012). Typical activities that can cause dust emission occur largely during the construction phase of a project, e.g., earthmoving and vehicle activities on unpaved roads and preparation of sites. Sites will however be progressively rehabilitated as soon as practicable following construction and decommissioning activities (Commitment C015). Long term health impacts are therefore unlikely, as activities with potential to generate dust (as particulate emissions) will be localised, short term and small in magnitude. EIS Appendix C, Air Quality Impact Assessment, Section 4.3.6 provides information on the health impacts of particulate matter.
R6024	S157	Are service roads going to be sealed or watered to prevent dust generation and potential impacts on poultry and other livestock?	EIS Chapter 9, Section 9.6	Not all service roads will be sealed or watered. An assessment will be made on a case-by-case basis. Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012).
R6025	S150	The air quality assessment is unconvincing without the provision of site specific data demonstrating "natural airshed processes" likely to disperse nitrogen dioxide (NO _x) emissions from wells and production facilities.	EIS Appendix C, sections 4.4.2.1 and 4.4.3.1	The methods used in the air quality impact assessment to predict air quality impacts are consistent with best practice. They take advantage of current meteorological models that are able to accurately simulate local and regional meteorological conditions. One of the models used routinely for the purpose of generating meteorological data for air quality assessments is The Air Pollution Model (TAPM). This model was developed in the 1990s by CSIRO specifically so that air quality assessments could be done without the need for on-site measurements. TAPM and other meteorological are now widely used for this purpose and provide reliable input information for air quality modelling. Such models have been extensively validated to support their use as standard tools in air quality assessment.
R6026	S150	The exceedences identified in Chapter 9, Table 9.8 of the EIS are substantially above statutory guidelines and standards. The EIS needs to identify what impact these exceedences will have on local, regional and national air quality. The primary action needed to be taken by Arrow is to ensure its production facilities do not produce the air quality exceedences in the first place.	EIS Chapter 9, sections 9.3.5, 9.5 and 9.6	It is important to distinguish between emissions standards and air quality objectives. Air quality is the end result of emissions dispersing in the atmosphere, and represents the air we breathe. Emission standards refer to the levels of pollutants at the point of release into the air, e.g., inside the emission stack of a power plant or the exhaust pipe of a car. In Queensland there are no specific oxides of nitrogen (NO _x) emission standards, (i.e., standards for the amount or concentration of NO _x that can be emitted from a source), so the EHP tends to refer to standards and guidelines from other jurisdictions, such as NSW and the USA. These emission standards are generally based on the stringent requirements that have been developed specifically for constrained airsheds, such as Sydney, where large-scale, region-wide NO _x emissions contribute to photochemical smog and need to be carefully controlled. Even so, in these situations the emission guidelines are negotiable, depending on the results of impact assessments for specific cases (in line with clause 36 of the Protection of the Environment (Clean Air) Regulation 2010). Although Arrow's proposed wellhead engines do not meet the engine

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R6026	S150			<p>emission standards referred to, those standards are not specifically relevant and, importantly, NOx concentrations have been shown to meet Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives and the National Environment Protection (Ambient Air Quality) Measures (NEPM). The engines are to be located in remote rural locations where there are very few other emission sources. The situations that lead to smog and other air quality problems, i.e., large numbers of significant NOx emission sources (e.g., urban traffic) and high total emissions of NOx, across a region, do not exist here.</p> <p>For cases such as this, the regulatory authority can review and apply alternative emissions standards, if determined to be appropriate, based on an assessment of the impacts of the emissions. Such a review would include dispersion modelling, such as that conducted in EIS Appendix C, Air Quality Impact Assessment, to determine if the engine emissions cause an adverse impact on the ambient air quality, which is the most important factor. The EPP (Air) objectives are referred to in making this assessment.</p> <p>The wellhead engines are small emission sources in the context of the conditions required for smog formation. They are remotely located, i.e., not near residential areas. As they are small and remotely located, there is negligible risk that these emissions will cause either near-field impacts or contribute to regional photochemical smog. Prediction of near-field impacts shows that ambient guidelines are expected to be met because the dispersion of emissions between these sources and sensitive locations is adequate. The engine emissions are also considered in the regional assessment so that their cumulative impacts are assessed with all other relevant NOx sources.</p> <p>The result is that both the potential local and regional impacts of the wellhead engines are considered in the air quality impact assessment.</p> <p>There is no need for an assessment of national air quality: the assessment conforms to the standard requirements of an air quality assessment, and addresses the issues as identified, i.e., potential local and regional effects. Assessment at the local and regional scales is based on the ways that pollution behaves physically and chemically. There is no relevance to the national scale.</p>
R6027	S038	There is concern that the local environment will be severely impacted by release of gas into the atmosphere causing air pollution.	EIS Chapter 9, sections 9.4.3 and 9.6 and figures 9.6 and 9.7 and Appendix C, Table 7.1	<p>Releases of coal seam gas (which predominately consists of methane) from project infrastructure, i.e., fugitive emissions including releases from safety valves, will be small relative to the amounts needed to cause even localised air quality impacts.</p> <p>The combustion of gas due to project infrastructure has been modelled in the EIS. The results of the modelling show that the Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) guidelines are met at a distance of 225 m for central gas processing facilities (CGPFs) with water treatment facilities and 175 m for CGPFs without water treatment facilities.</p> <p>EPP (Air) has objectives for ecosystems (for the protection of the health and</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R6027	S038			biodiversity of ecosystems). EIS Appendix C, Air Quality Impact Assessment, Table 7.1 presents the annual nitrogen dioxide (NO ₂) concentrations for regional scenarios 1 and 2 as both being 9 ug/m ³ , which is less than the EPP (Air) - Ecosystems guideline of 33 ug/m ³ .
R6028	S075, S077, S089	The level of nitrogen oxides (NO _x) predicted is alarming.	EIS Chapter 9, sections 9.4.3, 9.4.4 and 9.6 and figures 9.6 and 9.7	The application of the separation distances will allow the Environmental Protection Policy (Air) 2008 (Qld) (EPP (Air)) objectives to be met at sensitive receptors. Modelling indicates that for nitrogen dioxide (NO ₂) emissions from the central gas processing facilities (CGPF) to meet guideline concentrations; separation distances should be 225 m for CGPFs with water treatment facilities and 175 m for CGPFs without water treatment facilities.
R6029	S133	Fugitive emission releases have not been considered at the well head (Appendix C, Section 6.3.3). The proponent must provide details as to any expected fugitive emissions which may occur at the wells' gas heads. Appropriate methodologies must be utilised to generate emission factors from the well heads and mitigation measures identified if pollutant levels are shown to exceed human health and well-being criteria.	EIS Appendix C, Appendix A, Section A.1.2	Fugitive emissions of coal seam gas were estimated for production well surface facilities (and other gas production infrastructure), water gathering lines and processing plants. The emission estimation is presented in EIS Appendix C, Air Quality Impact Assessment, Appendix A, Section A.1.2.
R6030	S150	Proposing a minimum separation distance between facilities and sensitive receptors is not considered a satisfactory mitigation measure. The exceedences should not occur in the first instance, especially if production facilities will be operating for 30 years, 24 hours a day, 7 days a week.	EIS Chapter 9, Section 9.7 SREIS Chapter 5, Section 5.5	Separation distances are designed to be a conservative, first-pass method of establishing whether a proposed development is likely to have an adverse impact on air quality in the near field. As such the separation distances presented in the air quality assessment are based on conservative modelling. The output of a model presents the maximum (peak) concentrations that may occur. These high concentrations have occurred under a worst-case scenario with meteorological conditions conducive to less dispersion and also the emissions calculated are based on a theoretical worst-case scenario. When site-specific modelling (local meteorology and topography) is undertaken with an understanding of the final equipment, layout and location, in most cases this will see a reduction in dispersed emissions concentrations.
R6031	S143	The term 'separation distances' needs to be further defined. It is not clear what an 'appropriate' distance is (between a well and residence).	EIS Chapter 9, sections 9.4.3 and 9.6 and figures 9.6 and 9.7	The term 'separation distance' refers to the distance required between specific project infrastructure and a sensitive receptor (e.g., an occupied dwelling) so that the sensitive receptor is not impacted by the infrastructure. In relation to air quality, this means that the air pollutant concentrations do not exceed applicable statutory guidelines or criteria at the receptor. In the case of central gas processing facilities (with and without water

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Issue No.	Submission No.	Issue	Reference	Responses
R6031	S143			treatment facilities) the air quality impact assessment undertaken for the EIS indicates that separation distances of 225 m and 175 m (respectively) are required.
R6032	S026, S036, S081, S083	Provide a map outlining the boundaries of the northern, central and southern portions of the project development area in regard to the air quality impact assessment.	EIS Appendix C, Section 4.4.3.1 and Table 4.3	EIS Appendix C, Section 4.4.3.1 explains that three locations within the project development area were selected to represent the northern, central and southern regions. Table 4.3 presents the locations of the meteorological model extracts. The southern extract point is located approximately 30 km southwest of Millmerran, the central extract point is located 15 km northwest of Cecil Plains and the northern extract point is located 12 km north northeast of Miles.
R6033	S134	Provide details on how Arrow proposes to manage complaints relating to air quality and dust impacts.	–	Arrow maintains a complaints management system which will be implemented for the Surat Gas Project. The details of the process are described on Arrow's website and summarised below: 1. Arrow receives a complaint. 2. Arrow provides the submitter with written confirmation of receipt of complaint within two business days. 3. Arrow may contact interested parties for clarification or further information. 4. Arrow will contact the interested parties once the complaint has been addressed, resolved or an outcome has been reached. 5. If the interested party is dissatisfied with the outcome then Arrow will advise them of independent review bodies that are available.
R6034	S143, S151	There is concern over large volumes of traffic required to transport brine to Swanbank. Flow on impacts from traffic increase should be addressed with respect to air quality. How will dust caused by the transport of brine via trucks from coal seam gas wells to landfill affect the local community and the environment, including the local fauna.	EIS Chapter 9, Section 9.6 and Chapter 19, Section 19.4	The worst case scenario whereby brine is transported to a registered landfill has been considered in the EIS, with the heavy vehicle traffic generated by the project, including the trucking of brine, deemed to represent less than 2% of the existing (2009) levels (EIS, Chapter 19, Roads and Transport, Section 19.4). Presently, trucking to landfill is not Arrow's preferred measure of brine disposal and significant impacts on air quality are not expected from this source. Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012).
R6035	S099	There are concerns in regards to heavy vehicle traffic on roads causing dust (specifically Karingal-Apunyal Road and Pirrinuan-Apunyal Road near Macalister).	EIS Chapter 9, Section 9.6 and Appendix M, Section 9.1	Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012). At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Localised impacts, such as those on Karingal-Apunyal Road if applicable, will be addressed in road use management plans prepared and regularly

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Issue No.	Submission No.	Issue	Reference	Responses
R6035	S099			reviewed in consultation with the relevant council or the Department of Transport and Main Roads (Commitment C284).

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Issue No.	Submission No.	Issue	Reference	Responses
R7001	S074	The EIS should provide a process flow diagram upon which the sources of Scope 1 and Scope 2 greenhouse gas emissions are clearly identified.	EIS Appendix D, Section 3 and Table 4	Scope 1 and Scope 2 emissions are defined and explained in Section 3 of EIS Appendix D, Greenhouse Gas Impact Assessment. A comprehensive list of all the Scope 1 greenhouse gas emissions specific to the project is presented in Table 4 of EIS Appendix D. A list of Scope 2 emissions for the project is presented in Section 3.1.2.2 of EIS Appendix D.
R7002	S074	The EIS definition for fugitive emissions is not consistent with the definition given in the National Greenhouse Accounts Factors, National Greenhouse and Energy Reporting System, or EIS Appendix D, Greenhouse Gas Impact Assessment, page 17.	EIS Chapter 30 and Appendix D, Section 3.1.2.1 SREIS Chapter 24	Noted. The National Greenhouse and Energy Reporting Scheme definition of fugitive emissions was used in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 3.1.2.1. A different definition was used in EIS Chapter 30, Glossary. The definition of fugitive emissions in SREIS Chapter 24, Glossary and Abbreviations has been updated.
R7003	S024, S026, S036, S074, S081, S083, S150	The report in Appendix D does not apply the fugitive emission definition consistently when identifying activities and sources of fugitive emissions, for example in Table 4 and the mass balance in Appendix A.2 of the Greenhouse Gas Emissions Assessment flaring is separate to fugitive emissions. Fugitive emissions must consider a wide variety of sources: <ul style="list-style-type: none"> • Point Sources • Equipment Leaks • Open Vats and Mixing • Storage Tanks • Wastewater Treatment • Emissions from Cooling Towers • Maintenance Operations • Vehicle Movement and Exhaust • Liquid Spills • Storage Piles • Bulk Materials Handling and Unit Operations • Loading and Unloading of Vehicles. 	EIS Appendix D, Section 3 and Appendix A SREIS Appendix 3, Section 3.5	The National Greenhouse and Energy Reporting (NGER) definition of fugitive emissions is 'the release of emissions that occur during the extraction, processing and delivery of fossil fuels'. These emissions include: <ul style="list-style-type: none"> • Deliberate venting and flaring from exploration activities. • Leaks from equipment, and planned and unplanned venting and flaring from gas production and processing activities. In accordance with the NGER definition, the following sources of fugitive emissions were considered in the EIS: <ul style="list-style-type: none"> • Ramp-up flaring (construction). • Gas transmission emissions (operation). • Leaks from equipment (operation). • Deliberate venting from well workovers (operation). • Pilot lights and flaring during planned and unplanned events (operation). Additional venting emissions sources were included in the SREIS based on Arrow's NGER inventory. No reportable greenhouse gas emissions from wastewater handling are expected due to one of the following reasons: <ul style="list-style-type: none"> • The wastewater treatment process is anticipated to be similar to the process currently used at Arrow's facilities; i.e. aerobic process with sludge transferred offsite. • Sewage water will be transferred to a town's sewage treatment plant in the vicinity of the project. Fugitive emissions from storage piles, bulk material handling, and loading and unloading of vehicles do not lead to any greenhouse gas emissions additional to those already considered in the assessment. Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.
R7004	S074	The EIS does not identify or account for migratory emissions under the sources of fugitive emissions from coal seam gas production as identified in a	EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3	As required by Section 4.6.3.1 of the Terms of Reference, both the DIICCSRTE (formerly DCCEE) National Greenhouse Accounts Factors (NGAF) and current methodologies in the National Greenhouse and Energy

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Issue No.	Submission No.	Issue	Reference	Responses
R7004	S074	publication "Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources", published in the journal "Energies".	SREIS Appendix 3, Section 3.2 and Appendix A	Reporting (Measurement) Determination 2008 were used to conduct the greenhouse gas impact assessment and the updated 2012 NGER Determination was used for the supplementary greenhouse gas assessment (EIS Appendix D, Greenhouse Gas Impact Assessment, Section 3 and SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.2). The National Greenhouse and Energy Reporting methods often refer to methods published by the American Petroleum Institute (API). The API's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry was also consulted. However, no default emission factor or alternative methods were provided to account for gas migration emissions. Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.
R7005	S089	Escaping methane is already a very serious, little-understood issue in the Condamine River with coal seam gas mining a likely cause.	-	The cause of the presence of gas in the Condamine River has not been determined at the time of submission of the SREIS. Investigations carried out at the time of writing suggested that based on the information obtained by the LNG (liquefied natural gas) enforcement unit (DNRM, 2012b), the cause of bubbles in the Condamine River was unlikely to be due to coal seam gas activities. Origin Energy has advised DNRM that the gas present may be naturally-occurring coal seam methane rising through the underlying geology in the area. Further investigations into the cause of gas in the Condamine River are continuing. Part 1 of the summary technical report of the Condamine River gas seep investigation (DNRM, 2012b) also concluded no apparent safety risk in the immediate are of the seeps, and no apparent evidence of environmental harm that can be attributed to the present gas seeps.
R7006	S074	The EIS does not identify or account for well completions under the sources of fugitive emissions from coal seam gas production as identified in a publication "Life Cycle Greenhouse Gas Emissions form Electricity Generation: A Comparative Analysis of Australian Energy Sources, published in the journal "Energies".	EIS Appendix D, Table 7 SREIS Appendix 3, Table 4.3	EIS Appendix D, Greenhouse Gas Impact Assessment, Table 7 and SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.3 include well completions in the emissions estimation of gas ramp-up flaring.
R7007	S143	Fugitive emissions from hydraulic fracturing should be included in greenhouse gas emission estimates.	EIS Chapter 14, Section 14.6.3	Arrow will enforce a no hydraulic fracturing (fraccing) policy in the project development area (Commitment C079).

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Issue No.	Submission No.	Issue	Reference	Responses
R7008	S075, S077, S089, S108, S117, S138, S142, S163	<p>The issue of fugitive emissions is not dealt with appropriately. The EIS used facility-level average fugitive emission factor from the American Petroleum Institute (2009) 'Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industries' (API Compendium). The API Compendium in turn relies heavily upon estimates of fugitive methane emissions from 1996 study by the Gas Research Institute and United States of America Environmental Protection Agency (GRI/USEPA study). The calculations are based on United States model figures for shale gas, and there is no empirical data to support them. The United States of America is conducting intensive research on life cycle analysis of natural gas production and use. A recent USEPA study revised many of the emission factors from the USEPA/GRI upwards significantly. American experience has shown that escaping methane emissions are likely to be underestimated. Consequently the estimates of emissions should be revised to rely on update emission factors from the USEPA study where applicable.</p>	<p>EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3 and Appendix A SREIS Appendix 3, Section 3.2 and Appendix A</p>	<p>As required by Section 4.6.3.1 of the Terms of Reference, current methodologies in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Determination) were used to conduct the greenhouse gas impact assessment (EIS Appendix D, Greenhouse Gas Impact Assessment). The updated 2012 NGER Determination was used in the preparation of the supplementary greenhouse gas assessment. The National Greenhouse and Energy Reporting methods often refer to methods published by the American Petroleum Institute (API). The API's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry was used to estimate fugitive emissions as they provide more conservative estimates than the NGER Determination. Additional venting emission sources were included in the SREIS emissions calculations, see Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.5.</p>
R7009	S138	<p>Several recent studies of shale gas fields in the United States of America have found significantly higher fugitive emissions than those estimates provided in a 2010 USEPA study. The recent Australian Government senate enquiry found that uncertainty in fugitive emissions was significant for Australian coal seam gas projects. Consequently, the estimates of emissions in the Greenhouse Gas Emissions chapter of the EIS should also state the uncertainty in emissions estimates, including results from United States shale gas fields in the uncertainty range.</p>	<p>EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3 and Appendix A SREIS Appendix 3, Section 3.2 and Appendix A</p>	<p>The report entitled Fugitive Greenhouse Gas Emissions from Coal Seam Gas Production in Australia (Day et al., 2012) noted that 'recent emissions estimates for unconventional gas production in the United States of America may not be a reliable indicator for emissions from the Australian coal seam gas industry because of major differences in production and processing methods that could affect emissions. For example, in the United States of America, hydraulic fracturing is used extensively in shale gas and tight gas production, whereas in Australia, far fewer coal seam gas wells currently require this treatment.' In the case of the Surat Gas Project, Arrow will enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079). As required by Section 4.6.3.1 of the Terms of Reference, the best available methods from the DIICSRTE (formerly DCCEE) National Greenhouse Accounts Factors and current methodologies in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Determination) were used to conduct the greenhouse gas impact assessment (EIS Appendix D, Greenhouse Gas Impact Assessment). The updated 2012 NGER Determination was used in the preparation of the supplementary greenhouse gas assessment. The American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R7009	S138			<p>Industry was also consulted to estimate fugitive emissions where no methodologies were provided in the NGER Determination. Emissions were estimated based on conservative levels of future activity to provide conservative emissions estimates. It is not possible to calculate the uncertainty of the emissions estimates, as these forecasts are based on many variables, including the exact timing and scope of project activities in any given year.</p> <p>Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.</p>
R7010	S007, S046, S088, S108, S110, S146	<p>Why are fugitive emissions (gas migration) not accounted for in Greenhouse Gas Report? While emissions from infrastructure are considered, emissions from the Earth's surface are not included. There have been recent reports of methane bubbling up into the Condamine River, and therefore these issues should be considered in the EIS. Fugitive emissions directly from the earth's surface have not been considered in the Air Quality Chapter. What is the environmental impact of fugitive methane emissions which could happen from this source (gas migration)? The EIS does not consider fugitive emissions of coal seam gas through the ground and into the atmosphere. Gas has been seen to bubble up into the Condamine River near Origin Energy coal seam gas activities. More needs to be known about the depressurisation of the Walloon Coal Measures and soil moisture conditions. There are instruments made by Picarro that can measure fugitive emissions and log your position via GPS. More work should be done to establish baseline conditions prior to the commencement of Arrow's activities over the Condamine Alluvium.</p>	<p>EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3 and Appendix A</p> <p>SREIS Appendix 3, Section 3.2 and Appendix A</p>	<p>As required by Section 4.6.3.1 of the Terms of Reference, both the DIICCSRTE (formerly DCCEE) National Greenhouse Accounts Factors and current methodologies in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 were used to estimate emissions for the greenhouse gas impact assessment (EIS Appendix D, Greenhouse Gas Impact Assessment). The updated 2012 NGER Determination was used in the preparation of the supplementary greenhouse gas assessment. The American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry was also consulted. However, no default emission factor or alternative methods were provided to account for gas migration emissions.</p> <p>Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.</p>
R7011	S074	<p>The EIS references the American Petroleum Institute Compendium and uses an emission factor of 0.04707 tonnes methane/well workover. The United States of America Environmental Protection Agency issued an update to the well workover emission factor in 2010, upgrading the factor from 0.05 tonnes methane/year-workover to 177 tonnes methane/year-workover (Subpart-W TSD EPA</p>	<p>EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3 and Appendix A</p> <p>SREIS Appendix 3, Section 3.2 and Appendix A</p>	<p>As required by Section 4.6.3.1 of the Terms of Reference, both the DIICCSRTE (formerly DCCEE) National Greenhouse Accounts Factors and current methodologies in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 were used to conduct the greenhouse gas impact assessment (EIS Appendix D, Greenhouse Gas Impact Assessment) and the 2012 update was used in the preparation of the supplementary greenhouse gas assessment (SREIS Appendix 3, Supplementary Greenhouse Gas Assessment). The National Greenhouse</p>

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7011	S074	2010). Please explain why the most up to date and significantly larger value of the well workover emission factor was not used. Ensure that the units of the well workover emission factor are correctly interpreted and applied for the SREIS. The technical report uses tonnes methane per well workover while the USEPA update uses methane per year-workover.		and Energy Reporting methods often refer to methods published by the American Petroleum Institute (API). The API's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry was also consulted. Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.
R7012	S074	The EIS should include a comprehensive list of all scope 1 greenhouse gas emissions, fugitive emissions or otherwise identified in the American Petroleum Institute Compendium and the most recent scientific literature.	EIS Appendix D, Section 3 and Table 4 SREIS Appendix 3, Section 3.5	A list of Scope 1 greenhouse gas emissions is provided in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 3.1.2.1, Table 4. Fugitive emissions have been included in the Scope 1 emissions. Additional venting emission sources were included in the SREIS emissions calculations, see Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.5.
R7013	S074	Please clarify if Arrow has been collecting field data on greenhouse gas emissions from its coal seam gas wells and production facilities and if so clarify if this data has been used in estimating greenhouse gas emissions presented in Appendix D rather than data that is dated and specific to the United States of America natural gas industry.	EIS Attachment 1, Section 4.6.3 and Appendix D, Section 3 SREIS Appendix 3, Section 3.2	Section 4.6.3.1 of the Surat Gas Project EIS Terms of Reference (TOR) specifies that the DIICCS RTE (formerly DCCEE) National Greenhouse Accounts Factors (NGAF) are to be used as the reference source for emission estimation. The NGAF July 2010 workbook specifies that the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry should be consulted in accordance with methodologies to estimate vented emissions. Greenhouse gas emissions in the EIS (EIS Appendix D, Greenhouse Gas Impact Assessment, Section 3) and SREIS (SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.2) have been calculated in accordance with the Terms of Reference (TOR).
R7014	S074	Compressor blowdowns are listed (Table 4, Section 3.1.2.1 of Appendix D) against gas gathering infrastructure and should be listed against facility operation and maintenance.	EIS Appendix D, Section 3 and Table 4 SREIS Appendix 3, tables 4.3 and 4.7	Noted. The emission factor used to estimate fugitive emissions associated with gas gathering and transmission infrastructure accounts for emissions from compressor blowdowns at production facilities. For the SREIS, the compressor blowdown emissions are included under venting calculated based on Arrow's National Greenhouse and Energy Reporting inventory. These emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.3. Scope 1, 2 and 3 emissions are presented in Table 4.7 of the SREIS Appendix 3.
R7015	S074	The EIS uses an emission factor for compressor blowdown greenhouse gas emissions that is based on pipeline length and is incorporated into the pipeline emission factor which is incorrect. Compressor blowdown greenhouse gas emissions are considered vented emissions and are addressed in Part 5 – Process and Vented Emission Estimation Methods in the American	EIS Attachment 1, Section 4.6.3 and Chapter 10, Section 10.2 and Appendix D, Appendix A SREIS Appendix 3, tables 4.3 and 4.7	The emission factor for gas transmission used was sourced from the National Greenhouse and Energy Reporting (Measurement) Determination 2008, in line with Section 4.6.3.1 of the Terms of Reference. The updated 2012 NGER Determination was used in the preparation of the supplementary greenhouse gas assessment. As set out in Appendix A to EIS Appendix D, Greenhouse Gas Impact Assessment, it accounts for fugitive emissions from: • Compressor blowdowns for production facilities. • Maintenance on pipelines.

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7015	S074	Petroleum Institute Compendium.		<ul style="list-style-type: none"> • Leakage. • Accidents. <p>Additional emission factors are available in Section 5.7 of the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry for estimating venting emissions from compressor starts and blowdowns from the production segment. However, they were not used for the EIS as the required information was not available at the time.</p> <p>For the SREIS, the compressor blowdown emissions are included under venting calculated based on Arrow's National Greenhouse and Energy Reporting inventory. These emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.3. Scope 1, 2 and 3 emissions are presented in Table 4.7 of the SREIS Appendix 3.</p>
R7016	S158	Arrow claims that the most significant source of greenhouse gas emissions associated with the Arrow Surat Gas Project is the use of gas by end-users for energy production (Scope 3 for this project) as electricity sourced from gas has a significant advantage over other fossil fuels with respect to greenhouse gas emissions. However, this estimation is only factual if the process is pure and has not been tainted by methane leakage from the seam or nearby landscape features under pressure (as implied in the case of the Condamine River), natural disaster events causing accidental gas and water toxin release, loss of sequestered carbon from terrestrial and marine habitat destruction for support infrastructure - including pipelines and ports - ongoing and escalated shipping of gas for export, including potential shipping accidents requiring extensive clean-up.	<p>EIS Attachment 1, Section 4.6.3 and Chapter 10, Section 10.2 and Appendix D, Appendix A</p> <p>SREIS Appendix 3, Table 4.7</p>	<p>As required by Section 4.6.3.1 of the Terms of Reference, both the DIICSRTE National Greenhouse Accounts Factors and current methodologies in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 were used to conduct the greenhouse gas impact assessment (EIS Appendix D, Greenhouse Gas Impact Assessment). The updated 2012 NGER Determination was used in the preparation of the supplementary greenhouse gas assessment. The American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry was also consulted, however no default emission factor or alternative methods were provided to account for gas migration emissions.</p> <p>Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production.</p> <p>Arrow supports efforts to further understand sources of emissions related to coal seam gas exploration and production.</p> <p>Scope 3 emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7.</p>
R7017	S108, S117, S138, S142, S163	For the EIS to properly inform the assessment of the future Project Environmental Application it should consider all three scopes of emissions. Some of the Scope 3 emission may be from the burning of the product LNG overseas but as stated in the EIS: "The location of emission sources is not a critical aspect of greenhouse gas emission estimation." This may lead to the emissions being double counted. If that receiving country is a party	<p>EIS Attachment 1, Section 4.6.3 and Chapter 10, Section 10.4.1</p> <p>SREIS Appendix 3, Table 4.7</p>	<p>As required by Section 4.6.3.1 of the Terms of Reference, Scope 3 emissions were estimated as part of the EIS. Scope 3 emissions are typically estimated to provide a broad indication of the total scale of emissions associated with a particular project, product or service. Scope 3 emissions are, by nature, considered as Scope 1 emissions in other contexts or countries and therefore inherently subject to double counting in other jurisdictions. The statement regarding location of emissions presented in the EIS attempted to convey that given the nature of the issue under consideration (i.e., global change in climate), the location that the emission occurs is not as important as the scale</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R7017	S108, S117, S138, S142, S163	to the Kyoto protocol however this is of little consequence while there is no internationally binding agreement on emissions and, in any case, does not allow the administering authority to disregard its obligation to assess all the indirect emissions proposed to be authorised.		of the emission itself. Scope 3 emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7.
R7018	S046, S143	More information should be provided on Scope 3 emissions. This should include flow on impacts from the Liquefied Natural Gas process and gas/ fuel used to operate the Liquefied Natural Gas tanker and emissions of end-users for the energy production.	EIS Chapter 10, Section 10.4.2, Table 10.3 and Table 10.4 and Appendix D, Section 3.1.2.3 SREIS Appendix 3, Table 4.7	As set out in EIS Appendix D. Greenhouse Gas Impact Assessment, Section 3.1.2.3, emissions associated with LNG (liquefied natural gas) product shipping, waste products management and construction material embedded energy was not included in the Scope 3 emissions estimate. These emission sources were excluded due to uncertainty with regard to origin (i.e., construction materials) and destination (LNG tankers, waste disposal). Scope 3 emissions include: <ul style="list-style-type: none"> • Fuel cycles of diesel (indirect emissions due to extraction, production and transport of fuel consumed). • Electricity consumption from the grid (fuel transport, distribution losses). • Gas end use (domestic or export). • Third-party infrastructure (Arrow Surat Pipeline) to export the gas as LNG. Scope 3 emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7.
R7019	S150	Arrow must address carbon emissions and carbon offsets based on coal seam gas mining life-cycle emissions (including direct, fugitive and downstream) when considering energy production and environmental sustainability.	EIS Appendix D, Section 4 SREIS Appendix 3, Table 6.1	As described in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 4, the following sources of Scope 3 emissions were considered in the life cycle assessment: <ul style="list-style-type: none"> • Full fuel cycles (diesel and electricity consumption from the grid). • End-use of product gas assuming combustion of all gas produced as a conservative approach. • Transmission-related emissions to Arrow LNG Plant. • Downstream emissions associated with processing of gas at Arrow LNG Plant using the Scope 1 and Scope 2 annual emissions associated with the “all electrical” scenario (worst-case) from the Arrow LNG Plant SREIS, Appendix 3, Greenhouse Gas Impact Assessment – Supplementary Report). An assessment of life cycle emissions for the SREIS worst-case greenhouse gas emissions year (2029) in comparison with brown coal, black coal and natural gas is presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 6. Table 6.1 shows that the total life cycle emissions per unit of energy of fuel are 58 for coal seam gas, 93 for brown and black coal and 59 for natural gas.
R7020	S024, S025, S026,	Arrow's supported findings relating to Table 3.1 of	EIS	Table 3.1 in EIS Chapter 3, Project Need, shows the greenhouse gas

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7020	S024, S025, S026, S036, S074, S081, S083, S143, S150	the EIS (Greenhouse gas emissions per GJ of fuel combined) ignore current intelligence on the relative emissions of coal seam gas versus conventional coal when whole of life cycle analyses are conducted. Recent research and life-cycle analysis show that it cannot be categorically said that coal seam gas is less greenhouse gas intensive than coal. It is misleading and incorrect to include statements like this in the EIS. Please review Hardisty et al (2012) in the Energies scientific journal – “in an export scenario, greenhouse gas emissions from coal seam gas methane combusted in a combined cycle gas turbine power station can equal and be more than the greenhouse gas emissions generated by a black coal fired supercritical power station.” In order to properly determine the relative merits of coal seam gas and coal with regard to greenhouse gas emissions to comply with state and federal energy policies, Arrow must engage in whole of life cycle comparisons between the two for this EIS. More work should be done to clarify the life cycle of emissions from coal seam gas developments. This will help quantify greenhouse gas emission costs or benefits.	Chapter 3, Table 3.1 and Appendix D, Table 14 SREIS Appendix 3, Section 6 and Table 4.7	emissions per GJ of fuel combusted, not total life cycle emissions. Life cycle analyses are discussed further in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 6 and an updated life cycle assessment based on the revised project description is provided in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 6. It is important to note that the study by Hardisty et al (2012) does not discuss the other advantages of natural gas. For example, natural gas can be distributed in existing pipeline and distribution systems (unlike coal) and used where needed in bi and trigeneration systems that provide both electricity heating and cooling with extremely high overall efficiencies. Updated Scope 3 emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Table 4.7.
R7021	S015	The gas emissions and pollution from trucks and heavy machinery needed during the development of the project would surely outweigh the benefit of fewer emissions from coal seam gas compared to brown coal.	EIS Appendix D, Appendix A SREIS Appendix 3, Appendix A	The greenhouse gas emissions from trucks and heavy machinery associated with the development were accounted for in the calculation of Scope 1 emissions for the project. See Appendix A to EIS Appendix D, Greenhouse Gas Impact Assessment, Section A.3.2. The greenhouse gas emissions for the updated kilometres travelled by project vehicles for the revised project description were included in Appendix A to SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section A.3.3. An assessment of life cycle emissions for the SREIS worst-case greenhouse gas emissions year (2029) in comparison with brown coal, black coal and natural gas is presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 6. Table 6.1 shows that the total life cycle emissions per unit of energy of fuel are 58 for coal seam gas, 93 for brown and black coal and 59 for natural gas.
R7022	S112	If the coal seam gas is liquefied for the export Liquefied Natural Gas market, as proposed, the greenhouse gas footprint is higher still, as the	EIS Appendix D, Table 8 SREIS	Greenhouse gas emissions associated with the liquefaction process have been included as Scope 3 emissions in EIS Appendix D, Greenhouse Gas Impact Assessment, Table 8 (refer to the emissions for ‘third party

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Issue No.	Submission No.	Issue	Reference	Responses
R7022	S112	liquefaction process consumes more than 20% of its energy value. The evidence is increasing that coal seam gas is not a clean fuel. It's time that the coal seam gas industry and governments faced up to that reality.	Appendix 3, Section 6 and Table 4.7	infrastructure – coal seam gas downstream processing'). These calculations were sourced from estimates prepared for the Arrow LNG Plant SREIS, Appendix 3, Greenhouse Gas Impact Assessment – Supplementary Report. The estimate was derived from 'worst-case' Scope 1 and 2 emissions, based on the Arrow LNG Plant "all electrical" scenario. Updated Scope 3 emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7.
R7023	S112	Methane is a more potent greenhouse gas than carbon dioxide – by a factor of 72 times over a 20 year period, and 25 times over a 100 year period. The fugitive methane is wiping out any carbon saving from switching from coal to gas.	EIS Attachment 1, Section 4.6.3 and Appendix D, Table 14 and Appendix A SREIS Chapter 6, Section 6.3.2 and Appendix 3, Section 3.3	The global warming potential of methane was considered in accordance with the National Greenhouse and Energy Reporting (Measurement) Determination 2012 as required by Section 4.6.3.1 of the Terms of Reference. Presently, the global warming potential of methane is given as 21 t CO ₂ -e/ t CH ₄ . The Australian Government has indicated a value of 25 t CO ₂ -e/ t CH ₄ may be adopted from 2017 for emissions estimation for carbon pricing. Fugitive methane emissions have been considered where data was available. Currently, the Australian Government is undertaking a program to update emission factors in the context of Australian coal seam gas industry emission sources. Arrow and other coal seam gas proponents have been working in consultation with the Clean Energy Regulator to improve measures and estimation of fugitive greenhouse gas emissions from coal seam gas exploration and production. Any changes to legislated emission factors will be accounted for when preparing Arrow's annual reporting obligations and when determining the company's carbon liability under the Australian carbon pricing mechanism. Further discussion on the global warming potential of methane is provided in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 3.3. An assessment of life cycle emissions for the SREIS worst-case greenhouse gas emissions year (2029) in comparison with brown coal, black coal and natural gas is presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section 6. Table 6.1 shows that the total life cycle emissions per unit of energy of fuel are 58 for coal seam gas, 93 for brown and black coal and 59 for natural gas.
R7024	S081	The aggregate volumes that have been estimated for the foundations of all the production facilities have been substantially underestimated. Such an increase would place considerable pressure on existing borrow pits and quarries, other users of those resources, transportation and road infrastructure to name a few. Calculations for greenhouse gas emissions will also need to be	SREIS Appendix 3, Appendix A	Greenhouse gas emissions have been revised in the SREIS based on the updated data for fuel consumed by the heavy duty vehicles transporting raw materials to the site (based on kilometres travelled). See Appendix A to SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section A.3.3.

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7024	S081	revised to account for this.		
R7025	S011, S079, S143	The large volumes of traffic that will transport brine to Swanbank or other waste disposal facilities which are located a greater distance away (if local waste disposal facilities can't handle these large volumes of waste) will increase the project's greenhouse gas emissions.	SREIS Chapter 3, Section 3.7.5 and Attachment 5, Section 3.3	Noted. Arrow's salt disposal strategy has been updated since the publication of the EIS, with changes described in SREIS Chapter 3, Project Description, Section 3.7.5 and Attachment 5, Coal Seam Gas Water and Salt Management Strategy, Section 3.3. Brine will initially be stored in brine storage dams, with Arrow's preference to transport the brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, brine can be transformed into commercial products including salts and soda ash. The disposal of salt to Swanbank is no longer an option being considered by Arrow.
R7026	S108	The trucking of soils outside of the strategic cropping land area for storage will increase the carbon footprint of the project.	EIS Appendix D, Appendix A SREIS Appendix 3, Section 6, Table 4.7 and Appendix A	Arrow may avoid stockpiling soil in irrigated floodplain areas to avoid impacts to overland flow. This does not mean soil would be removed from the area entirely or transported vast distances. Notwithstanding this, the transportation of materials, products, waste and employees is a Scope 1 greenhouse gas emission. Section A.3.2 of Appendix A of EIS Appendix D, Greenhouse Gas Impact Assessment, presents the calculations of fuel combustion in transport vehicles. This uses an estimated quantity of diesel combusted in the vehicles calculated from the total kilometres travelled in the worst-case year at an average rate of diesel consumption. SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, provides an update to the greenhouse emissions estimates presented in the EIS. Appendix A to SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Section A.3.3 provides an update to the fuel combustion calculations.
R7027	S015	The EIS states that major earthworks and construction for the project will add much to greenhouse gas emissions. Hydrofluorocarbons, perfluorocarbons and sulphur hexfluorides all add to greenhouse gas emissions and result exclusively from human industrial process. The project will add to major human industrial processes.	–	Hydrofluorocarbons (HFCs) emissions are negligible in comparison to the total annual Scope 1 emissions during the worst-case scenarios assessed in this project. HFCs are only expected to be emitted from commercial air conditioning units installed at the on-site offices located at the central gas processing facilities after the units are decommissioned. Sulfur hexafluoride (SF ₆) is mostly used as an insulator in gas insulated switchgear and circuit breaker applications, which is applicable to power stations. Therefore, no SF ₆ emissions are expected to be associated with the Surat Gas Project. Perfluorocarbon emissions are associated with aluminium production and are therefore not associated with the Surat Gas Project.
R7028	S074	It is unclear if flaring at the wellhead during exploration and well completion activities has been accounted for in section A.4.1 of Appendix D.	EIS Appendix D, Section A.4.1 and Table 29	Exploration activities are conducted under an Authority to Prospect (ATP), which is an exploration permit for petroleum. Arrow hold a number of ATPs over the project area and as exploration activities are already authorised, they fall outside the scope of the EIS. Emissions associated with well completions were included in ramp-up flaring emissions as presented in Appendix A, Table 29 of EIS Appendix D,

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Issue No.	Submission No.	Issue	Reference	Responses
R7028	S074			Greenhouse Gas Impact Assessment. The total amount of gas flared includes three months of flaring required prior to facility commissioning based on drilling commencing six months prior, first month for completions and, second and third month for dewatering only.
R7029	S074	Table 4 in Appendix D lists well workovers as a project activity that generates scope 1 greenhouse gas emissions, however does not list coal seam gas venting or flaring as a source of greenhouse gas emissions. Vented coal seam gas emissions from well workovers have been calculated in Appendix A of the Greenhouse Gas Technical Report (A.5.2.3 Non-Routine Emissions – Well Workovers). Flared and/or vented greenhouse gas emissions associated with exploration and pilot well completion have also not been accounted for in the greenhouse gas inventory.	EIS Appendix D, Table 4 SREIS Appendix 3, tables 4.3 and 4.7	EIS Appendix D, Greenhouse Gas Impact Assessment, Table 4 lists venting and flaring as a source of Scope 1 greenhouse gas emissions during the operation and maintenance project phase under 'gathering infrastructure operation and maintenance (water and gas)' and 'facility operation and maintenance' project activities. For the SREIS, the venting emissions were calculated based on Arrow's National Greenhouse and Energy Reporting inventory. These emissions were included in the SREIS emissions calculations; see SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.3. Scope 1, 2 and 3 emissions are presented in Table 4.7 of the SREIS Appendix 3. Exploration activities (including pilot well programs) are conducted under an Authority to Prospect, which is an exploration permit for petroleum and are outside the scope of the EIS.
R7030	S024, S026, S034, S036, S069, S079, S081, S083, S162	How is released accumulated gas captured? If it is not captured, what is the impact of these emissions to atmosphere and on environmental values? What are the anticipated quantities of released gas from vents and drains?	EIS Chapter 5, Section 5.6.2 SREIS Chapter 3, Section 3.4.2 and Appendix 3, Table 3.1	Accumulated gas will be released through high-point vents. Venting emission sources were included in the SREIS emissions calculations; see Appendix 3, Supplementary Greenhouse Gas Assessment, Table 3.1. To reduce greenhouse gas emissions during project operations, Arrow has committed to prevent venting and flaring of gas as far as practicable and where safe to do so (Commitment C016).
R7031	S158	While mention has been made of the project eventually being self-sufficient in energy supply through use of self-supplied gas, whether the greenhouse gas cost has been properly accounted for in the overall estimation of the project's emissions load is not clear; also, coal based power will be drawn from the grid in the initial phases of the project, which constitutes a very significant greenhouse gas emissions tally.	EIS Appendix D, Section 3.1.2.2 SREIS Chapter 3, Section 3.4.5 and Appendix 3, Table 4.7	The project description (SREIS Chapter 3, Project Description) has been revised since the publication of the EIS. Queensland electricity grid power will be supplied to project facilities and wellheads. However, self-generated power using gas will be retained as a power supply option when grid power is not available, e.g., potentially in the first two years of development until a grid connection is made or on a case by case basis. Self-generated power may also be used where the wells are unable to be connected to Queensland electricity grid power. Section 3.1.2.2 of EIS Appendix D, Greenhouse Gas Impact Assessment states '[g]reenhouse gas emissions released from the production of electricity in the proposed infrastructure are classified as Scope 1 emissions in this assessment since the power generation is under the control of Arrow. However, electricity purchased from the grid during construction or operation has associated Scope 2 emissions.' Therefore Scope 1 emissions will be

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7031	S158			higher where Arrow is producing their own power, whereas Scope 2 emissions will be higher where electricity is purchased from the grid. The Scope 1 and Scope 2 greenhouse gas emissions for the 35-year project life are presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7.
R7032	S081, S108, S117, S138, S142, S163	The EIS is required to recognise that emissions have already exceeded those which maintain conditions on earth at levels similar to that of the last 650,000 years.	EIS Appendix D, Section 5.1	EIS Appendix D, Greenhouse Gas Impact Assessment, Section 5.1 notes that according to the Intergovernmental Panel on Climate Change, global surface temperature has increased by 0.74 plus or minus 0.18°C during the 100 years ending 2005, and that: "most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC, 2007a). 'Very likely' is defined as greater than 90% probability of occurrence (IPCC, 2007a).
R7033	S081, S108, S117, S138, S142, S150, S163	The EIS neglects to consider the importance of the internationally agreed target to limit global warming to below 2 degrees Celsius. A more meaningful assessment of the significance of the emissions however is by reference to the reliance of the environment, in particular the contribution the project would make towards exceeding the internationally agreed target of staying below 2 degrees warming. The project will consume approximately 0.16% of the world's remaining budget to stay under 2 degrees warming. The proponent should be responsible for their proportional contribution to the impacts of 2 degrees warming, i.e. 0.16% of all of the impacts of climate change at that level. The EIS should describe the character, resilience and values of the receiving environment and in particular the fact that the resilience of the environment to further emission is already exceeded and approaching a critical threshold of 2 degrees.	EIS Chapter 10, Section 10.6 SREIS Chapter 6, Section 6.5 and Appendix 3, Table 4.7	The Australian Government has agreed to greenhouse gas emissions targets. As such, overall Australian national emissions targets do not change regardless of the project proceeding. Direct (Scope 1) and indirect (Scope 2) greenhouse gas emissions from the operation of the Surat Gas Project have been estimated to be 3.6 Mt CO ₂ -e/annum for year 2029 at peak operation (i.e. worst-case for emissions). The worst-case year represents approximately 0.89% of Australia's 2009 greenhouse gas emissions for the energy sector and 0.012% of global 2009 fossil fuel consumption emissions. As such, the emissions associated with the project are not expected to have any discernible impact on climate change and the two degrees Celsius threshold. The Scope 1 and Scope 2 greenhouse gas emissions for the revised project description over the 35-year project life are presented in SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7. Irrespective, Arrow has made a number of commitments aimed towards reducing greenhouse gas emissions from its operations and will participate in government-approved emissions trading schemes. See EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6 and SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5.
R7034	S081, S108, S117, S138, S142, S150, S163	To allow the administering authority to consider the environmental harm proposed, the EIS should: • Identify several key elements of the science of climate change and relevant statutory framework. • Present the cumulative direct and indirect emissions, i.e., Scope 1, 2 and 3 emissions, for the life of the project and therefore does not assist the assessment of environmental harm.	EIS Attachment 1, Section 4.6.3 and Appendix D, Section 5.1 SREIS Chapter 6, Section 6.5.1 and Appendix 3, Table 4.7	The assessment addressed the Terms of Reference (TOR) relating to greenhouse gas emissions released by the administering authority. As required by Section 4.6.3.1 of the TOR, and consistent with Australian legislative requirements for the reporting of greenhouse gas emissions, the estimated emissions of the Surat Gas Project were calculated in accordance with: • National Greenhouse Accounts Factors. • National Greenhouse and Energy Reporting Scheme.

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7034	S081, S108, S117, S138, S142, S150, S163	<ul style="list-style-type: none"> • Assess the resilience of the environment to further emissions. • Explain that emissions accumulate and persist for thousands of years therefore it is the cumulative impact of the emissions consequent on the approval that matter. • Describe the cumulative impacts of the activity and all other activities on the environment through climate change. • Provide the information relevant to an assessment under the Environmental Protection Act. 		<ul style="list-style-type: none"> • World Resources Institute and the World Business Council for Sustainable Development's Greenhouse Gas Protocol. Where emission factors from these sources were not available or appropriate, methods from international sources such as the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry were applied. As such, the EIS presents emissions data in a manner consistent with the assessment authority's requirements (EIS Chapter 10, Greenhouse Gas Emissions). SREIS Chapter 6 and Appendix 3 provide an update to the greenhouse emissions estimates presented in the EIS. SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7 presents the Scope 1, 2 and 3 greenhouse gas emissions for the life of the project. EIS Appendix D, Greenhouse Gas Impact Assessment, Section 5.1 acknowledges that climate change is a global occurrence. Appendix B to Appendix D of EIS Appendix D describes the impacts associated with climate change predicted by the Garnaut Climate Change Review (Garnaut, 2008). The Garnaut Review is the most recent and authoritative work in predicting the future impacts of global greenhouse gas emissions on Australian climate patterns and the Australian economy.
R7035	S081, S108, S117, S138, S142, S163	<p>The EIS should describe the cumulative impacts from climate change resulting from the project and all other emission over the life of the project. The EIS fails to consider the cumulative impacts of climate change.</p>	<p>EIS Chapter 10 and Appendix D, Section 5.1 and Appendix B SREIS Appendix 3, Table 4.7</p>	<p>The EIS considers the cumulative impacts of climate change. Appendix B to EIS Appendix D, Greenhouse Gas Impact Assessment, describes the impacts associated with climate change predicted by the Garnaut Climate Change Review (Garnaut, 2008). The Garnaut Review is the most recent and authoritative work in predicting the future impacts of global greenhouse gas emissions on Australian climate patterns and the Australian economy. As attributing potential impacts associated with climate change to a single source of greenhouse emissions is problematic, the potential impacts associated with greenhouse gas emissions from the project will be in proportion to the project's contribution to global greenhouse gas emissions (i.e., 0.012% for the worst-case operational year compared to global 2009 fossil fuel consumption emissions); see Chapter 6, Greenhouse Gas Emissions, Section 6.5. The SREIS greenhouse gas emissions calculated for the life of the project for cumulative Scope 1 and 2 emissions are 21% lower than those estimated in the EIS. SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7 presents the Scope 1, 2 and 3 greenhouse gas emissions for the life of the project.</p>
R7036	S143	<p>Disagree with the statement that 'the impacts are expected to be negligible' in Appendix D, Section 10 (Conclusions).</p>	<p>EIS Chapter 10, Section 10.4.2 SREIS Chapter 6, Section 6.5</p>	<p>Noted. The SREIS found that cumulative Scope 1 and Scope 2 emissions from the Arrow Surat Gas Project associated with the worst-case operational year (i.e., 2029) equated to 0.012% of global 2009 fossil fuel consumption emissions (SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5). The SREIS greenhouse gas emissions calculated for the life of the project for</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R7036	S143			cumulative Scope 1 and 2 emissions are 21% lower than those estimated in the EIS.
R7037	S108, S117, S138, S142, S163	The EIS also does not quantify the cumulative impact from the project and all other fossil fuel projects approved and seeking approval in Queensland. Anticipated coal production alone (not including gas) would accumulate to 66.5 billion tonnes of carbon dioxide over the 35 year life of the project.	EIS Chapter 10, Section 10.4.2 SREIS Chapter 6, Section 6.5	Noted. Estimated greenhouse gases are expressed as a percentage of Queensland, Australian and global greenhouse emissions; see EIS Chapter 10, Greenhouse Gas Emissions, Section 10.4.2 and SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5.
R7038	S075, S077, S089, S150	The greenhouse gas management plan presented in the EIS is flimsy and it only promises that Arrow will "consider" energy efficiency programs and technological improvements. There is no real method proposed of reducing the residual impacts of the greenhouse gas emissions, which is concerning, considering the level of predicted carbon dioxide equivalents. Suggest Arrow's actions need to move from mere consideration to a commitment to an actual energy efficiency program, especially by examining their demand of energy from the grid and better use of solar power.	EIS Chapter 10, Section 10.6 and Appendix D, Section 2.2.4	From 2013, Arrow will participate in Australia's carbon pricing mechanism, and therefore has significant interest (incentive) in seeking all measures to reduce its carbon footprint. Arrow is flexible to explore means to reduce its greenhouse gas emissions as new technologies emerge and has committed to a number of measures to reduce emissions as described in EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6, including the development of a greenhouse gas management plan. As discussed in EIS Appendix D, Greenhouse Gas Impact Assessment, Section 2.2.4, Arrow also participates in the Energy Efficiency Opportunities Program, designed to improve the energy efficiency of large business.
R7039	S134	Arrow to provide detail on how Arrow plan to reduce their greenhouse gas emissions (given vegetation clearing is required e.g., vegetation offsets?).	EIS Chapter 10, Section 10.6 and Chapter 17, Section 17.6.6 SREIS Attachment 6	Arrow's plan to reduce greenhouse gas emissions are set out in EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6 and include (but are not limited to) the following commitments: <ul style="list-style-type: none"> • Prevent venting and flaring of gas as far as practicable and where safe to do so (Commitment C016). • Minimise the disturbance footprints and vegetation clearing (Commitment C020). • Consider energy efficiency programs both locally and across the company that contribute to greenhouse gas emission reductions (Commitment C007). Where avoidance of vegetation clearing is not possible and significant residual impacts remain to Endangered, Vulnerable and Near Threatened species and threatened communities, Arrow will implement an offset strategy approved by a relevant government agency and comply with the reporting conditions of the offset plan (Commitment C219). More information on biodiversity offsets is provided in SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan.
R7040	S150	Implementation of an environmental re-vegetation offset program to offset GHG emissions masks the fact that construction clearing may disturb terrestrial vegetation corridors, cause scouring and	EIS Chapter 10, Section 10.6 and Chapter 12, Section 12.3 and Chapter 17,	The EIS discusses potential impacts to biodiversity values in Chapter 17, Terrestrial Ecology, and potential erosion issues in Chapter 12, Geology, Landform and Soils. Mitigation and management measures for the protection of these values are set out in the above chapters irrespective of Arrow's

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7040	S150	erosion of river banks. The biodiversity condition and ecological health of native vegetation in priority catchments must be maintained or improved regardless of the need for GHG emission offsets.	Section 17.3 SREIS Attachment 6	commitments to reduce greenhouse emissions by minimising the disturbance footprint and vegetation clearance (Commitment C020) and implementing rehabilitation as soon as practicable following construction activities (Commitment C021). More information on biodiversity offsets is provided in SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan.
R7041	S150	An assessment of carbon emissions and the carbon offsets required need to ensure that interactions between terrestrial carbon disturbance and coal seam gas production can be managed or mitigated. For example: <ul style="list-style-type: none"> • reduction in the rate of deforestation and land degradation; • development of carbon sequestration projects in forestry and agriculture; • promoting energy efficiency; • development of alternative and renewable energy sources; • reduction in solid and liquid waste; • shifting to low emission transportation modes; • adopting optimal mining surface disturbance practices; • soil and biomass storage, and • advancing reclamation best practices. 	EIS Chapter 10, Section 10.6	Arrow is committed to reducing the greenhouse gas emissions of the company's operations through the support of mitigation and management measures as set out in EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6. Measures include minimising the disturbance footprint and vegetation clearing (Commitment C020), considering energy efficiency programs both locally and across the company that contribute to greenhouse gas emission reductions (Commitment C007) and considering supporting gas industry initiatives that seek to improve technology or processes, such as contributions or sponsorship of research and development (Commitment C022).
R7042	S081, S108, S117, S138, S142, S150, S163	The EIS is required to correct its reporting deficiencies and demonstrate that 100% of the emissions from the project can be safely and permanently sequestered.	EIS Attachment 1, Section 4.6.3 and Chapter 10, Section 10.6	As required by Section 4.6.3.1 of the Terms of Reference, and consistent with Australian legislative requirements for the reporting of greenhouse gas emissions, the estimated emissions of the Surat Gas Project were calculated in accordance with: <ul style="list-style-type: none"> • National Greenhouse Accounts Factors. • National Greenhouse and Energy Reporting Scheme. • World Resources Institute and the World Business Council for Sustainable Development's Greenhouse Gas Protocol. Where emission factors from these sources were not available or appropriate, methods from international sources such as the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry were applied. As such, the EIS presents emissions data in a manner consistent with the assessment authority's requirements. It is not possible to demonstrate that 100% of project emissions can be safely and permanently sequestered, nor is this a requirement under the terms of reference or Australian regulatory frameworks. However, Arrow is committed to reducing the greenhouse gas emissions of the company's operations through the support of mitigation and management measures as set out in

Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7042	S081, S108, S117,			EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6.
R7043	S081, S108, S117, S138, S142, S150, S163	<p>The EIS should assess the proportional contribution of the cumulative emissions to the impacts of climate change, such as by assessment of the social cost of carbon.</p> <p>The impacts are massive global and varied and therefore difficult to summarise. One method is to divide the total economic costs of climate change by the quantity of emissions required to cause those costs to derive a "social cost of carbon". A recent comprehensive review of the social cost of carbon through climate change found an appropriate level to be \$30/tonne rising 2% each year. Applying that level to the total cumulative emissions from the project (843 million tonnes of carbon dioxide) gives an economic impact of approximately \$35 billion dollars which far outweighs the \$1.66 Billion the project is estimated to benefit to the Queensland economy.</p> <p>Cumulative greenhouse gas emissions are expected to be around 843 million tonnes CO₂-e which would significantly exacerbate the harms from further exceeding the resilience of the atmosphere and represent a significant step towards 2 degrees warming which Australia has agreed internationally to avoid.</p>	EIS Chapter 10, Section 10.6	<p>Arrow agrees that the effects of climate change are many and varied and difficult to summarise. In costing carbon in relation to this project, commencing in 2013 Arrow is a participant in Australia's carbon pricing mechanism, which places an economic value on carbon.</p> <p>Arrow consequently has significant interest (incentive) in seeking all measures to reduce its carbon footprint. Arrow is flexible to explore means to reduce its greenhouse gas emissions as new technologies emerge and has committed to a number of measures to reduce emissions as described in EIS Chapter 10, Greenhouse Gas Emissions, Section 10.6.</p>
R7044	S158	Failure to meet peak production may impact negatively on the project's claim of full-cycle emissions being outweighed by global emissions attributable to gas-sourced energy. The lack of certainty of peak production from the Surat Gas Project is reflected in the project's provision of additional drilling to confirm yield if necessary.	EIS Chapter 10, Section 10.4 and Table 10.4 SREIS Chapter 6, Section 6.5 and Appendix 3, Table 4.7	<p>Should the project not reach production levels set out in the EIS, Scope 1 and 2 emissions associated with the project will likely decrease. Therefore the proportion of emissions from the project compared to global greenhouse gas emissions would be less.</p> <p>SREIS Appendix 3, Table 4.7 presents the revised Scope 1, 2 and 3 greenhouse gas emissions for the life of the project. Updated estimates with comparison to global emissions from the consumption of fossil fuels are provided in SREIS Chapter 6, Greenhouse Gas Emissions, Section 6.5.</p>
R7045	S158	In effect, the coal seam gas industry will render the eventual transition to clean energy meaningless by having added considerably to climate change and critically endangered survival and aesthetic values over the course of this industry's thirty year viability.	EIS Chapter 3, sections 3.1.1 and 3.3.2	<p>Alternative energy sources (including renewables) to coal seam gas do exist, although not currently on a scale and stage of development that will meet Australian and world energy demands in the short to medium term. Natural gas has been widely identified as a 'transitional' fuel that will allow governments to implement policies that provide both for economic growth and a move from a high dependence on carbon rich fossil fuels (such as coal) to a range of less carbon intensive sources, including renewable energy.</p> <p>Predictions by the International Energy Agency are that natural gas, in</p>

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Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7045	S158			particular, will play a central role in meeting the world's energy needs for the next two-and-a half decades (EIS Chapter 3, Project Need, Section 3.1.1). In Queensland, the Government considers the use of gas to be a key factor in reducing the greenhouse gas emissions intensity from electricity generation (Section 3.3.2). Reliance on natural gas therefore will continue through the next 20 to 30 years while alternatives, such as solar, become more viable on a large scale.
R7046	S081, S108, S117, S138, S142, S163	The greenhouse gas components of the EIS are severely understated and fail to address the statutory framework for assessing the future project Environmental Application.	EIS Chapter 10, sections 10.1 and 10.2 and Attachment 1, Section 4.6.3 and Appendix D, Section 3 SREIS Appendix 3, Table 4.7	As required by Section 4.6.3.1 of the Terms of Reference, and consistent with Australian legislative requirements for the reporting of greenhouse gas emissions, the estimated emissions of the Surat Gas Project were calculated in accordance with: • National Greenhouse Accounts Factors. • National Greenhouse and Energy Reporting Scheme. • World Resources Institute and the World Business Council for Sustainable Development's Greenhouse Gas Protocol. Where emission factors from these sources were not available or appropriate, methods from international sources such as the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry were applied. As such, the EIS presents emissions data in a manner consistent with the assessment authority's requirements. SREIS Appendix 3, Table 4.7 presents the revised Scope 1, 2 and 3 greenhouse gas emissions for the life of the project.
R7047	S081, S108, S117, S138, S142, S163	The EIS fails to identify key requirements of the legislative framework for greenhouse gas emissions in Queensland and consequently fails to present emissions data in a way that enables assessment under that framework. Note that the purposes of a voluntary EIS under the Environmental Protection Act are to: • Assess the potential adverse and beneficial environmental economic and social impacts of the project. • Give enough information about the potential adverse environmental, economic and social impacts to the Commonwealth, State and the public. • Help the administering authority decide an environmental authority application for which the EIS is required. • Give information to other Commonwealth and State authorities to help them make informed decisions.	EIS Chapter 10, Section 10.1 and 10.2 and Attachment 1, Section 4.6.3 and Appendix D, Section 3 SREIS Appendix 3, Table 4.7	As required by Section 4.6.3.1 of the Terms of Reference, and consistent with Australian legislative requirements for the reporting of greenhouse gas emissions, the estimated emissions of the Surat Gas Project were calculated in accordance with: • National Greenhouse Accounts Factors. • National Greenhouse and Energy Reporting Scheme. • World Resources Institute and the World Business Council for Sustainable Development's Greenhouse Gas Protocol. Where emission factors from these sources were not available or appropriate, methods from international sources such as the American Petroleum Institute's Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry were applied. As such, the EIS presents emissions data in a manner consistent with the assessment authority's requirements. SREIS Appendix 3, Supplementary Greenhouse Gas Assessment, Table 4.7 presents the revised Scope 1, 2 and 3 greenhouse gas emissions for the life of the project.

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Table 19.7 Greenhouse Gas Emissions

Issue No.	Submission No.	Issue	Reference	Responses
R7047	S081, S108, S117, S138, S142, S163	The EIS is required under Queensland legislation to provide greater information to allow the determination of impacts related to climate change and greenhouse gas emissions to be considered due to the project's emissions causing environmental harm. Consideration must be given to Scope 1, 2 and 3 emissions.		

Table 19.8 Climatic Adaptation

Issue No.	Submission No.	Issue	Reference	Responses
R8001	S158	Arrow's 'proactive approach' to addressing the effects of climate change is contradictory given that the Garnaut Report acknowledges the uncertainties and wide range of eventualities in relation to future climate change. Coal seam gas proponents are demonstrating a dismissive attitude to climate change and instead prioritising short-term monetary priorities.	EIS Attachment 1, Section 4.6.3.3 and Chapter 11, Section 11.6	The uncertainties related to climate change predictions are recognised by Arrow (EIS Chapter 11, Climatic Adaptation) and EHP (Surat Gas Project EIS Terms of Reference, Section 4.6.3.3), who acknowledge that a balance must be found between the costs of preparing for climate change and the uncertainties of outcomes. Proponents are expected to use best efforts to incorporate climate change adaptation in their EIS and project design. The project's proposed climate change adaptation strategy is set out in EIS Chapter 11, Climatic Adaptation, Section 11.6.
R8002	S112, S158	The Garnaut predictions of a potential 4.6°C increase in air temperature over the next 60 years specific to the project development area has many environmental implications, e.g., increased intensity of cyclones and storms, increased days with extreme fire danger, more frequent flood events, which constitute an unacceptable risk to the project.	EIS Chapter 11, sections 11.4.2 and 11.6.	Climate change adaptation will be considered in planning and design, construction, operation and decommissioning phases of the project. This will include developing preventative and responsive measures for bushfire management and flooding (Commitment C027) and designing and constructing production facilities in accordance with current Australian standards for climatic factors including wind, bushfires and floods (Commitment C026) as set out in EIS Chapter 11, Climatic Adaptation, Section 11.6.
R8003	S150	Should EHP (formerly DERM) not require further assessment of the EIS, then EHP must impose stringent conditions on Arrow to adopt climate change adaptation strategies.	–	Noted.

Table 19.9 Geology, Landform and Soils

Issue No.	Submission No.	Issue	Reference	Responses
R9001	S014, S044, S081, S139	Have rehabilitation trials been undertaken in regards to compaction of soil around well heads and gathering lines?	–	The layout, design and construction methods used to install production wells, gathering lines and access tracks on vertosols will consider site specific conditions and the results of landholder negotiations on specific farming practices. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance footprint through multi-well pad designs. Initially, Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks.
R9002	S108	EIS Chapter 6, Section 6.2.3 describes the potential for compaction impacts to soils, but no information is given for managing these impacts.	EIS Chapter 12, Section 12.6	Several of the commitments in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 will be used to manage the impacts of compaction on soils. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the results of landholder negotiations on specific farming practices. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance footprint through multi-well pad designs. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks.
R9003	S117	Arrow do not fully understand the impact of compaction on the black soils. The Geology, Landform and Soils chapter has failed to consider several irreversible impacts that such activities will have on the black soils.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the results of landholder negotiations on specific farming practices. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance footprint through multi-well pad designs. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks.
R9004	S014, S044, S081, S117	The operation of heavy machinery on black soil, will require the importation of significant quantities of gravel hardstand (at least 600 mm in depth). Mere transportation of this gravel to the site in itself will cause a large amount of compaction. Furthermore,	–	The layout, design and construction methods used to install production wells and access tracks on vertosols (black soils) will consider site specific conditions and the results of landholder negotiations on specific farming practices. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance

Table 19.9 Geology, Landform and Soils

Issue No.	Submission No.	Issue	Reference	Responses
R9004	S014, S044, S081, S117	the removal of this gravel and rehabilitation will have inevitable compaction consequences on black soils.		footprint through multi-well pad designs. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks.
R9005	S139	What compaction issues will result from access roads?	EIS Chapter 12, sections 12.4.1, 12.6 and Appendix E	Compaction impacts are discussed in EIS Chapter 12, Geology Landform and Soils, Section 12.4.1 and EIS Appendix E, Geology, Landform and Soils Impact Assessment, sections 6.2.3 and 6.4.3. Management measures are discussed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.
R9006	S012, S013, S016, S024, S026, S045, S047, S057, S069, S084, S095, S100, S101, S102, S103, S107, S151, S164	Clarification is required around how brine waste facilities must be listed on the Environmental Management Register (EMR), and how, based on the DERM guideline, this must be the coal seam gas operator's responsibility.	SREIS Attachment 5	Arrow's preference, as set out in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, is to transport brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, the brine can be transformed into commercial products including salts and soda ash. It is intended that all the properties identified for major facilities (such as compressor stations, water treatment facilities, etc.) are either owned by Arrow, or under a long term lease arrangement. Facilities will need to be registered as waste facilities and may require listing on the Environmental Management Register. Arrow will be responsible for obtaining these listings. Brine dams for the temporary storage of brine will be designed in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Disposal of brine to landfill is not Arrow's preferred option; however should this occur, brine will be transported to a regulated third party waste facility licensed to accept this material. This facility may be listed on the Environmental Management Register in its own right, and the third-party operator will be responsible for the environmental management requirements that are associated with waste management facilities.
R9007	S026, S036, S057, S081, S083	The EIS does not provide sufficient detail about which activities are notifiable activities (i.e., on Environmental Management Register (EMR)), and which activities are likely to result in contamination and subsequent listing on the Contaminated Land Register (CLR) or the nature of the contamination. Arrow needs to provide more information regarding their project activities and listings on the Environmental Management Register and Contaminated Land Register. Will all land upon which project activities occur be listed on these registers? Which project activities are currently notifiable activities? Which activities will be notifiable activities in the future?	EIS Chapter 12, Section 12.4.4 and Box 12.1	Arrow activities with the potential to be classified as notifiable, and therefore require the land parcel to be listed on the Environmental Management Register (EMR), may occur in relation to the operation of central gas processing facilities and water treatment facilities. It is intended that all the properties identified for major facilities (such as compressor stations, camps, etc.) are either owned by Arrow, or under a long term lease arrangement. Schedule 3 to the Environmental Protection Act 1994 (Qld) defines notifiable activities, which are also presented in EIS Chapter 12, Geology, Landform and Soils, Box 12.1. Other project infrastructure (i.e., wells, gathering lines, and access tracks) located on private properties will not require land parcels to be listed on the EMR, because there are no notifiable activities associated with the construction, operation and decommissioning of this infrastructure. For non-facility sites, a maximum hydrocarbon storage capacity of 25 kL will be

Table 19.9 Geology, Landform and Soils

Issue No.	Submission No.	Issue	Reference	Responses
R9007	S026, S036, S057, S081, S083			<p>enforced to prevent EMR listing.</p> <p>A property will only be listed on the Contaminated Land Register (CLR) if a scientific investigation shows that the land is contaminated, and that action needs to be taken to remediate or manage the land. Application of the mitigation and management measures detailed in EIS Chapter 12, Soils, Landform and Geology, Section 12.6.3 will reduce the potential for soil or groundwater to be contaminated by project activities.</p> <p>The EIS acknowledges that site specific conditions in relation to contaminated land status (i.e., whether individual land parcels within the project development area are listed on the CLR or EMR) have not been presented. Existing recording practices do not allow contaminated land environmental values to be mapped in order to provide a proactive tool for site selection. As the project progresses, additional information will become available as Arrow applies the strategies described in Figures 12.5 and 12.6.</p> <p>Any contaminated land issues that arise will be dealt with in accordance with the Queensland Government's Guideline for Contaminated Land Professionals (EHP, 2012b).</p> <p>In the event that Schedule 3 to the EP Act is amended to include any other project activities as notifiable activities, Arrow would be required to make notifications in the future.</p>
R9008	S014, S044, S081, S139	What precautions are put in place to protect landholders' properties from negative impacts associated with salt/salinity in regards to contaminated land registers etc.?	-	<p>The storage of brine associated with water treatment facilities will occur on Arrow-owned properties, or on land subject to long term leases as agreed with the landholder. Brine dams will be designed in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f).</p> <p>Water gathering lines installed to deliver coal seam gas water from wells to the water treatment facilities may be located on private land. Arrow will design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards to reduce the potential for failure (Commitment C444).</p> <p>Landholders will also be consulted during field planning to determine land use practices. Pipelines will be buried to a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network.</p> <p>The installation of water gathering lines on private properties will not require the land parcel to be listed on the Environmental Management Register, as this activity is not notifiable under the Environmental Protection Act 1994 (Qld) schedule of notifiable activities. A property will only be listed on the Contaminated Land Register if a scientific investigation shows that the land is contaminated, and that action needs to be taken to remediate or manage the land.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R9009	S015	The EIS states that built facilities and coal seam gas infrastructure operations will minimise the possibility of contaminating land. The term 'minimise' is insufficient and no guarantee is given.	EIS Chapter 12, Section 12.6.3	A risk of contamination exists if notifiable activities are conducted, however potential impacts will be reduced through implementation of the control measures detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.3.
R9010	S032	Concerned that in the case of pipeline failure, the removal/substitution of large volumes of contaminated soil would not be economical and consequently not be conducted, leaving materials onsite.	–	Under the Environmental Protection Act 1994 (Qld), Arrow is legally required and has committed to remediate any contamination caused by project activities. This is detailed in Commitment C038 which states that Arrow will carry out corrective actions immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities. Remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP) which would be developed should land contamination occur. These objectives may include remediation to a level that would allow the land parcel(s) to be removed from the Environmental Management Register or Contaminated Land Register. A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP. Pipeline failure will be reduced through adherence to the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards (Commitment C444). Landholders will also be consulted during field planning to determine land use practices. Pipelines will be buried to a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network.
R9011	S057, S083	Chapters 13 and 21 and Appendices F and O need to be rewritten, taking into account the impact of Environmental Management Register (EMR) and Contaminated Land Register (CLR) listings, and the status of notifiable activities on landholders' properties.	EIS Chapter 12, Figures 12.5 and 12.6	The EIS acknowledges that site specific conditions in relation to contaminated land status (i.e., whether individual land parcels within the project development area are listed on the Contaminated Land Register (CLR) or Environmental Management Register (EMR)) has not been presented. Existing recording practices do not allow contaminated land environmental values to be mapped in order to provide a proactive tool for site selection. Additional information will become available as Arrow applies the strategies described in Figures 12.5 and 12.6. Any contaminated land issues that arise will be dealt with in accordance with the Queensland Government's Guideline for Contaminated Land Professionals (EHP, 2012b). Arrow activities with the potential to be classified as notifiable, and therefore require the land parcel to be listed on the EMR, will occur in relation to the operation of central gas processing facilities and water treatment facilities, which will be predominantly located on Arrow-owned properties, or long term leased properties, as agreed with the landholder. Other project infrastructure (i.e., wells, gathering lines, and access tracks)

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Issue No.	Submission No.	Issue	Reference	Responses
R9011	S057, S083			located on private properties will not require land parcels to be listed on the EMR, because there are no notifiable activities associated with the construction, operation and decommissioning of this infrastructure.
R9012	S081	Arrow cannot possibly claim that this project is compatible with a Environmental Management Register (EMR) site management plan. At this point in time, there is not enough information for Arrow to even develop a plan.	EIS Chapter 12, Figures 12.5 and 12.6	The contaminated land strategies for project activities are detailed in EIS Chapter 12, Geology, Landform and Soils, Figures 12.5 and 12.6. These strategies show how project activities on potentially contaminated land will be managed. The EIS acknowledges that site specific conditions in relation to contaminated land status (i.e., whether individual land parcels within the project development area are listed on the Contaminated Land Register or Environmental Management Register) have not been presented. Existing recording practices do not allow contaminated land environmental values to be mapped in order to provide a proactive tool for site selection. As the project progresses, additional information will become available as Arrow applies the strategies described in Figures 12.5 and 12.6. Any contaminated land issues that arise will be dealt with in accordance with the Queensland Government's Guideline for Contaminated Land Professionals (EHP, 2012b).
R9013	S086	EIS Chapter 12, Section 12.4.4 states that the potential release of untreated coal seam gas water or brine is not addressed under contaminated land management guideline. Why not?, And if not where is it addressed?	EIS Chapter 2, Section 2.1.5 SREIS Chapter 2, Section 2.3.1	The Queensland Government's Guidelines for Contaminated Land Professionals (EHP, 2012) currently does not cover coal seam gas activities. However, the potential release of untreated coal seam gas water from wells, gathering systems or dams, and the release of brine from water treatment facilities and dams, are environmentally relevant activities under the Environmental Protection Act 1994 (Qld). These activities will be governed by the environmental authority for the project, as described in EIS Chapter 2, Project Approvals, Section 2.1.5 and SREIS Chapter 2, Project Approvals, Section 2.3.1.
R9014	S134	Arrow to provide details on how Arrow will assess and remediate land contaminated by project activities, including who is responsible for assessing and for undertaking contaminated land monitoring, what controls are in place to prevent land contamination, and how complaints which relate to land contamination are dealt with.	EIS Chapter 12, Section 12.6.3	Arrow will assess and remediate land contaminated by project activities in accordance with the Queensland Government's Guidelines for Contaminated Land Professionals (EHP, 2012b). The Guideline Assessing Qualified Persons According to Section 381, 395 and 410 of the Environmental Protection Act 1994 (Qld) (EHP, 2012e), defines the requirements to be met by persons performing contaminated land assessments. EIS Chapter 12, Geology, Landform and Soils, Section 12.6.3 outlines avoidance, mitigation and management measures that will be implemented for project activities that have the potential to cause land contamination. Complaints relating to land contamination will be dealt with through Arrow's complaints management system process, detailed on Arrow's website.
R9015	S134	Arrow to detail the quality of land after decommissioning of water treatment and storage facilities.	-	Under the Environmental Protection Act 1994 (Qld), Arrow is legally required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as

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Issue No.	Submission No.	Issue	Reference	Responses
R9015	S134			part of a Remediation Action Plan (RAP) which would be developed in line with the Guidelines for Contaminated Land Professionals (EHP, 2012b) should land contamination occur. A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP.
R9016	S146	Arrow should list what aspects of their project activities have the potential to result in land contamination, clearly defining the trigger for the contamination.	EIS Chapter 12, Section 12.4.4	EIS Chapter 12, Geology, Landform and Soils, Section 12.4.4, provides a general description of project activities with the potential to cause land contamination, and the means by which contamination could occur.
R9017	S146	Arrow should locate aspects of their project activities that have the potential to contaminate on their own land.	–	Any notifiable activities performed by Arrow will be associated with the development of gas production and water treatment facilities, which will be located on Arrow-owned properties, or properties with long term leases. No notifiable activities are to be associated with the construction, operation or decommissioning of other project infrastructure (e.g., wells, gathering lines and access tracks), which will be located on private properties.
R9018	S146	What is the third party affects from neighbouring land on the Contaminated Land Register?	EIS Chapter 12, Section 12.6.3, Figures 12.5, 12.6	Any property neighbouring a land parcel listed on the Contaminated Land Register (CLR) that has the potential to be adversely impacted by land contamination issues will require notification under the Environmental Protection Act 1994 (Qld), and the impact will be dealt in accordance with Queensland Government Guidelines for Contaminated Land Professionals (EHP 2012b). The source of the contamination would require remediation, with goals set to verify that the end state is compatible with the identified proposed land use. These goals would form part of a Remediation Action Plan (RAP), and a validation sampling program would be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP. Application of the contaminated land strategies presented in EIS, Chapter 12, Geology Landform and Soils, Figures 12.5 and 12.6, detail how development of a site listed on the CLR (if present within the project development area) will be avoided or managed. Once Arrow commences activities, the application of control measures detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 will manage the potential for project activities to result in contamination, and therefore the requirement for land parcels to be listed on the CLR. A property will only be listed on the CLR if a scientific investigation shows that the land is contaminated, that it is causing, or may cause serious environmental harm or public health risk and that action needs to be taken to remediate or manage the land.
R9019	S062	If land upon which Arrow conducts project activities subsequently becomes listed on the Environmental Management Register or the Contaminated Land Register, the future land use would be changed.	EIS Chapter 12, Section 12.6.3, Figures 12.5, 12.6	Arrow has committed to, and is required to remediate any contamination caused by project activities. This is detailed in Commitment C038 which states that Arrow will carry out corrective actions immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities.

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Issue No.	Submission No.	Issue	Reference	Responses
R9019	S062			<p>Remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP). A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP. Sites can be removed from the Environmental Management Register and Contaminated Land Register (CLR) through the completion of appropriate assessment, remediation and validation programs.</p> <p>The potential for Arrow's activities to result in a property becoming listed on the CLR are low, given that these are sites with proven contamination that are causing, or may cause serious environmental harm or public health risk. Application of the contaminated land strategies in the EIS Chapter 12, Geology Landform and Soils, figures 12.5 and 12.6 detail how development on these sites (if present within the project development area) will be avoided or managed.</p> <p>Any notifiable activities performed by Arrow will be associated with the development of facilities, which will be located on Arrow-owned properties or long term lease sites. No notifiable activities are to be associated with the construction, operation or decommissioning of other project infrastructure (e.g. wells, gathering lines and access tracks) located on non-Arrow-owned properties and therefore those properties will not require inclusion on the Environmental Management Register. Once Arrow commences project activities, the application of control measures detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 will manage the potential for project activities to result in contamination, and therefore the potential for land parcels to require listing on the CLR. A property will only be listed on the CLR if a scientific investigation shows that the land is contaminated, i.e., it is causing, or may cause serious environmental harm or public health risk and that action needs to be taken to remediate or manage the land.</p>
R9020	S143	<p>Concern over the statement 'all land upon which Arrow may conduct project activities could be listed on the EMR or CLR' and 'A number of Arrow project activities will be notifiable in their own right and land parcels upon which Arrow conducts project activities may accordingly be required to be listed on the EMR'. More information is required on the area likely to be listed on the CLR/EMR, the impact on GQAL and agricultural production and financial impacts to landholders.</p>	<p>EIS Chapter 12, Section 12.6.3, Figures 12.5 and 12.6</p>	<p>The EIS acknowledges that site specific conditions in relation to contaminated land status (i.e., whether individual land parcels within the project development area are listed on the Contaminated Land Register (CLR) or Environmental Management Register (EMR)) has not been presented. Existing recording practices do not allow contaminated land environmental values to be mapped in order to provide a proactive tool for site selection. Arrow is therefore unable to confirm the contaminated land status of all land parcels within the project development area, however, it is considered likely that some land parcels within the project development area are listed on the EMR or CLR. The properties purchased by Arrow for the development of central gas processing facilities (CGPFs) within drainage areas, DA2, DA7, DA8, DA9 and a temporary worker accommodation facility are not listed on either of these registers.</p> <p>As the project progresses, and infrastructure locations become known, Arrow will apply the strategies described in Figures 12.5 and 12.6, to collect additional information, and deal with any development on known</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R9020	S143			<p>contaminated land in accordance with the Queensland Government's Guideline for Contaminated Land Professionals (EHP, 2012b). Arrow activities with the potential to be classified as notifiable, and therefore require the land parcel to be listed on the EMR, will occur in relation to the operation of CGPFs and water treatment facilities, which will be located on Arrow-owned properties or long term lease sites. Schedule 3 of the Environmental Protection Act 1994 (Qld) defines notifiable activities, which are also presented in EIS Chapter 12, Geology, Landform and Soils, Box 12.1.</p> <p>Under the Environmental Protection Act 1994 (Qld), Arrow is legally required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP) which would be developed should land contamination occur. A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP.</p>
R9021	S015	The EIS must address the much feared potential impact of the contamination of soil. The good rich soils of the Darling Downs must not be placed in jeopardy.	EIS Chapter 12, Sections 12.2.2, 12.3.7, 12.4.7 and 12.6.3	EIS Chapter 12, Geology Landform and Soils, Sections 12.2.2, 12.3.7, 12.4.7 and 12.6.3 discuss potential land contamination and associated management controls.
R9022	S081	Does Arrow intend to remediate contamination caused as a result of their activities?	–	<p>Arrow has committed to, and is required by law to remediate any contamination caused by project activities. This is detailed in Commitment C038 which states that Arrow will carry out corrective actions immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities.</p> <p>In the event this should occur, remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP). A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP.</p>
R9023	S032, S067, S099, S143	The EIS should address the potential for spills from operational activities which would result in leaking or failed pipes to contaminate land. Concerned that movement (expansion/contraction) in black soils currently results in pipe failures and releases to the land. When pipes are filled with high sodium water, this will render farmlands toxic. Convinced that failures will occur based on extensive experience.	–	<p>Arrow will design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards to reduce the potential for failure (Commitment C444).</p> <p>In addition, landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to a depth that reduces the risk of damage.</p> <p>Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R9024	S027, S050, S069, S086, S146, S162	In EIS Chapter 12, Section 12.4, there is no mention of potential soil contamination from leaking of ruptured pipelines or well leaks. Arrow Energy should provide detail of what safeguards they have in place to ensure pipelines will not leak or rupture and gas wells will not leak. Arrow Energy should provide detail on how it would remedy soil contamination if leakage occurs from pipelines or wells.	EIS Chapter 12, sections 12.4.4 and 12.6.3	EIS Chapter 12, Geology, Landform and Soils, Section 12.4.4 identifies that the potential release of untreated coal seam gas water from wells, gathering systems or dams, and the release of brine from treatment facilities and dams, are environmentally relevant and activities that will be controlled through environmental authorities for petroleum activities. While the generation, storage and handling of coal seam gas water is currently not addressed under contaminated land management guidance, it will be managed by Arrow as a potentially contaminating activity. Arrow will design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards (Commitment C444) including those pipelines built on cracking clays to reduce the potential for failure. High pressure gas pipelines will be constructed in accordance with AS 2885.1-2012. Landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network. During project activities, the potential for soil contamination resulting from project activities will be reduced by the application of management measures detailed in the EIS, Chapter 12, Geology, Landform and Soils, Section 12.6.3. Arrow is required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP). A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP. Impacts specific to saline wastes will be managed in accordance with advice provided by the Queensland Government's Salinity Management Handbook (DERM, 2011).
R9025	S079	If the inert gas/water used to decommission gas pipelines leaks, will this cause contamination of the soil?	EIS Chapter 5, Section 5.7.2	The process for the decommissioning of gas and water gathering systems is detailed in the EIS Chapter 5, Project Description, Section 5.7.2. The inert material used to fill the pipelines for decommissioning will be non-reactive and isolated from any source of potential contamination.
R9026	S108	Gathering lines installed in vertosols will be subject to soil movement and related forces which could affect the pipe integrity and result in escape of gas or untreated coal seam water, likely to be saline and detrimental to the soil's structural integrity.	-	Arrow will design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards (Commitment C444) including those pipelines built on cracking clays to reduce the potential for failure. In addition, landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to

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Issue No.	Submission No.	Issue	Reference	Responses
R9026	S108			a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network.
R9027	S014, S044	Saline water is hazardous to 2:1 clay soils when the Sodium Absorption Ratio (SAR) is greater than 6 (Queensland Government Agriculture, Forestry and Fisheries). Coal seam water with a high SAR will permanently damage Vertosol soils if it is used for dust suppression on access tracks or if there is spillage from high or low point vents.	EIS Chapter 12, Section 12.6.2	Untreated coal seam gas water will not be used for dust suppression unless it meets relevant water quality objectives. Water from low point drains will be transferred to adjacent water gathering lines and processed as coal seam gas water. As detailed in Commitment C067, Arrow will ensure coal seam gas water used on highly productive soils is of comparable water quality to that used for irrigation in the specific area.
R9028	S014, S044	The supplementary report to the EIS should include the issues and potential impacts of coal seam water coming into contact with vertosol soil types.	–	Arrow has established a demonstration project at their Theten property. The purpose of the project is to demonstrate the sustainable use of treated coal seam gas water for agricultural purposes, including on vertosols. Arrow will continue to report demonstration updates on its website when available.
R9029	S050, S162	Not having an erosion and sediment plan available in EIS Appendix E is a missed opportunity to show an example of what Section 12.2 and 12.4.2 would mean.	EIS Chapter 12, section 12.1 and 12.6.4.	An erosion and sediment control plan will be developed for the project as outlined in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.4. Due to the site-specific nature of erosion and sediment control, plans will be tailored to reflect the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan.
R9030	S014, S044	The EIS states in Commitment C034 'develop an erosion and sediment control plan and install and maintain appropriate site specific controls'. Considering Arrow's commitment refers to site specific controls, will the administering authority set conditions that involve individual landholders to have input into the planning of Erosion and Sediment Control?	EIS Chapter 12, Section 12. 1	Due to the site-specific nature of erosion and sediment control, controls will be tailored to reflect the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan. Site specific actions will be discussed with landholders as part of the land access negotiations.
R9031	S027, S104	Built-up roads sheeted with gravel will be required to allow access in wet weather. Concerns are raised around the construction of properly formed roads on level ground which will then cause a change in the overland flow water regime in times of flood, in turn causing erosion.	EIS Chapter 12, Section 12.1 and 12.6.2	The issues associated with built-up roads are acknowledged. Infrastructure will be located in agreement with relevant landholders. Arrow will avoid disrupting overland flow paths, and where avoidance is not practicable, maintain connectivity of flow in watercourses (Commitment C053). This commitment will assist in mitigating the effects of project infrastructure on erosion and sedimentation due to overland flow. Arrow will develop an erosion and sediment control plan and install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in

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R9031	S027, S104			the preparation of the erosion and sediment control plan, along with topographic LIDAR data and landholder information.
R9032	S050, S162	There is confusion about the role of a clay alluvial plain, as Terrain Unit 1 soils are classed as 'prone to waterlogging'. Alluvial plains are also known as floodplains as they spread water when saturated across the entire area. This has not been stated nor understood in either the Chapter or Appendix, nor of its importance to the local agriculture in Chapter 13. These flood events cause the greatest levels of erosion and small changes in topography change the flow direction. Concerned how Arrow will be able to meet or go below the 0.3m/s surface water flow rate to avoid erosion of cracking clays around a fully operational well with gathering lines.	EIS Chapter 12, sections 12.3.4, 12.6.2, and Table 12.3	EIS Chapter 12, Geology, Landform and Soils, Table 12.3 details the characteristics, properties and processes of Terrain Unit 1 soils, where the geomorphic process of flooding is identified. The interrelationship of this terrain unit and the distribution of good quality agricultural land is presented in Section 12.3.4. Arrow's commitments relating to overland flow as detailed in EIS Section 12.6.2 are intended to reduce the impact of project activities on the erosive potential of overland flow. Arrow will develop an erosion and sediment control plan and install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan, along with topographic LIDAR data and landholder information.
R9033	S086	Arrow states that they will avoid mounding of soils along pipelines in irrigation paddocks. This is not acceptable on a flood plain or on any intensively farmed land. Mounded soils will create erosion and will impede farming practices.	EIS Chapter 12, Section 12.1 and Chapter 13	The positioning of soil stockpiles will be negotiated with landholders, with the requirements of the erosion and sediment control plan tailored to the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan, along with topographic LIDAR data and landholder information. Where relevant, the Strategic Cropping Land Standard Conditions Code for Resource Activities (DNRM, 2012) will be met. The potential impacts of project activities on farming practices and the associated management measures are outlined in EIS Chapter 13, Agriculture.
R9034	S092	Requests a description as to how Arrow will monitor infrastructure in times of flood and deal with debris removal caught up on infrastructure. Concerned that trees planted around gas infrastructure for visual amenity purposes will be uprooted during a flood and cause soil erosion and potential damage to mining infrastructure.	–	Once the location of infrastructure is known, any trees planted for visual amenity purposes will be positioned at a suitably safe distance from infrastructure. Trees selected for planting will be specific to the original ecosystem wherever practicable (Commitment C253). Well site remote telemetry units (RTUs) will be used to monitor well site infrastructure, and initiate a shutdown in case of an incident. Well site infrastructure will be fenced which will help to protect it from flood-related debris; the design of the fence will be dependent considerations such as location, risk assessment, and outcomes of liaison with landholders. Any potential damage resulting from debris movement during a flood event will be dealt with through Arrow's emergency response plan.
R9035	S134	Constructing infrastructure in erosion prone areas could lead to sediment and excess nutrients entering the waterways, affecting water quality. Arrow to avoid areas prone to erosion for site	EIS Chapter 8, Chapter 12, Section 12.6.2 and Chapter 15, Section 15.4	Arrow will use constraints mapping as described in the EIS Chapter 8, Environmental Framework, to inform site selection and avoid environmentally sensitive and erosion prone areas where practicable. Erosion prone areas will be identified through soil type mapping conducted as part of the detailed

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Issue No.	Submission No.	Issue	Reference	Responses
R9035	S134	selection.		design process, and in conjunction with the site specific conditions determined during land access negotiations and statutory information requirements provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' (EHP, 2013) to accompany environmental authority (EA) or EA amendment application(s). Arrow's commitments relating to land degradation as detailed in EIS Chapter 12, Geology Landform and Soils, Section 12.6.2 are intended to reduce the impact of project activities and associated erosion. In addition, Arrow will develop an erosion and sediment control plan and install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). The potential impacts of project activities on water quality and the associated management measures are outlined in EIS Chapter 15, Surface Water, Section 15.4.
R9036	S150	The impact assessment presented in Appendix E (Geology, Landform and Soils technical report) does not identify or state whether there are areas that might be too severely impacted to warrant development at all, i.e. a 'no go' area.	EIS Chapter 1, Section 1.2.4	EIS Chapter 1, Introduction, Section 1.2.4 details the factors that will influence site selection. 'No go' areas such as the Chinchilla Sands Local Fossil Fauna Site have been identified. Where highly constrained areas cannot be avoided, Arrow will develop site specific mitigation measures, as required, at the time of applying for an environmental authority amendment.
R9037	S002, S003, S009, S018, S019, S020, S032, S037, S055, S059, S064, S070, S071, S076, S086, S098, S139, S140,	EIS Chapter 12, Section 12.6.1 does not account for the Strategic Cropping Land Legislation and should be revised to include the legislation.	EIS Chapter 4, Section 4.3.2 SREIS Chapter 2, Section 2.4.1, Chapter 7, Section 7.3	Strategic cropping land legislation is discussed in EIS Chapter 4, Environmental, Social and Economic Context, Section 4.3.2. At the time that the Surat Gas Project EIS was submitted to DERM for adequacy review against the Terms of Reference (which is required before public exhibition), the Strategic Cropping Land Act 2011 had not been enacted. However, it is discussed in greater detail in SREIS Chapter 2, Project Approvals, Section 2.4.1, and Chapter 7, Agriculture, Section 7.3.
R9038	S141, S144	The EIS makes no reference to standard conditions codes for impacts on Strategic Cropping Land.	EIS Chapter 4, Section 4.3.2 SREIS Chapter 2, Section 2.4.1, Chapter 7, Section 7.3	Strategic cropping land legislation is discussed in EIS Chapter 4, Environmental, Social and Economic Context, Section 4.3.2. At the time that the Surat Gas Project EIS was submitted to DERM for adequacy review against the Terms of Reference (which is required before public exhibition), the Strategic Cropping Land Act 2011 had not been enacted. However, it is discussed in greater detail in SREIS Chapter 2, Project Approvals, Section 2.4.1, and Chapter 7, Agriculture, Section 7.3.
R9039	S014, S044	Arrow should explain why 'wells general' have a lower magnitude classification than other activities in EIS Table 6.2, Summary of Magnitude of Potential Impacts.	EIS Appendix E, Section 6.5.1	The magnitude of pre-mitigated impacts associated with each project component is discussed in EIS Appendix E, Geology, Landform and Soils Impact Assessment, Section 6.5.1.
R9040	S108	The residual impacts presented in the technical report for facilities and production wells are not provided with any evidence to support these statements. The rankings do not reflect the	EIS Appendix E, Section 6.6, Section 8, Table 6.3	A discussion of the residual risk rankings for facilities and production wells is presented in EIS Appendix E, Geology, Landform and Soils Impact Assessment, Section 8. The results of the residual impact assessment reflect the magnitude of impact after the implementation of mitigation measures, and

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Issue No.	Submission No.	Issue	Reference	Responses
R9040	S108	discussions earlier in the report regarding the potential for land degradation, and the results of the pre-mitigation impact assessment. This carries across to Table 8.1, where an opaque formula derives the residual impact assessment.		show a reduction in the significance of impacts in comparison with the pre-mitigation impact assessment. The formula used to derive residual risk rankings is explained in EIS Appendix E, Geology, Landform and Soils Impact Assessment Section 6.6 and Table 6.3. The matrix presented as Table 6.3 shows how the sensitivity of the environmental value and the magnitude of the impact relate to generate the significance ranking (ranging from negligible to major).
R9041	S150	The detailed soil investigation areas appear superficial given the size of the project development area. Specialists rely on the Land Resource Area (LRA) mapping. The LRA classifications are comprised of a number of soil types, with different features. These differences have not been accounted for in the assessment.	EIS Appendix E, Table 3.3	The nature of the development is such that at the time of the EIS, Arrow was yet to determine the exact locations of infrastructure. The EIS presents a high level assessment of the soil types present within the project development area. The assessment included a desktop study, using Land Resource Area information to identify soil types, group them into terrain units, and map their distribution across the project development area. The different soil types and their properties that make up each terrain unit are identified in EIS Appendix E, Geology, Landform and Soils Impact Assessment, Table 3.3. The subsequent detailed soil investigation targeted a representation of the different soil types mapped within the project development area, to confirm the soil properties as determined through the desktop mapping. When facility locations are known, Arrow will conduct geotechnical investigations prior to construction to determine the physical and chemical properties of the soils and subsurface materials at those locations.
R9042	S150	The soil analyses and chemical analysis results in Appendix C of the geology, soils and landform technical report show little connection between any constraints identified in Appendix E with site specific impact assessment.	–	The nature of the development is such that at the time of the EIS, Arrow was yet to determine the exact locations of infrastructure. The EIS presents a high level assessment of the soil types present within the project development area. Site specific impact assessments were not performed as part of the EIS. When facility locations are known, Arrow will conduct geotechnical investigations prior to construction to determine the physical and chemical properties of the soils and subsurface materials at those locations.
R9043	S157	Is the scale of the soil mapping presented suitable given the requirements of section 4.2.1.4 of the terms of reference?	EIS Chapter 12, Figure 12.4	The scale of the soil mapping and the description of soil profiles presented in the EIS satisfy the requirements of the terms of reference.
R9044	S014, S044	This impact assessment method has underestimated the environmental value of the Condamine Flood Plain by failing to accurately assess its rehabilitation potential. To date, there is no proven rehabilitation method for this soil type to be reinstated to its pre-existing productive capacity after long term vehicular compaction and contamination by salty water, as would occur from	EIS Chapter 12, Section 12.6	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming

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Issue No.	Submission No.	Issue	Reference	Responses
R9044	S014, S044	<p>the following activities over the 35 year project life:</p> <ul style="list-style-type: none"> • Construction and maintenance of production wells • Construction and maintenance of field compression facilities • Regular traffic on gravel access roads • Unplanned incidents or accidents that cause coal seam water to come in contact with the soil • Dust suppression on gravel access roads using coal seam water with a SAR ratio higher than water currently used for irrigation from the Condamine Alluvium (Attachment 4 from submitter - presenting laboratory services test report 02/3585/1 with SAR showing at 1.7). <p>Arrow should therefore consider the above impacts and propose management and mitigation measures that are appropriate.</p>		<p>practices. It is on this basis, and an ongoing review of soil management techniques, that the sensitivity is assessed. Application of the avoidance, mitigation and management measures outlined in EIS Chapter 12, Geology Landform and Soils, Section 12.6 were found to reduce the magnitude of impacts from high to low. Therefore, there is a corresponding reduction in the significance of impacts from high (for pre-mitigated impacts) to low (for residual impacts).</p> <p>Additional work programs being undertaken include a review of the best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks. In addition, Arrow has established a demonstration project at its Theten property to show sustainable use of treated coal seam gas water for agriculture purposes. Arrow will continue to report demonstration updates on its website when available.</p> <p>The EIS considers impacts to vertosols and presents mitigation measures to reduce the impacts of the project activities on this soil type. Revisions to, or the development of any additional mitigation measures will be set out in statutory information requirements as described in the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required.</p>
R9045	S014, S044	<p>The EIS outlines the Significance Assessment Method identifying the worst case scenario. The EIS has not considered the 'worst-case' scenario of Arrow's inability to rehabilitate vertosol soils. This should be assumed as the rehabilitation methodology for this soil type to be reinstated to its pre-existing productive capacity, is unknown at this stage. Coal seam gas infrastructure on the Condamine Flood Plain cannot be successfully rehabilitated to its pre-existing condition and this footprint will be permanently alienated.</p>	<p>EIS Chapter 12, Section 12.6</p>	<p>Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.</p> <p>It is on this basis, and an ongoing review of soil management techniques that the sensitivity is assessed. Avoidance, mitigation and management measures outlined in EIS Chapter 12, Geology Landform and Soils, Section 12.6 will reduce the magnitude of impacts from high to low. Therefore, there is a corresponding reduction in the significance of impacts from high (for pre-mitigated impacts) to low (for residual impacts).</p>
R9046	S024, S026, S036, S057, S081, S083	<p>The sensitivity of the environmental value (Clay Alluvial Plains) needs to be increased to reflect its waterlogging properties and its potential inability to be rehabilitated.</p>	<p>EIS Appendix E, Table 4.3</p>	<p>The overall sensitivity of the clay alluvial plain terrain unit is determined by the individual sensitivity rankings of the properties presented in EIS Appendix E, Geology, Landform and Soils Impact Assessment Table 4.3. The waterlogging properties of the soils within the clay alluvial plains terrain unit are acknowledged, and determined to have a high sensitivity to disturbance. The rehabilitation potential is determined to have a moderate sensitivity, based on the ability of these soils to be returned to their former land use, as</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R9046	S024, S026, S036,			discussed by Arrow at consultation and at Arrow's website. Individual sensitivity rankings were used to determine overall sensitivity.
R9047	S108	The summary of the sensitivity of environmental values does not reflect the concerns regarding the rehabilitation potential and overall sensitivity for vertosols. No method for deriving these values is given and particularly the overall sensitivity rating does not reflect the major issues for the environment values of water erosion and soft soils.	EIS Chapter 12, Table 12.4, Appendix E, Section 4.2, Table 4.3	The overall sensitivity ranking determined for each terrain unit is presented in EIS Chapter 12, Geology, Landform and Soils, Table 12.4. Additional details on the process for determining the overall sensitivity rankings are presented EIS Appendix E, Geology, Landform and Soils Impact Assessment, Section 4.2 and Table 4.3. Table 4.3 presents the individual sensitivity rankings for the key properties of the soils that define each terrain unit. Properties of the soils within the clay alluvial plain terrain unit with high sensitivity to disturbance include their susceptibility to erosion and waterlogging potential.
R9048	S014, S044, S081, S139	Have studies been undertaken on different soil types to determine the different impacts to soil from undertaking coal seam gas operations?	EIS Chapter 12, Section 12.4	The EIS investigated several soil types across the project development area. The properties of the soil determined the likely response to disturbance based on an understanding of how Arrow will conduct its activities. Soil types more sensitive to disturbance (e.g., vertosols) will be the focus of additional work by Arrow to determine the best methods for rehabilitation. These additional work programs include a review of the best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks. Arrow will report the results of trials on its website when available.
R9049	S014, S044	The question must be asked, how does Arrow propose to rehabilitate these soil types? A soil rehabilitation procedure for Vertosols or Black Clay soils must be provided.	EIS Chapter 12, Section 12.6.2	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow will develop rehabilitation plans based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070). Site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods that are to be used. Further details on how Arrow will rehabilitate land used for project activities will be provided in accordance with the EHP Guideline 'Application

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Issue No.	Submission No.	Issue	Reference	Responses
R9049	S014, S044			requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required.
R9050	S014, S044	Importing soil for rehabilitation creates a number of potential issues. Weeds, soil borne diseases and poorer quality soils could all be imported reducing the effectiveness of rehabilitation. This method could not be considered as rehabilitating the soil to its pre-existing productive capacity, which is essential for cropping purposes.	EIS Chapter 13, Section 13.6.4 and Chapter 16, Section 16.6.3	The final rehabilitated land use will be determined in conjunction with the landholder. Where possible, excavated soil will be preserved for future use as rehabilitation material; Arrow has committed to backfill soils in the reverse order of removal, and undertake backfilling progressively and regularly during pipeline construction (Commitment C090). This will assist in retaining the soil profile. When sourcing materials, Arrow will check materials such as bedding sand, topsoil and sand bags for weeds and plant materials or animal pathogens. Arrow will request a weed hygiene declaration form from the supplier where there is possible risk of contamination in products or materials (Commitment C190).
R9051	S014, S044, S081	In relation to salt management, have remediation technologies been used on intensive farmed soils?	SREIS Attachment 5	Salt will not be stored on intensively farmed areas. Brine dams at water treatment facilities associated with central gas processing facilities (CGPFs), CGPF2 and CGPF9, will not be located within intensively farmed land. Brine and salt will be removed from the water treatment facilities for either processing at a selective salt recovery facility, or offsite disposal, e.g., at a third-party licensed landfill in line with Arrow's Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5).
R9052	S108	The information presented regarding rehabilitation are nowhere detailed enough, and especially do not prescribe how full rehabilitation will be achieved.	EIS Chapter 12, Section 12.6.2	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow will develop a rehabilitation plan based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070). Site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods that are to be used. Further details on how Arrow will rehabilitate land used for project activities will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) and EA amendment application(s), as required.

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Issue No.	Submission No.	Issue	Reference	Responses
R9053	S150	It is not clear from either the soils impact assessment or the agricultural report how the impacts on the 60% good quality agricultural land and 49% strategic cropping land are proposed to be managed so that they will be restored to their former designation.	EIS Chapter 12, Section 12.6.2	Arrow will develop a rehabilitation plan based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070). Site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods that are to be used.
R9054	S123	Regarding rehabilitation and stockpiling of top soils there are known soil types through extensive studies that have not to date shown how they can be successfully rehabilitated. This will then need to be incorporated into Table 12.6. The land once disturbed will alienate that land from productivity. The department has concerns as rehabilitation of these soils has not been able to be demonstrated to date. What are the contingency measures and has there been any thought to making these no go zones?	EIS Chapter 12, Section 12.6.2 SREIS Attachment 4	The EIS acknowledges that there is the potential for residual impacts depending on the ability to rehabilitate disturbed land to its former use. Land that cannot be rehabilitated to its former use may lead to a residual permanent change in that land use. Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Ground disturbed during the construction and operation of central gas processing facilities and water treatment facilities may not be able to be restored to its former use; however, these facilities are not proposed to be located on vertosols. Arrow is investigating ways to reduce the loss of organic content and fertility in productive soils expected to require long term storage. This may include avoiding the use of stockpiles, and alternative placement and management methods. A new commitment to address this issue have been included in the SREIS which states 'stabilise and revegetate long-term stockpiles as soon as possible to reduce potential for erosion' (Commitment C542). Detailed management measures associated with long-term soil storage will be developed when infrastructure locations are identified, and soil conditions are determined. These stockpile management measures will be negotiated and agreed with landholders prior to the commencement of ground disturbance activities. Arrow will develop a rehabilitation plan based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover,

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Issue No.	Submission No.	Issue	Reference	Responses
R9054	S123			land use and landholder requirements (Commitment C070). Site specific requirements will be identified as the development progresses, and infrastructure locations and rehabilitation requirements are determined and negotiated with landholders under Arrow's conduct and compensation agreement.
R9055	S134	Arrow to minimise soil disturbance during construction of project infrastructure. Where soils are disturbed, Arrow is to rehabilitate to former physical, biological and chemical structure using the same soils, not off-site soils.	EIS Chapter 9, Section 9.6, Chapter 13, Section 13.6.4, Chapter 16, Section 16.6.3	Arrow has committed to minimise the disturbance footprint and vegetation clearing (Commitment C020). The final rehabilitated land use will be determined in conjunction with the landholder. Where possible, excavated soil will be preserved for future use as rehabilitation material. Arrow will backfill soils in the reverse order of removal, and undertake backfilling progressively and regularly during pipeline construction (Commitment C090), which will assist in retaining the soil profile. When sourcing materials, Arrow will check materials such as bedding sand, topsoil and sand bags for weeds and plant materials or animal pathogens. Arrow will request a weed hygiene declaration form from the supplier where there is possible risk of contamination in products or materials (Commitment C190).
R9056	S014, S044, S050, S150	Rehabilitation of pipeline routes cannot be used as an example of successful rehabilitation for well construction activities on black soil. The method for rehabilitating black soil is unknown at this stage. Once this soil has been significantly damaged by compaction or permanently damaged by salty water it cannot be rehabilitated.	-	The EIS acknowledges that there is the potential for residual impacts depending on the ability to rehabilitate disturbed land to its former use. Land that cannot be rehabilitated to its former use may lead to a residual permanent change in that land use. Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Ground disturbed during the construction and operation of central gas processing facilities (CGPFs) and water treatment facilities may not be able to be restored to its former use; however these facilities are not proposed to be located on black soils. The layout, design and construction methods used to install production wells and access tracks within black soils will consider site specific conditions and the results of landholder negotiations on specific farming practices. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance footprint through multi-well pad designs. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications

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Issue No.	Submission No.	Issue	Reference	Responses
R9056	S014, S044, S050, S150			such as swamp matting or caterpillar tracks. Arrow will also design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards (Commitment C444) including those pipelines built on cracking clays to reduce the potential for failure and subsequent leaks of saline water to the surrounding soil. Landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities(s) to alert operators to faults within the gathering network.
R9057	S162	There is an assumption that the complete rehabilitation of black cracking clays is attainable despite no known examples of this taken place to our knowledge. Arrow has not provided evidence to suggest they can rehabilitate black cracking clays to date.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.
R9058	S025, S026, S036, S038, S072, S079, S081, S083, S162	No instances anywhere worldwide where vertosol soils have been successfully rehabilitated after mining. It would be prudent for Arrow to conduct rehabilitation trials on vertosol soils prior to approval for gas field development being given.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.
R9059	S024, S026, S036, S057, S081, S083	Rehabilitation trials must be conducted to determine whether vertosol soils within the project development area are able to be successfully rehabilitated prior to the commencement of gas field development in these areas.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.
R9060	S024, S026, S036, S057, S081, S083	Medium and heavy clay topsoils within the project development area should not be stripped and used	EIS Chapter 9, Section 9.6,	Arrow will minimise the disturbance footprint and vegetation clearing (Commitment C020).

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Issue No.	Submission No.	Issue	Reference	Responses
R9060	S024, S026, S036, S057, S081, S083	for rehabilitation.	Chapter 13, Section 13.6.4 and Chapter 16, Section 16.6.3	The final rehabilitated land use will be determined in conjunction with the landholder. Where possible, excavated soil will be preserved for future use as rehabilitation material. Arrow will backfill soils in the reverse order or removal, and undertake backfilling progressively and regularly during pipeline construction (Commitment C090), which will assist in retaining the soil profile. When sourcing materials, Arrow will check materials such as bedding sand, topsoil and sand bags for weeds and plant materials or animal pathogens. Arrow will request a weed hygiene declaration form from the supplier where there is possible risk of contamination in products or materials (Commitment C190).
R9061	S108	There is no documented case in Australia of the vertosol sub-orders present in the project development area being rehabilitated after such disturbance. Arrow states an over optimistic estimate of recovery from the impact of projection wells and gathering lines in 10 years without and supporting evidence. Recent publications indicated that crop yields on rehabilitated vertosols are lower than on undisturbed soils. Page 19 and 20 of the submission contains reference to articles that provide technical context around this statement.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.
R9062	S017	Insufficient trial work in rehabilitation of vertosol soils. It is difficult or near impossible to rehabilitate compaction of a level that can be expected from the specified activities. It is difficult or probably impossible to restore these soils back to its pre-existing condition based on experience installing an underground main from an irrigation bore.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks.
R9063	S014, S044	What does Arrow propose to do with all the stockpiled soil that is unsuitable for rehabilitation purposes, how will this be managed?	–	The management of soil that is unsuitable for rehabilitation purposes will be detailed in the rehabilitation plan. Any contaminated soil will be remediated in situ, or removed by a licensed waste contractor to a third-party operated offsite licensed waste disposal facility. If the soil is not contaminated, it will be reused on-site where possible, in agreement with the landholder; otherwise, it will be transported off site for beneficial reuse, or for disposal at a licensed

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Issue No.	Submission No.	Issue	Reference	Responses
R9063	S014, S044			third-party operated waste disposal facility.
R9064	S024, S026, S036, S057, S081, S083	EIS Chapter 12, Section 12.4 needs to be rewritten to give regard to the issues and potential impacts of stockpiled soil on other landform, geology and soil values in the project area.	SREIS Attachment 4	Detailed management measures associated with long-term soil storage will be developed when infrastructure locations are identified, and soil conditions are determined. These stockpile management measures will be negotiated and agreed with landholders prior to the commencement of ground disturbance activities. Arrow is investigating ways to reduce the loss of organic content and fertility in productive soils expected to require long term storage. This may include avoiding the use of stockpiles, and alternative placement and management methods. A new commitment to address this issue have been included in the SREIS which states 'stabilise and revegetate long-term stockpiles as soon as possible to reduce potential for erosion' (Commitment C542).
R9065	S024, S036, S057, S079, S081, S083, S108	The technical report states 'Stockpiles (of topsoil) that are anticipated to be in situ require intensive management to avoid loss of fertility.' The EIS does not provide a procedure explaining how this process will work. The complexity and lack of experimental precedence means that the management methods are not known. Land restoration to original SCL condition, let alone to original productivity is very unlikely. How will stockpiles be managed to maintain fertility?	EIS Chapter 12, Section 12.6.2 SREIS Attachment 4	Arrow is investigating ways to reduce the loss of organic content and fertility in productive soils expected to require long term storage. This may include avoiding the use of stockpiles, and alternative placement and management methods. A new commitment to address this issue have been included in the SREIS which states 'stabilise and revegetate long-term stockpiles as soon as possible to reduce potential for erosion' (Commitment C542). Detailed management measures associated with long-term soil storage will be developed when infrastructure locations are identified, and soil conditions are determined. These stockpile management measures will be negotiated and agreed with landholders prior to the commencement of ground disturbance activities. Arrow will develop rehabilitation plans based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landholder requirements (Commitment C070). The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods used, including those for stockpiling and topsoil management.
R9066	S024, S026, S057, S081, S083	Petroleum activities requiring the stripping of the top soil layer for stockpiling must be prohibited in areas of medium to heavy clay soil. Importing soils with lower clay content from elsewhere for rehab will affect agricultural production and may cause contamination and disease spread and must be	EIS Chapter 9, Section 9.6, Chapter 13, Section 13.6.4 and Chapter 16, Section 16.6.3 SREIS	Arrow will minimise the disturbance footprint and vegetation clearing (Commitment C020). Where disturbance of soils cannot be avoided, Arrow's preference is to preserve excavated soil for future use as rehabilitation material. In this case, soil will be returned to the excavation in reverse order, to retain the soil profile (Commitment C090).

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Issue No.	Submission No.	Issue	Reference	Responses
R9066	S024, S026, S057, S081, S083	prohibited.	Chapter 19	When sourcing materials, Arrow will check materials such as bedding sand, topsoil and sand bags for weeds and plant materials or animal pathogens. Arrow will request a weed hygiene declaration form from the supplier where there is possible risk of contamination in products or materials (Commitment C190). For responses to issues raised in relation to potential impacts on agricultural productivity please refer to the agriculture section of SREIS Chapter 19, Submission Responses.
R9067	S134	Arrow to ensure that spoil from pipeline trenches placed on banks of waterways or adjacent to roads will be inspected and approved by the Council or the relevant government agency.	EIS Chapter 15, sections 15.6.1 and 15.6.4	Arrow will implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads and pipelines and discharge infrastructure and associated stream monitoring equipment) Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through pre-construction clearance surveys. (Commitment C157). Storage of stockpiles within this buffer area will be restricted, and may only occur on a temporary basis as a function of watercourse crossing works. In addition, Arrow is committed to locating soil stockpiles away from watercourses and wetlands to reduce potential for sediment runoff to enter the watercourse or wetland (Commitment C170). The final placement of stockpiles to be stored on private property will be agreed with the landholder and documented as part of the conduct and compensation agreement. If stockpiles are to be stored within a road reserve, the final placement will be agreed with the relevant road authority (whether local, state or federally controlled).
R9068	S023	Will historical and future activities associated with disturbance of underground layers of rock etc. cause earthquakes or other catastrophic problems in the long term?	EIS Chapter 12, Section 12.3.1	As detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.3.1, the geology of the project development area is relatively simple, with basement rocks overlain by deep sediments with volcanic intrusions. Compared to the rest of Australia, the area has a moderate level of earthquake activity. A recent study has been undertaken investigating the relationship between the hydraulic fracturing process and noticeable seismic activity. This has concluded that hydraulic fracturing is not a significant mechanism for inducing felt earthquakes (Davies et. al., 2013). Note that as Arrow will enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079), no influence on seismicity is expected.
R9069	S050, S051, S141, S144	Not comfortable with comments regarding the general management measures and management of land degradation as there is no genuine commitment by Arrow, just 'where practicable' or 'to the greatest extent practicable'. These so called commitments are in no way binding and can be	EIS Chapter 13, Section 13.6.1 SREIS Chapter 2, Section 2.3	Statutory information requirements, including management measures will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required. In addition, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (to well sites and along pipelines). Arrow will clearly identify the

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Issue No.	Submission No.	Issue	Reference	Responses
R9069	S050, S051, S141, S144	changed to our detriment. There are no absolute assurances that Arrow can operate in a manner that avoids degradation of high quality agricultural land.		outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures (Commitment C084). The terms of these discussions will stipulate rehabilitation requirements agreed between Arrow and the landholder. Commitments have been made on the basis that in the vast majority of cases, these management measures can be implemented. The use of 'where practicable' or 'to the greatest extent practicable' is included to cover those circumstances where management measures may not be feasible or able to be implemented as stipulated, due to other constraints; for example, weather or seasonality issues, or specific land use on properties that requires a different approach.
R9070	S108	The recommended rehabilitation and mitigation measures associated with geology, landform and soils often use the terminology 'with landholder consultation'. The terminology 'landholder consultation and consent in writing' should be used otherwise landholders have no mandated role or veto over that is being conducted on their land.	–	Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (to well sites and along pipelines). Arrow will clearly identify the outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures (Commitment C084). The terms of these discussions will stipulate rehabilitation requirements agreed between Arrow and the landholder.
R9071	S150	Mitigation measures are too general. There is no feedback mechanism that relates soil reporting and detailed technical assessments to potential impacts and mitigation measures.	EIS Chapter 12, Section 12.1	Due to the site-specific nature of erosion and sediment control, controls will be tailored to reflect the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan. Site specific conditions will be discussed with landholders as part of the land access negotiations. The terms of conduct and compensation agreements will stipulate rehabilitation requirements agreed between Arrow and the landholder.
R9072	S108	The technical report identified that prior to mitigation measures, land degradation could be a project-wide impact. The EIS does not detail how these potential impacts may be mitigated on a catchment-wide basis.	EIS Chapter 12, Section 12.6, Attachment 8	The mitigation measures detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 and other mitigation measures summarised in EIS Attachment 8, Commitments will apply to the whole project development area, including the catchments within that area, where their application will be relevant in avoiding, mitigating or managing an impact.
R9073	S162	The EIS does not have satisfactory strategies to mitigate environmental impacts on the cracking-clay floodplains east of the Condamine River.	EIS Chapter 12, Section 12.6	EIS Chapter 12, Geology Landform and Soils, Section 12.6 presents the measures Arrow will adopt to mitigate impacts on vertosols (cracking clays). These measures are in line with practices used in the area to successfully rehabilitate and restore these soils to their former use, as demonstrated by Arrow at consultation and on their website. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been

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R9073	S162			successfully rehabilitated and has been farmed for over 20 years.
R9074	S024, S026, S036, S057, S081, S083	The characteristics of Clay Alluvial Plains as described in EIS Chapter 12, Table 12.4 are not correct. They are susceptible to flooding, not only near the Condamine River and its tributaries, but over their entire extent.	EIS Chapter 4, Section 4.1.3 and Chapter 12, Section 12.3.6, Table 12.4	The distribution of the clay alluvial plains terrain unit is mapped in EIS Chapter 12, Geology, Landform and Soils, Figure 12.4, showing that this terrain unit is concentrated along the Condamine River and its tributaries, as is flooding within the project development area (presented in EIS Chapter 4, Environmental Social and Economic Context, Figures 4.6 and 4.7). The characteristics of the clay alluvial plains presented in EIS Chapter 12, Geology, Landform and Soils, Table 12.4 summarises the key properties of this unit, and reflects that it is susceptible to flooding, which primarily occurs along the Condamine River and its tributaries.
R9075	S162	EIS Chapter 12 understated the properties of the black cracking clays.	EIS Chapter 12, Section 12.3.3	The soil characteristics of cracking clays presented in EIS Chapter 12, Geology, Landform and Soils, Section 12.3.3 are average values which take into account a variety of properties over a large project area. It is recognised that smaller or greater values may be observed in different areas of the project development area.
R9076	S086	Backfill and rehabilitate trenches and drilling sumps as drilling sumps on strategic cropping land could permanently alienate the soil.	EIS Chapter 13, Section 13.6.2	Arrow will use surface tanks (not pits) to manage drilling muds on black soils when drilling production wells (Commitment C096).
R9077	S086	Commitment C071 'backfilling to preconstructed levels' needs to be changed to state that 'backfilling to original sedimentary layers and soil densities'.	EIS Chapter 9, Section 9.6, Chapter 13, Section 13.6.4	Arrow will minimise the disturbance footprint and vegetation clearing (Commitment C020). Arrow will also compact padding material and subsoils used to backfill pipeline trenches to reduce settling, and limit compaction to no deeper than 0.5 m below natural surface level (Commitment C119). The density of soils used in backfilling activities will be determined by the level of compaction required to restore the original surface profile. There will be an inspection program implemented following backfilling activities to check that rehabilitation objectives have been met, and the agreed land use is restored.
R9078	S162	In reference to EIS Chapter 12, Section 12.2, once land is rehabilitated after decommissioning does it remain on the contaminated land register? If so what are the management implications for this, and is it then the state's or landholders responsibility and liability to maintain the contaminated land register provisions.	EIS Chapter 12, Section 12.6, Figures 12.5, 12.6	The potential for Arrow's activities to result in a property becoming listed on the Contaminated Land Register (CLR) are low, given that application of the contaminated land strategies in EIS Chapter 12, Geology Landform and Soils, Figures 12.5 and 12.6 detail how development on these sites (if present within the project development area) will be avoided or managed. Once Arrow commences activities, the application of control measures detailed in EIS Section 12.6 will assist in managing the potential for project activities to result in contamination, and therefore the potential for land parcels to require listing on the CLR. If the site is listed on the CLR, the site will have proven contamination issues that are causing, or may cause serious environmental harm or public health risk, and that action needs to be taken to remediate or manage the land. Arrow will carry out corrective actions immediately upon the identification of

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R9078	S162			any contamination of soil or groundwater that has occurred as a result of project activities (Commitment C038). Remediation goals including the identification of proposed land uses will be determined as part of a Remediation Action Plan (RAP) which would be developed should land contamination occur. These goals may include remediation to a level that would allow the land parcel(s) to be removed from the Environmental Management Register or CLR. A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP.
R9079	S010	Arrow does not understand the characteristics of the soil and how difficult it will be to rehabilitate after their intrusion.	EIS Chapter 12, Section 12.6.2	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow will develop a rehabilitation plan based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070). Site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods that are to be used. Further details on how Arrow will rehabilitate land used for project activities will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required.
R9080	S123	Careful design and planning needs to ensure that earthworks put in place do not result in additional detrimental effect to the surrounding landscape. Avoidance, mitigation and management measures should address how potential adverse impacts, including those associated with earthworks, can be avoided, minimised or managed.	EIS Chapter 8, Chapter 12, Section 12.6.2 and Chapter 18	Arrow will use constraints mapping as described in EIS Chapter 8, Environmental Framework, to inform site selection and avoid environmentally sensitive areas and significant landform features. EIS Chapter 12, Geology, Landform and Soils, Section 12.6.2 outlines avoidance, mitigation and management measures that will be implemented for activities that have the potential to impact on geology, soil and landform values, including through ground disturbance (earthwork) activities. Mitigation measures required to protect or enhance landscape and visual values within the project development area are detailed in EIS Chapter 18, Landscape and Visual Amenity.

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Issue No.	Submission No.	Issue	Reference	Responses
R9081	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050,	Arrow should be conditioned to ensure that there is no way hydrotest water or wastes generated from 'pigging' can escape and contaminate surrounding land.	SREIS Chapter 3, Section 3.6.2	As set out in SREIS Chapter 3, Project Description, Section 3.6.2, water used for hydro-testing pipelines will be diverted to holding dams for reuse or treatment and/or discharge. Pigging wastes will be disposed of onsite in a wastewater treatment facility, or taken to an offsite licensed waste facility.
R9082	S002, S009, S010, S018, S020, S034, S037, S039, S050, S053, S055, S059, S064, S065, S069, S070, S076, S085, S088, S095, S096, S097, S108, S114, S140, S152, S154, S167	Landholders have significant concerns with the proposal to use gravel outside existing farm roadways, as it would appear to be impossible to fully remove the gravel from the floodplain soils after the infrastructure is no longer required. A condition should be applied to regulate the use of gravel or other road based material on the floodplain soils.	EIS Chapter 12, Section 12.6.2 and Chapter 13, Section 13.6.1 SREIS Chapter 3, Section 3.4.6	The use of aggregate material is discussed in SREIS Chapter 3, Project Description, Section 3.4.6. Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines). Arrow will clearly identify the outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures (Commitment C084). In many cases, where aggregate is used, and with landholder approval, those components of the project (e.g., access tracks) may remain in place after completion of the project. Where the aggregate material requires removal after project-related infrastructure is no longer required, the area will be rehabilitated. Arrow will develop a rehabilitation plan based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070). These site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plan will be developed prior to commencing ground disturbance activities, and will detail the procedures and methods used.
R9083	S024, S026, S036, S057, S072, S081, S083, S162	If successful rehabilitation of vertosol soils is not possible, then project development activities must be prohibited in these areas.	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow will be conditioned by the regulator under the environmental authority. These conditions will enforce protection of environmental values, and may include areas where development is prohibited.
R9084	S014, S044, S050	If the project is approved, we request the administering authority impose conditions that exclude development on the Clay Alluvial Plains as identified in Figure 12.4 Terrain Unit I, until	–	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area

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Issue No.	Submission No.	Issue	Reference	Responses
R9084	S014, S044, S050	rehabilitation methods are proven by independent soil experts.		along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow will be conditioned by the regulator under the environmental authority. These conditions will enforce protection of environmental values, and may include areas where development is prohibited.
R9085	S157	The use of surface containers to collect drilling fluids at the surface (pitless drilling) should be conditioned to avoid contamination of soils and water.	SREIS Chapter 2, Section 2.3	Further details on Arrow's management measures, including inspection and monitoring, will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required. Arrow must comply with the conditions of the EA for the project. These conditions will enforce protection of environmental values, and incorporate communication procedures and feedback mechanisms for inspection, monitoring and reporting.
R9086	S021, S024, S026, S036, S038, S057, S069, S081, S083, S086, S146	Commitment C042 states 'design infrastructure located in cracking clays to withstand the differential shrink-swell ground movement.' How will Arrow design infrastructure to withstand this differential shrink-swell ground movement?	–	Arrow will design, construct and maintain the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2.0, or relevant Australian standards (Commitment C444) including those pipelines built on cracking clays to reduce the potential for failure. In addition, landholders will be consulted during field planning to determine land use practices and unique local knowledge, and pipelines will be buried to a depth that reduces the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities to alert operators to faults within the gathering network.
R9087	S021	Commitment C034 states 'develop an erosion and sediment control plan and install and maintain appropriate site-specific controls.' What are the site specific controls?	EIS Chapter 12, Section 12.1 and Chapter 13, Section 13.6.4	Due to the site-specific nature of erosion and sediment control, controls will be tailored to reflect the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan. Site specific conditions will be discussed with landholders as part of the land access negotiations.
R9088	S021, S088	Commitment C056 states 'avoid mounding of soil along pipelines in irrigated paddocks, to the greatest extent practicable, allowing for settlement of backfill.' What is the 'the greatest extent practicable'? To the greatest extent practicable is not an absolute commitment or obligation to avoid impacts.	EIS Chapter 12, Section 12.6.2	Arrow will avoid impacts in the first instance. Where this is not possible, potential impacts will be reduced. Site specific impacts caused by soil mounding along pipeline routes in the vicinity of irrigated paddocks, and the required mitigation measures will be determined during the land access negotiation process. These site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The agreed outcomes of these negotiations will be documented prior to the

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R9088	S021, S088			commencement of ground disturbance works, and referred to during construction, operation and decommissioning activities. Commitments have been made on the basis that in the vast majority of cases, these management measures can be implemented. The use of 'where practicable' or 'to the greatest extent practicable' is included to cover those circumstances where management measures may not be feasible or able to be implemented as stipulated, due to other constraints; for example, weather or seasonality issues, or specific land use on properties that requires a different approach.
R9089	S021	Commitment C057 states 'conduct pipeline construction to minimise the duration of exposure of soils.' What is the minimum duration?	EIS Chapter 12, Section 12.6.2	The appropriate duration of soil exposure is related to a number of factors, including the soil type and weather conditions during ground disturbance works. These site specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The agreed outcomes of these negotiations will be documented prior to the commencement of ground disturbance works, and referred to during construction, operation and decommissioning activities.
R9090	S021	Commitment C059 states 'avoid excessive watering of saline soils to reduce leaching of salts and rising groundwater.' What level of watering is considered excessive?	EIS Chapter 12, Section 12.6.2	The appropriate level of watering is related to specific properties of the soils to be watered. As the development progresses and Arrow determines where water will be applied to soils within the project development area, statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required.
R9091	S021	Commitment C060 states 'avoid excessive watering of surface-crusting soils to reduce crust formation.' What level of watering is considered excessive?	EIS Chapter 12, Section 12.6.2	The appropriate level of watering is related to specific properties of the soils to be watered. As the development progresses and Arrow determines where water will be applied to soils within the project development area. Statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required.
R9092	S021	Commitment C061 states 'provide regular access points to pipeline construction ROWs to limit rutting and compaction of soils from vehicles travelling along the ROW.' How regular will the access points be?	EIS Chapter 12, Section 12.6.2	These site-specific details will be provided as the development progresses, and infrastructure locations are determined and negotiated with landholders. The agreed outcomes of these negotiations will be documented prior to the commencement of ground disturbance works, and referred to during construction, operation and decommissioning activities.
R9093	S021	Commitment C062 states 'strip, salvage and stockpile topsoil near the work site separately to subsoils (in consultation with landholders). Ensure topsoil stockpiles have a maximum height of 2 m, where the future use is intended for rehabilitation, and are protected from erosion.' Can soil be stockpiled on the floodplain?	EIS Chapter 12, Section 12.6.2	Soil can be stockpiled on the floodplain in consultation with landholders. Soil stockpiles will be protected with suitable erosion and sediment control measures in accordance with the erosion and sediment control plan. Where relevant, the Strategic Cropping Land Standard Conditions Code for Resource Activities (DNR, 2012) will be met.

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Issue No.	Submission No.	Issue	Reference	Responses
R9094	S134	Commitment C505 states 'inspect erosion and sediment control measures following significant rainfall events to ensure effectiveness of measures is maintained.' Arrow to provide additional information of the monitoring and inspection measures to be undertaken in C505.	SREIS Chapter 2, Section 2.3	Further details on Arrow's management measures, including inspection and monitoring, will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany the environmental authority (EA) or EA amendment application(s), as required. Arrow must comply with the conditions of the EA for the project. These conditions will enforce protection of environmental values, and incorporate communication procedures and feedback mechanisms for inspection, monitoring and reporting. Erosion and sediment control plans will detail suitable monitoring and inspection requirements in accordance with Best Practice Erosion and Sediment Control (IECA, 2008).
R9095	S134	Commitment C506 states 'inspect pipeline ROWs routinely until ground stabilisation and natural revegetation or pasture grasses or crops are established.' Arrow to provide additional information of the monitoring and inspection measures to be undertaken in this commitment.	SREIS Chapter 2, Section 2.3	Further details on Arrow's management measures, including inspection and monitoring, will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s), as required. Arrow must comply with the conditions of the EA for the project. These conditions will enforce protection of environmental values, and incorporate communication procedures and feedback mechanisms for inspection, monitoring and reporting.
R9096	S002, S003, S009, S018, S020, S032, S039, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S085, S087, S095, S096, S097, S098, S114, S139, S140, S149, S152, S154, S167	How will access to an infield well be managed during the irrigation season, when soils will be saturated? What process will be put in place to ensure emergency access to a well, even during the irrigation season?	EIS Chapter 13, Section 13.6	Landholders will be consulted during field planning to determine land use practices and locations of infrastructure in order to reduce the risk of damage to saturated soils. Site access, including arrangements for emergency access will be discussed with landholders as part of the negotiation of conduct and compensation agreements. Arrow has set out a number of proposed performance objectives to reduce impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6. Under performance objective 8, Arrow will seek to locate wells, gathering lines and associated access tracks in a manner that does not significantly interfere with the swept paths (effective coverage) of centre-pivot and lateral and low-pressure boom irrigators. Under performance objective 11, access tracks developed in cultivation paddocks will be designed to maintain the existing hydrologic and hydraulic regime of the site. Arrow is reviewing the best methods to limit and manage soil compaction around project-related infrastructure including when soils are saturated. Arrow will suspend works during rainfall events that will compromise erosion and sediment control or leading to rutting or compaction (Commitment C105).

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R10001	S010, S014, S034, S044, S050, S051, S067, S069, S078, S099, S104, S108, S112, S118, S130, S134, S145, S146, S150, S162, S165	<p>General concerns about the large areas of strategic cropping land (SCL) that would be affected by the project, particularly the vertosols on the Darling Downs that access the Condamine Alluvium for irrigation and drinking water supplies, and the risk of permanent alienation.</p> <p>In accordance with the SCL Policy if considered 'relevant development' Arrow's proposed development should avoid locating or impacting on SCL, unless Arrow can demonstrate 'exceptional circumstances' it will not be permitted to develop on SCL unless 'the site can be fully restored to SCL condition'.</p> <p>The project should not be considered an 'exceptional circumstance' under the SCL Act. Due to the available gas resources elsewhere. Any disturbance or impacts on soils of land designation as SCL will seriously interfere with sustainable farming practices.</p> <p>The project should not proceed on SCL. It should be mandatory that Arrow won't place facilities on SCL.</p>	<p>EIS Chapter 13, sections 13.4.7 , 13.6 and Chapter 12, Section 12.4</p> <p>SREIS Chapter 2, Section 2.4.1</p>	<p>The purpose of the Strategic Cropping Land Act 2011 (Qld) (SCL Act) and the associated State Planning Policy 1/12: Protection of Queensland's Strategic Cropping Land 2013 (SPP 1/12) is to protect land that is highly suitable for cropping; manage the impacts of development on that land; and preserve the productive capacity of that land for future generations.</p> <p>Under the SCL Act and SPP 1/12, development is considered to have a permanent impact on land if carrying out the development impedes the land from being cropped for at least 50 years; being restored to its pre-development condition; or the activity involves open cut mining or the storage of mine wastes.</p> <p>Development is considered to have temporary impact if it does not have a permanent impact or it is a type prescribed under a regulation.</p> <p>It is Arrow's intention to avoid the placement of central gas processing facilities (CGPFs) and water treatment facilities on strategic cropping land (SCL). Wells, gathering lines and access tracks are proposed on SCL. Gathering lines will be rehabilitated following installation of the pipes and ancillary infrastructure (low point drains, high point vents, gas and water nodes) enabling former land uses to resume and continue for the duration of coal seam gas production from the associated production wells. Production wells will typically be decommissioned after 15 to 20 years of operation when gas resources are exhausted or become uneconomic to extract. The wells will be decommissioned in accordance with relevant guidelines. Access tracks, if not required by the landholder, will be removed and the land rehabilitated to its pre-development condition.</p> <p>Any resource activities that will have a permanent or temporary impact on SCL or potential SCL must be assessed under the SCL Act. A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the Strategic Cropping Land Act 2011 (Qld) and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the SCL Standard Conditions Code for Resource Activities.</p> <p>As set out in Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Arrow has made 12 commitments to coexistence on IFL in the Surat Basin which are detailed on Arrow's website. These include no permanent alienation of IFL.</p>
R10002	S108	<p>Catchment-wide mitigation strategies for the protection of strategic cropping land do not consider the very sophisticated land management system already in place. This is evident in the speed at which the area recovered from the 2011 floods. This coordinated approach has been</p>	<p>EIS Appendix F, Section 3</p>	<p>Noted. This publication was considered in the preparation of EIS Appendix F, Agricultural Report, Section 3. It will also be considered when preparing procedures to be included in environmental management plans for construction and operation and maintenance activities of the project.</p>

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R10002	S108	managed through the Department of Environment and Resource Management (DERM)(now EHP) and the Condamine Alliance. Details of the techniques developed in the area are contained in the publication: Biggs A, Coutts A, Harris PS, editors. 1999. (1999) Central Darling Down Land Management Manual: Department of Primary Industries.		
R10003	S024, S026, S079, S081, S099, S146, S162	<p>Concern that assessment of 'development type' (related to permanent and temporary impacts) of wells, gathering systems, pipelines, and facilities is incorrect. Believe that wells, gathering lines and pipelines should be type 2c permanent impact activity, due to the need for gravel pads that will not be able to be rehabilitated and potential for leaking, pigging and venting of coal seam water contaminating soils.</p> <p>Arrow's assessment of the project infrastructure that triggers relevant development types is incorrect (from State Planning Policy 1/12). At this time, Arrow does not know whether the land can be fully restored after development has ceased, and depending on the nature of the soils, project infrastructure may also be a 2c development according to State Planning Policy 1/12.</p> <p>A reassessment of the potential of the various project development activities to trigger relevant development types under SPP 1/12 needs to be undertaken, taking into account the information provided in EIS Chapter 12, Geology, Landform and Soils and EIS Appendix E, Geology, Landform and Soils Impact Assessment, regarding potential impact to soils.</p>	<p>EIS Chapter 13, Section 13.1</p> <p>SREIS Chapter 2, Section 2.4.1</p>	<p>Noted. Arrow stated in EIS Chapter 13, Agriculture, Section 13.1 that the Surat Gas Project has the potential to trigger development types 1 and 2c, with wells, gathering systems and pipelines being type 1 developments and production facilities being type 2c developments. These types are defined under SPP 1/12 as:</p> <p>Type 1: Development that causes temporary diminished productivity—where development that impacts upon the soil resource and/or prevents cropping activity, but where the land can be fully restored following cessation of the use.</p> <p>Type 2c: a development that causes long-lasting impacts that prevents or reduces cropping capability such as subsidence, changes to the soil structure or contamination (e.g. minerals extraction).</p> <p>Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.</p>
R10004	S010, S041, S079, S086, S099, S108, S141, S144, S157	<p>The impact of 800 m grids on strategic cropping land (SCL) and the broader floodplain has not been adequately addressed in the EIS and further impacts of 'in-fill' operations has also not been addressed. Will in-fill wells be used on intensively farmed good quality agricultural land, at any stage? Provide details of proposed in-fill gas well spacing. Production wells would in effect render the farming systems impossible to operate. Even if wells are spaced 800 m apart, they will impose unacceptable</p>	<p>EIS Chapter 13, Section 13.6</p> <p>SREIS Chapter 3, Section 3.4.1</p>	<p>SREIS Chapter 3, Project Description, Section 3.4.1 clarifies Arrow's position on infilling.</p> <p>The grid of production wells may be drilled in sequence, or in stages to enable learning from the performance of early wells with a wide spacing, before adding remaining wells to complete the grid (this historically has been referred to as infilling). The most favourable reserves are initially targeted, with infill drilling occurring where production is less than predicted or yields deplete over time. Infill drilling may reduce the well spacing presented in the EIS but will be on average 800 m. As part of the 12 commitments made to coexistence on intensively farmed land (IFL) in the Surat Basin, Arrow has</p>

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R10004	S010, S041, S079, S086, S099, S108, S141, S144, S157	constraints on land use and flood management. Additional in-fill wells would exacerbate the problem and take the land out of agriculture production well beyond the life of the project, and the 50 years defined in the <i>Strategic Cropping Land Act 2011</i> (Qld). Every additional well makes farmers less productive. An environmental authority for the project must prohibit the drilling of in-fill wells on SCL.		committed to maximise spacing between wells on IFL (between 800 m and 1.5 km). The use of deviated drilling technology may allow the surface well pad sites for multi-well pads to be separated over a distance of up to 2,000 m where practicable. Siting of gas field infrastructure will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Arrow has set out a number of proposed performance objectives to reduce impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6.
R10005	S079	Is our assumption correct for intensively cropped, good quality agricultural land and strategic cropping land (irrigated and non-irrigated) falling within the 'class of C' in EIS Chapter 15, Table 15.6 Proposed buffer distances from the environmentally sensitive area (ESA) boundary? Where do the boundary lines lie for Class C proposed buffer distances? If we are Class C, then is it right to assume that only low-impact activities can be performed within the boundary?	EIS Chapter 15, Table 15.6 and Chapter 17, Section 17.1	EIS Chapter 15, Surface Water, Section 15.6, Table 15.6 does not relate to good quality agricultural land or strategic cropping land. The categories listed pertain to environmentally sensitive areas (ESAs) as defined under the <i>Environmental Protection Act 1994</i> (Qld). Further explanation of ESAs is provided in EIS Chapter 17, Terrestrial Ecology, Section 17.1.
R10006	S050, S086, S108, S123, S150	Concerns that this proposal will cause permanent alienation of this strategic cropping land (SCL) and its water source. These concerns are based on the Australian Society for Soil Science (ASSSI) submission to the senate committee inquiry into the impacts of mining in the Murray Darling Basin in response to the draft SCL bill. The ASSSI submission indicates that the SCL areas are scarce, and potential impacts from permanent alienation or severely reduced productivity after rehabilitation are substantial. There is concern regarding the alienation of agriculture particularly in the SCL and it is recommended that Arrow provide information regarding proposed well spacing based on sensitivity of landscapes. If needed this should also include areas of further avoidance.	EIS Chapter 13, Section 13.6 and Appendix F, Section 8.5 SREIS Chapter 3, Section 3.4.1	As per EIS Chapter 13, Agriculture, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from, IFL. 'Trigger maps' that identify potential strategic cropping land (SCL) have been prepared by EHP (formerly DERM). These maps indicate, at a landscape scale, the expected extent of SCL and are based on current land, soil and climate information. The extent of SCL will be determined at a local scale, with site investigations forming the basis for inclusion or exclusion of this land type. EIS Appendix F, Agriculture Report, undertaken as part of the EIS indicates that good quality agricultural land (GQAL) covers approximately 59% of the project development area with the balance comprising other agricultural areas, crown land, state forest and industrial areas. Potential SCL comprises approximately 49% of the project development area and is mostly coincident with GQAL. SREIS Chapter 3, Project Description, Section 3.4.1 clarifies Arrow's position on well spacing. The EIS conceptualised that vertical wells be drilled with a separation distance between wells averaging a minimum of 800 m across the project development area. The use of deviated drilling technology may allow the

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R10006	S050, S086, S108, S123, S150			<p>surface well pad sites for multi-well pads to be separated over a distance of up to 2,000 m where practicable.</p> <p>The grid of production wells may be drilled in sequence, or in stages to enable learning from the performance of early wells with a wide spacing, before adding remaining wells to complete the grid (this historically has been referred to as infilling). The most favourable reserves are initially targeted, with infill drilling occurring where production is less than predicted or yields deplete over time. Infill drilling may reduce the well spacing presented in the EIS but will be on average 800 m. As part of the 12 commitments made to coexistence on intensively farmed land (IFL) in the Surat Basin, Arrow has committed to maximise spacing between wells on IFL (between 800 m and 1.5 km).</p>
R10007	S014, S044	<p>The assumption is made that intensively farmed land, good quality agricultural land (GQAL) and strategic cropping land (SCL) would all coincide but statements made in this EIS would suggest that Arrow may not agree with this opinion. Referring back to EIS Section 13.4.7, Extent of Disturbance to Good Quality Agricultural Land and Potential Strategic Cropping Land, this section suggests that all types of infrastructure associated with coal seam gas may be located on either GQAL or SCL, despite (Commitment C092).</p>	<p>EIS Attachment 8 and Chapter 13, Section 13.4.7</p> <p>SREIS Chapter 2, Section 2.4.1</p>	<p>Arrow does distinguish between intensively farmed land (IFL), strategic cropping land (SCL) and good quality agricultural land (GQAL). GQAL, as set out in the Planning Guidelines: The Identification of Good Quality Agricultural Land (DPI and DHLGP, 1993) is land which is capable of sustainable use for agriculture, with a reasonable level of inputs, and without causing degradation of land or other natural resources.</p> <p>SCL, Queensland's best cropping land under State Planning Policy (SPP) 1/12, is considered a finite resource that must be conserved and managed for the longer term. SPP 1/12 states that as a general aim, planning and approval powers should be used to protect such land from those developments that lead to its permanent alienation or diminished productivity.</p> <p>IFL is considered by Arrow to be a subset of SCL. It refers to land actively being used for broad acre cropping, using either dry land or irrigated farming practices and having been altered to suit those cropping purposes—e.g., laser levelled, irrigation channels and existing dams. For the purposes of Arrow's petroleum tenures, Arrow's tenure, IFL applies to areas over the Condamine Alluvium, on Authority to Prospect (ATP) 683 and 676.</p> <p>To clarify Arrow's intentions with regard to the placement of project infrastructure on IFL, SCL and GQAL:</p> <ul style="list-style-type: none"> • Arrow will ensure dams for coal seam gas water and brine are not constructed on IFL (Commitment C092). • Arrow will not locate major infrastructure facilities (e.g., central gas processing facilities) on IFL as part of the 12 commitments that Arrow has made to coexistence on IFL in the Surat Basin. It is Arrow's intention to avoid locating CGPFs on GQAL and SCL. • Wells, gathering lines and access tracks are proposed on IFL, SCL and GQAL. Gathering lines will be rehabilitated following installation of the pipes and ancillary infrastructure (low point drains, high point vents, gas and water nodes) enabling former land uses to resume and continue for the duration of coal seam gas production from the associated production wells. Production wells will be decommissioned after 15 to 20 years of operation when gas resources are exhausted or become uneconomic to extract. The wells will be

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R10007	S014, S044			decommissioned in accordance with relevant guidelines. Access tracks, if not required by the landholder, will be removed and the land rehabilitated to its pre-development condition. 'Trigger maps' that identify potential SCL have been prepared by EHP (formerly DERM). These maps indicate, at a landscape scale, the expected extent of SCL and are based on current land, soil and climate information. The extent of SCL will be determined at a local scale, with site investigations forming the basis for inclusion or exclusion of this land type.
R10008	S050, S053, S065, S085, S095, S096, S097, S114, S139, S146, S154, S167	EIS Section 12.6.1, General Measures pays no regard to strategic cropping land legislation and should be revised to include the legislation.	EIS Chapter 13, sections 13.1 and 13.6 SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3 and Attachment 7, Section 1.2.1	The legislative context for strategic cropping land (SCL) is provided in the EIS Chapter 13, Agriculture, Section 13.1. An update has been provided in SREIS Chapter 7, Agriculture, Section 7.3. As discussed in SREIS Attachment 7, Section 1.2.1, at the time the SREIS was being prepared, the Queensland Government was reviewing all state interests and in the process of preparing a single state planning policy (SSPP) which will outline the state's position about matters of state interests. The new SSPP is due for release in mid-2013 and will supersede previous state planning policies. The Queensland Government will prepare guidelines to assist with the interpretation of the new SSPP. Arrow will review this material once the SSPP takes effect and this may have implications for the conduct of Arrow's activities.
R10009	S026, S069, S081, S095, S162	Other locations for coal seam gas development are available Approximately 40% of this project development area is not classed as category A or B good quality agricultural land and the other proponents have already received state and federal government approval. Concern that the impacts on high value cropping land is potentially much greater than on land used for extensive grazing or similar.	EIS Chapter 13, Section 13.7	Noted. Key strategies for reducing impacts to strategic cropping land (SCL) and intensively farmed land (IFL) include the siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, and locating production facilities on less productive land, i.e., not IFL. Arrow will ensure that site selection considers low value agricultural land in preference to high value agricultural land, to reduce potential residual impacts to land use (EIS Chapter 13, Agriculture, Section 13.7).
R10010	S011, S024, S026, S069, S079, S081, S162	Where is the overriding need for the development in terms of public benefit? There are multiple sites elsewhere considering that the area is good quality agricultural land (GQAL) and highly productive? A cost benefit analysis of the project on GQAL must be undertaken separate from the whole to determine whether there is an overriding need for the project. In the absence of such a study, and considering that according to SPP 1/92 additional weight needs to be given to agriculture when considering development approvals, the project must not be allowed to proceed in areas of GQAL at this time.	EIS Chapter 13, Section 13.3 and Appendix F, sections 4 and 5 and Appendix O, Section 5.13	A cost benefit analysis was undertaken for the EIS, the methodology of which is set out in Appendix D to EIS Appendix O, Economic Impact Assessment. The findings of the cost benefit analysis are discussed in EIS Appendix O, Section 5.13. The sustainable development of resources in the public interest of Queensland provides broad benefits to the state and Australia in terms of economic development and diversification of industry which will reduce the impact of drought in the region. Arrow recognises the concerns of the community and is working with the community and landholders to resolve how their issues can be addressed during the design, construction and operation of the project. EIS Chapter 13, Agriculture provides a summary of the agricultural values within and surrounding the project development area and an assessment of

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R10010	S011, S024, S026, S069, S079, S081, S162			the potential for these values to be affected by direct and indirect impacts associated with the construction, operations and decommissioning phases of the project. The detailed findings of the project's impacts on agriculture are set out in the EIS Appendix F, Agricultural Report.
R10011	S110	There are conflicting commitments in the EIS and during public consultation regarding avoiding impacts to strategic cropping land (e.g., Arrow stated there would be no development east of Cecil Plains until 2023 and no development on floodplain until 95% of concerns were addressed). Arrow has not provided a response to concerns.	EIS Appendix B, Appendices	At public consultation in June 2010 (EIS Appendix B, Consultation Report, Appendices), Arrow made the statement that the company would not develop on intensively farmed areas until it had satisfactorily addressed concerns, however planning would need to take place and access to land will be required for such activities as establishing groundwater monitoring bores. Arrow continues to engage with the Condamine River floodplain community through a range of forums including Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups.
R10012	S134	Arrow to provide updated figures showing good quality agricultural land and strategic cropping land once site selection is final.	SREIS Chapter 7, Figure 7.1	Since the publication of the EIS, potential sites have been identified for four central gas processing facilities and a temporary workers accommodation facility. SREIS Chapter 7, Figure 7.1 shows these sites relative to good quality agricultural land and strategic cropping land. Information on these and any further sites will be provided with subsequent environmental authority (EA) or EA amendment application(s) in accordance with the EHP Guideline "Application requirements for petroleum activities".
R10013	S050, S081, S099, S109, S143, S145, S150, S162	Concerned that the project imposes a natural gas extraction system on a closely settled, intensive agricultural system. EIS Appendix F, Agricultural Report identified potential impacts but lacks site specificity. On page 67 (Conclusions) of the Agriculture Report four broad impact areas have been identified but not expanded in terms of location, severity and extent. In EIS Chapter 13, Section 13.4.7 and also in EIS Chapter 27, Section 27.2.2 Arrow states is not yet possible to assess the impact of the project development on strategic cropping land (SCL) and specific agricultural enterprises, as locations of proposed infrastructure are not known. This quote by itself shows the incomplete nature of the EIS. If Arrow cannot and has not assessed the project's impacts to good quality agricultural land (GQAL) and SCL, it is not possible at this time to conclude that the Surat Gas Project complies with State Planning Policy 1/92 and State Planning Policy	EIS Chapter 13, sections 13.4.7 and 13.6 SREIS Chapter 3, Section 3.4.1	Potential strategic cropping land (SCL) is generally coincident with good quality agricultural land (GQAL). As described in EIS Chapter 13, Agriculture, Section 13.4.7, SCL and GQAL cover 49% and 59% of the project development area respectively (with SCL generally coincident with GQAL). Based on Arrow's experience, operation of a typical production well, together with associated gas and water gathering infrastructure, will disturb 2% to 3% of land across the development. As part of the 12 commitments Arrow has made to coexistence on intensively farmed land (IFL) in the Surat Basin, Arrow has committed to minimise its operational footprint to less than 2% of the total IFL area. As gas field development is based on a series of production spaces, this estimate provides an indication of the overall area of disturbance across the development area. Rehabilitation of gathering systems and temporary workspaces around wells will reduce this area. Arrow is also exploring means to further increase production spacing through the use of multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1) which will further reduce the area of disturbance. The use of deviated drilling technology may allow the surface well pad sites for multi-well pads to be separated over a distance of up to 2,000 m where practicable. As set out in Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal

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R10013	S050, S081, S099, S109, S143, S145, S150, S162	1/12. There is a lack of information regarding the percentage of the project area that fall on SCL. Arrow needs to assess the impact to SCL and GQAL classes 1 and 2. These areas are 49% and 59% of the total EIS area respectively. Given the large proportion of GQAL and SCL within the project development area, more detailed assessments are required. Arrow should not be able to move onto these floodplains without a lot more information. The project is an inappropriate land use on GQAL and SCL. No development should be undertaken on SCL.		seam gas development planning, IFL and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Arrow will be required to comply with the Strategic Cropping Land Act 2011 and the Strategic Cropping Land Standard Conditions Code for Resource Activities. In addition to a range of other mitigation and management measures as set out in EIS Chapter 13, Agriculture, Section 13.6, twelve performance-based objectives have been proposed that provide an opportunity for the proponent to work with the landholder to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices.
R10014	S014, S015, S044, S079, S086, S108, S157	Arrow state the impact is only 2 to 3% of any 160 acre (65 ha) area, while 49% of the area to be impacted is land that is likely to be confirmed as strategic cropping land (SCL). This statement is misleading and the project will have much greater impacts than the area stated by Arrow, as it will affect the entire farming practice and their way of life. This project has the ability to cause permanent alienation therefore it should not be granted approval on SCL.	EIS Chapter 13, sections 13.4.7 and 13.6	The 2 to 3% potential impact across the development is based on Arrow's current operations and their experience in working with landholders to site coal seam gas infrastructure on their properties. This approximation includes the production well site and associated gathering line and access track footprints. As part of the 12 commitments made to coexistence on intensively farmed land (IFL) in the Surat Basin. Arrow has committed to minimise its operational footprint to less than 2% of the total IFL area. Although 49% of the project development area is included in potential strategic cropping land (SCL), as defined in trigger maps, only a small proportion of that land will be affected by wells, gathering lines and access tracks. Production facilities (central gas processing facilities, water treatment plants and brine treatment plants) will be sited to avoid SCL and IFL. Arrow will negotiate conduct and compensation agreements with landholders. This will include discussion and agreement on where coal seam gas infrastructure should be located on the property, and will take into consideration existing and proposed farm management practices and plans. EIS Chapter 13, Agriculture, Section 13.6 sets out the performance objectives for project activities on good quality agricultural land (GQAL), SCL and IFL, as well as a suite of management measures to enable the project activities to meet the performance objectives. Arrow will be required to comply with the Strategic Cropping Land Act 2011 and the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10015	S034, S039, S109, S150	EIS does not sufficiently address the risks of development on the intensively farmed floodplain overlaying a substantial potable water aquifer. Concerned over areas where there is an overlapping of risks in the eastern portion of the development area (maps are attached to	EIS Chapter 14 and Chapter 15 SREIS Chapter 8 and Chapter 9	Groundwater and surface water are integral to agriculture and the management of these environmental values are addressed in the EIS Chapter 14 Groundwater, and Chapter 15, Surface Water. Further details of potential project impacts to these environmental values are presented in SREIS Chapter 8, Groundwater and Chapter 9, Surface Water.

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R10015	S034, S039, S109, S150	<p>submission). The maps demonstrate an area where strategic cropping land occurs on the floodplain and has underlying aquifers for existing allocated uses, and is also an area of high biodiversity priority. These areas represent a “no go zone” where minimisation and rehabilitation of risks is unlikely to mitigate risks satisfactorily. The possibility to impact water availability for the region could cause Australia to lose the use of some highly productive food production areas. Approval should not be granted for extraction activities and associated infrastructure until it can be clearly demonstrated that gas extraction does not pose a risk to natural resources, including the Condamine Alluvium and SCL soils on the Condamine Floodplain.</p>		
R10016	S150	<p>In order to return the soil close to its original state (and cropping potential), entire soil profiles would have to be cut into layers and then stockpiled separately and replaced, in order, after mining. Mixing of the soil profile is likely to result in depression of crop yields due to the increased salinity and exchangeable sodium percentage in the upper layers. Due to the location of proposed facilities in flood prone areas, soil stockpiles (composed of soils from good quality agricultural land and strategic cropping land areas) would be prone to damage by flooding.</p>	<p>EIS Chapter 12, Section 12.6 and Chapter 13, Section 13.6 SREIS Attachment 4</p>	<p>Noted. Arrow has made a number of commitments in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 and Chapter 13, Agriculture, Section 13.6.4 which seek to protect the soil profile. Arrow has committed (Commitment C034) to develop an erosion and sediment control plan and install and maintain appropriate site-specific controls. Commitment C062 has been amended to state 'strip, salvage and stockpile topsoil near the work site separately to subsoils (in consultation with landowners). Ensure topsoil stockpiles are designed in accordance with best practise principles and are protected from erosion by wind, rain and floods. Stockpile topsoil to a maximum height of 2.5 m to maintain fertility and if stored for extended periods, sow with appropriate vegetation to maintain organic matter and microbial activity.' Where Arrow is operating on strategic cropping land it will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities, which set out the requirements for rehabilitation. Regardless, conditions of Arrow's environmental authority require the company to rehabilitate land to the predisturbed land use unless otherwise agreed to between Arrow, the landholder and the administering authority.</p>
R10017	S118, S157	<p>Areas that contain smaller family farms that have intensive farming practices, meaning they are located in close proximity to each other, are closely settled and cultivate most of their existing holdings. Any siting of gas well infrastructure would have serious implications for ones neighbour. Arrow should commit to ensuring that landowner negotiations and the location of infrastructure on</p>	<p>EIS Chapter 13, Section 13.6</p>	<p>Arrow will avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (EIS Chapter 13, Agriculture, Section 13.6, performance objective 2 – Intensive Farming Operations). Siting of gas field infrastructure will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Arrow has set out a number of proposed performance objectives</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10017	S118, S157	properties will involve consideration of impacts on neighbouring properties.		to reduce impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This will balance individual needs of landholders with the needs of neighbouring properties.
R10018	S002, S003, S004, S006, S009, S017, S018, S020, S030, S032, S034, S037, S039, S050, S053, S058, S059, S064, S065, S069, S070, S071, S076, S085, S088, S095, S096, S097, S098, S114, S116, S139, S140, S152, S154, S162, S167	Approval of this EIS must exclude the floodplain east of the Condamine River in ATP683 until Arrow has met its previously made commitments to this community (i.e., stakeholders concerns are satisfactorily addressed). The regulator should adopt the precautionary principle to the project acknowledging: • That intensively farmed land constitutes a unique and resilient agro ecosystem, containing environmental values that cannot be mitigated when impacted. • Adaptive management techniques cannot restore and rehabilitate the soils to their original condition. A condition should be applied to delay the project by at least 20 years in areas overlying the Condamine Alluvium to develop a better understanding of potential impacts, especially on intensively farmed land and waters of highly productive aquifers such as the Condamine Alluvium.	EIS Chapter 13, Section 13.6 and Chapter 14 SREIS Chapter 7 and Chapter 8	EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report provides a summary of the agricultural values within and surrounding the project development area and an assessment of the potential for these values to be affected by direct and indirect impacts associated with the construction, operations and decommissioning phases of the project. EIS Chapter 14, Groundwater and SREIS Chapter 8, Groundwater discusses the potential impacts of the project to groundwater. As per EIS Chapter 13, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Arrow continues to engage with the Condamine River floodplain community through a range of forums including Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups.
R10019	S050, S099, S139, S157, S162	Permanent impacts to strategic cropping land (SCL) have not been fully assessed (specifically in the context of the <i>Strategic Cropping Land Act 2011</i> (Qld) and State Planning Policy 1/12). It is unsatisfactory that SCL is not considered in this EIS, and it is also a breach of answering the Surat Gas Project Terms of Reference (Section 4.2.2.1). Considering this, 'during the development associated with the project' implies allowing Arrow to act on SCL without the appropriate scrutiny, especially during the project assessment stage. The document does not meet the conditions of DERM's terms of reference especially in addressing Section 4.2.2.1, Land Use Suitability and is incomplete without assessment of SCL legislation.	EIS Chapter 13, sections 13.1 and 13.6 SREIS Chapter 2, Section 2.4.1 and Chapter 3, Figure 3.1 and Chapter 7, Section 7.3	The legislative context for strategic cropping land (SCL) is provided in the EIS Chapter 13, Agriculture, Section 13.1. A further update is provided in SREIS Chapter 2, Project Approvals, Section 2.4.1 and SREIS Chapter 7, Agriculture, Section 7.3. At the time that the Surat Gas Project EIS was submitted to DERM for adequacy review against the Terms of Reference (which is required before public exhibition), the <i>Strategic Cropping Land Act 2011</i> (Qld) had not been enacted. Management and mitigation measures for project activities on strategic cropping land were set out in EIS Chapter 13, Agriculture, Section 13.6. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities. In the case of the Jimbour Plain, further knowledge of the gas reserves has been gained since the publication of the EIS and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.

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Issue No.	Submission No.	Issue	Reference	Responses
R10019	S050, S099, S139, S157, S162	The EIS does not meet the terms of reference requirements in Section 4.2.2.1, Land Use Suitability by not assessing the impact of Arrow's project on SCL. The statement shows Arrow to have breached its duty in responding to the terms of reference, especially since the document states many times that 49% of Arrow's tenure is considered SCL. As Arrow's tenement in Jimbour Floodplain is completely SCL and alluvial floodplains, it is disappointing that some of the chapters (EIS Chapters 13, 17, 18, 19 and 20) did not ground truth near or on similar type landscape - east of Cecil Plains.		
R10020	S002, S003, S004, S006, S009, S014, S018, S019, S020, S032, S034, S037, S039, S044, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S085, S086, S087, S088, S096, S097, S098, S114, S116, S139, S140, S149, S152, S154, S167	Medium-pressure pipelines would be an unreasonable interference on good quality agricultural land (GQAL) and strategic cropping land (SCL). Suggesting that landholders would ever have to consider shortening irrigators, increasing headlands and downsizing equipment is ridiculous and must be considered an unacceptable and unreasonable interference. The Queensland Government even recognises alterations to laser levelled fields and irrigation infrastructure to incorporate coal seam gas infrastructure will cause significant financial losses and should be avoided (Department of Employment, Economic Development and Innovation, 2010). If the project is approved, we request the administering authority impose conditions that prevent coal seam gas activities from interfering with cultivated paddocks so landholders are not required to downsize fields and add headlands to accommodate a gasfield and reduce the productivity of GQAL and SCL.	EIS Chapter 13, Section 13.6	Site access will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Arrow has set out a number of proposed performance objectives to minimise impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6. As set out in EIS Chapter 13, Section 13.6.2, Arrow will consult with landowners on the most appropriate method to minimise disruption to cultivation paddocks (including the introduction of additional headlands) and loss of productive land in controlled-traffic paddocks. The following measures will be considered in reaching agreement: <ul style="list-style-type: none"> • Locate infrastructure (in order of preference) outside of cultivation areas, in headlands or at the corners of cultivated areas, adjacent to boundary fences or in areas of a paddock with the lowest-quality soil. • Locate access tracks in headlands or adjacent to boundary fences. • Utilise existing access tracks and trafficked areas. • Align gathering lines and new access tracks parallel to the direction of cultivation, soil conservation structures and controlled traffic runs and avoid perpendicular or lateral connections. • Lay out drill pads in accordance with landowner requirements, subject to safety requirements, to reduce the overall impact on cultivation, where practicable (Commitment C088). Environmental conditions which are considered relevant to the project will be set by EHP and other agencies. Property-specific requirements will be discussed with landholders during the negotiation of conduct and compensation agreements and pipelines will be designed to account for land use in accordance with applicable standards including the depth of burial which is influenced by traffic on the easement, e.g., cotton pickers.
R10021	S001	Opposed to the project on any good quality agricultural land and the project scale should be	EIS Chapter 5, Section 5.7.1 and	Noted. Disruption to activities on agricultural land from wells and access tracks will be greatest during construction and will generally decrease during

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Issue No.	Submission No.	Issue	Reference	Responses
R10021	S001	reduced on all other land and the impacts carefully monitored.	Chapter 13, Section 13.6	operations. For example, the typical short-term construction footprint for each single production well is 1 ha and the operational footprint will be reduced in accordance the Strategic Cropping Land Standard Conditions Code for Resource Activities. The design life of facilities is 25 years with wells having a production life of 15 to 20 years and is dependent on depletion rate of the gas reserves years. Decommissioning and rehabilitation will be a progressive process. Following decommissioning, the well sites will be rehabilitated to a standard consistent with the surrounding land use, or as agreed with the landholder (EIS Chapter 5, Project Description, Section 5.7.1). No permanent alienation or diminished productivity of the land is expected (EIS Chapter 13, Agriculture, Section 13.6). Arrow has made 12 commitments to coexistence on intensively farmed land (IFL) in the Surat Basin which are detailed on Arrow's website and which include no permanent alienation of IFL. Arrow recognises the concerns that the community has in relation to the project and is working with the community and landholders to resolve how their interests can be considered and addressed through planning, design, construction and operation of the project.
R10022	S010	The EIS conclusion says that the "project should proceed". While the EIS does deal with the impacts in some of the proposed areas it falls far short of satisfactorily understanding and dealing with impacts on intensively farmed and irrigated strategic cropping land and the Condamine Alluvium.	EIS Chapter 13, Section 13.4.7 and Chapter 27 and Appendix F	EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report detail the predominant farming types and practices carried out on intensively farmed and irrigated strategic cropping land (SCL) and the constraints imposed by topographic features and inappropriately placed coal seam gas infrastructure. The impacts of not integrating coal seam gas development with agricultural activities are understood and are presented in the chapter and appendix. However, Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land (IFL) and irrigated SCL. Arrow is working with the Arrow Intensively Farmed Land Committee to work through these issues to demonstrate how development can and will occur including addressing such issues as Area Wide Planning and protocols for use of access tracks. Arrow is required to negotiate conduct and compensation agreements with landholders and through negotiation address issues specific to each property in agreeing the location of infrastructure and protocols for access and work during construction, operation and maintenance activities.
R10023	S007, S008, S014, S015, S044, S046, S066, S075, S077, S079, S082, S091, S104, S111, S112, S157	As the major cause of death in today's world is starvation, it is important that the Darling Downs should continue to produce food. It is unrealistic to reduce or interfere in any way with current food production operations because of population increases. Why is Queensland allowing such huge, rampant and seemingly uncontrolled mining on our	EIS Chapter 13, Section 13.6 and Appendix F	Australia's conventional gas resources are depleting and this has prompted exploration and development of unconventional gas resources including coal seam gas. Coal seam gas development was initially pursued to serve domestic markets and is evolving to serve export markets, principally through the export of LNG. The importance of the Darling Downs for agriculture for food and fibre production is understood and recognised in EIS Chapter 13, Agriculture and

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R10023	S007, S008, S014, S015, S044, S046, S066, S075, S077, S079, S082, S091, S104, S111, S112, S157	<p>limited productive rural land? Concerned the EIS does not address future of food producing land, of which Queensland has so little. Allowing a project of this size to go ahead in a food producing area would be short-sighted given Australia's dryness. If this project is approved and strategic cropping land is diminished or permanently contaminated, where will the future food and fibre production come from and at what cost? There are large gas reserves outside the nation's food bowl and coal seam gas drilling should be confined there until the risk to reward ratio is better known.</p>		<p>EIS Appendix F, Agricultural Report. The regional, state and national economies rely on both resources and consequently, Arrow is pursuing the Surat Gas Project on the basis that it coexists with agriculture. EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report have identified potential impacts on agricultural land and proposed management measures which address objectives (Section 13.6) designed to protect good quality agricultural land (GQAL), strategic cropping land (SCL) and intensively farmed land (IFL), as defined by Arrow. Arrow continues to engage and work with various committees to better understand how to integrate coal seam gas development with agricultural activities in the region. Arrow is working with the Arrow Intensively Farmed Land Committee to demonstrate how development can and will occur including addressing such issues as Area Wide Planning and protocols for use of access tracks.</p>
R10024	S014, S024, S026, S044, S079, S081, S139, S162	<p>What bearing does the good quality agricultural land (GQAL) policy and the strategic cropping land (SCL) legislation have on the placement of project infrastructure on cultivation and irrigation areas? Will dams, facilities, lay-down areas and camps etc. be located on land classified as intensive farming areas? What coal seam gas activity will not adversely (being unfavourable or opposing one's interest) affect our intensively cropped GQAL and SCL? Arrow must undertake an assessment of the impact of project development on GQAL and SCL. This must include the development of a hypothetical desktop gas fields with wells, gathering lines, access roads, field compression facilities, medium pressure pipelines, power lines, marker posts and rights of way areas and input thereafter from agricultural experts on the impacts to GQAL and SCL. If the project is approved, we request the administering authority impose conditions that prevent project infrastructure from interfering with irrigation infrastructure on GQAL and SCL.</p>	<p>EIS Chapter 13, Section 13.4.7 SREIS Chapter 2, Section 2.4.1 and Chapter 3, Section 3.4.1</p>	<p>Intensively farmed land (IFL) is considered by Arrow to be a subset of strategic cropping land (SCL). It refers to land actively being used for broad acre cropping, using either dry land or irrigated farming practices and having been altered to suit those cropping purposes—e.g., laser levelled, irrigation channels and existing dams. For the purposes of Arrow's petroleum tenures, Arrow's tenure, IFL applies to areas over the Condamine Alluvium, on Authority to Prospect (ATP) 683 and 676. To clarify Arrow's intentions with regard to the placement of project infrastructure on IFL, SCL and good quality agricultural land (GQAL):</p> <ul style="list-style-type: none"> • Arrow will ensure dams for coal seam gas water and brine are not constructed on IFL (Commitment C092). • Arrow will not locate major infrastructure facilities (e.g., central gas processing facilities) on IFL as part of the 12 commitments made to coexistence on IFL in the Surat Basin. It is Arrow's intention to avoid locating CGPFs on GQAL and SCL. • Wells, gathering lines and access tracks are proposed on IFL, SCL and GQAL. Gathering lines will be rehabilitated following installation of the pipes and ancillary infrastructure (low point drains, high point vents, gas and water nodes) enabling former land uses to resume and continue for the duration of coal seam gas production from the associated production wells. Production wells will be decommissioned after 15 to 20 years of operation when gas resources are exhausted or become uneconomic to extract. The wells will be decommissioned in accordance with relevant guidelines. Access tracks, if not required by the landholder, will be removed and the land rehabilitated to its pre-development condition. <p>Siting of gas field infrastructure will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Based on Arrow's experience, operation of a typical production well, together with associated gas and water gathering infrastructure, will</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10024	S014, S024, S026, S044, S079, S081, S139, S162			disturb 2% to 3% of land. As part of the 12 commitments made to coexistence on IFL in the Surat Basin. In the case of IFL, Arrow has committed to minimise its operational footprint to less than 2% of the total IFL area. As gas field development is based on a series of production spaces, this estimate provides an indication of the overall area of disturbance across the development area on SCL. Rehabilitation of gathering systems and temporary workspaces around wells will reduce this area. Arrow is also exploring means to further increase production spacing through the use of multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1) which will further reduce the area of disturbance. Any resource activities that will have a permanent or temporary impact on SCL or potential SCL must be assessed under the SCL Act. A resource authority will be required before activities can be undertaken. SCL requirements will be addressed in the environmental authority (EA) or EA amendment application processes, as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Environmental conditions which are considered relevant to the project will be set by EHP and other agencies. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10025	S026, S069, S081, S141, S144, S162	The EIS makes no reference to standard conditions codes for impacts on strategic cropping land (SCL). The SCL Standard Conditions Code for resource activities states that 'well heads should not be located on the inside area of an pivot or lateral move irrigation footprint'.	SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3	The Strategic Cropping Land Standard Conditions Code for Resource Activities was released after the EIS was prepared. Arrow will comply with the standard conditions in developing the Surat Gas Project. SREIS Chapter 7, Agriculture includes reference to the standard conditions and particular requirements that affect how Arrow proposes to undertake development.
R10026	S118	Based on the intent of the Strategic Cropping Land policy, strategic cropping land in the area should be excluded from the Surat Gas Project.	EIS Chapter 13, Section 13.4.7 SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3	'Trigger maps' that identify potential strategic cropping land (SCL) have been prepared by EHP (formerly DERM). These maps indicate, at a landscape scale, the expected extent of SCL and are based on current land, soil and climate information. The exact extent of SCL will be determined at a local scale, with site investigations forming the basis for inclusion or exclusion of this land type. Any resource activities that will have a permanent or temporary impact on SCL or potential SCL must be assessed under the SCL Act. Arrow, under its environmental authority (EA) or EA amendment application(s), will need to separately address SCL requirements, as set out in the <i>Strategic Cropping Land Act 2011</i> (Qld). Part 3 of the Strategic Cropping Land Standard Conditions Code for Resource Activities (released after the EIS was prepared) applies to buried linear infrastructure including gathering lines and powerlines, well leases and access tracks.
R10027	S108	The <i>Strategic Cropping Land Act 2011</i> (Qld) and its	SREIS	Where Arrow is operating on strategic cropping land it will be required to

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R10027	S108	guidelines require that strategic cropping land be rehabilitated to its original state. Arrow's terminology of 'return the disturbed land to as near as possible the pre-disturbed condition' is unacceptable.	Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3	comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which sets out the requirements for rehabilitation. Regardless, conditions of Arrow's environmental authority require it to rehabilitate land to the pre-disturbed land use unless otherwise agreed to between Arrow, the landholder and the administering authority. In addition, the environmental authority sets out the requirements for rehabilitation.
R10028	S010, S014, S026, S044, S051, S081, S088, S108, S110, S116, S139, S141, S144, S146, S157, S162	<p>The extraction of coal seam gas on irrigated strategic cropping land is incompatible with Section 804 of the Petroleum and Gas Act.</p> <p>Sections 804 and 805 of the <i>Petroleum and Gas (Production and Safety) Act 2004</i> raises the question 'what is an unreasonable interference or a reasonable excuse'? Landholders in this region would consider coal seam gas activities as having 'unreasonable interference':</p> <ul style="list-style-type: none"> • On the effectiveness of soil conservation structures or irrigation infrastructure (moving irrigators). • Through the introduction of headlands. • Resulting from coal seam gas activities in controlled traffic paddocks. • To field sizes and cultivation areas. • To have to shorten the boom of overhead irrigation infrastructure. <p>The EIS states Arrow is 'to maintain the operation and effectiveness of soil conservation structures'. Soil conservation structures and irrigation infrastructure are virtually the same on floodplain farms. Interference will affect the water use efficiency of irrigated farms.</p> <p>The EIS has not demonstrated 'how coal seam gas activities can be compatible with existing agricultural land use and not cause unreasonable interference'? Government should set conditions to ensure Section 804 of the act is upheld and to describe how no unreasonable interference will be applied and how the criteria of 'where practicable' stated in Arrow's commitments, will be assessed, with equal weighting to landholder contribution.</p>	SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3	<p>Section 804 of the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) requires that a petroleum authority holder carry out its activities in a way that does not unreasonably interfere with others conducting lawful activities.</p> <p>Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure and will address impacts through compensation.</p> <p>Arrow is working with the Arrow Intensively Farmed Land Committee to resolve how and when it will operate on intensively farmed land to not unreasonably interfere with the ability to farm the property. Arrow will work with landholders to develop workable protocols.</p> <p>Commitments have been made on the basis that in the vast majority of cases, these management measures can be implemented. The use of 'where practicable' or 'to the greatest extent practicable' is included to cover those circumstances where management measures may not be feasible or able to be implemented as stipulated, due to other constraints; for example, weather or seasonality issues, or specific land use on properties that requires a different approach.</p>
R10029	S150	DERM (now EHP) must decide whether a minimum	SREIS	Noted. Any resource activities that will have a permanent or temporary impact

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R10029	S150	impact to strategic cropping land (SCL) is acceptable, and when an impact on water supporting SCL will trigger the proposed Strategic Cropping Land Policy's intent to protect SCL.	Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3 and Attachment 7, Section 1.2.1	on strategic cropping land (SCL) or potential SCL must be assessed under the Strategic Cropping Land Act. A resource authority will be required before activities can be undertaken. SCL requirements will be built into the environmental authority (EA) or EA amendment application processes, as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. As discussed in SREIS Attachment 7, Legislation and Policy Update, Section 1.2.1, at the time the SREIS was being prepared, the Queensland Government was reviewing all state interests and in the process of preparing a single state planning policy (SSPP) which will outline the state's position about matters of state interests. The new SSPP is due for release in mid-2013 and will supersede previous state planning policies. The Queensland Government will prepare guidelines to assist with the interpretation of the new SSPP. Arrow will review this material in mid-2013 once the SSPP takes effect and this may have implications for the conduct of Arrow's activities.
R10030	S108	Generally concerned about the difficulty in rehabilitating disturbed soils and agro ecosystems and the effect of coal seam gas related infrastructure on the farming operations. The placement of production wells in agroecosystem associated with strategic cropping land will make them more vulnerable to erosion from storm events and flooding.	EIS Chapter 13, Section 13.6	The siting of wells will be undertaken in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation (EIS Chapter 13, Agriculture, Section 13.6).
R10031	S134	Arrow to identify detailed strategies to avoid or minimise the impact on good quality agricultural land and strategic cropping land and resulting agricultural production and agricultural enterprises.	EIS Chapter 13, Section 13.6	In addition to a range of other mitigation and management measures as set out in EIS Chapter 13, Agriculture, Section 13.6, twelve performance-based objectives have been proposed that provide an opportunity for the proponent to work with the landholder to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices.
R10032	S134	Arrow to assess the current impacts on good quality agricultural land and strategic cropping land from the 350 existing Arrow wells in Toowoomba Regional Council. This data will help identify future impacts in the absence of finalised site infrastructure locations.	EIS Chapter 13, Section 13.4.7 SREIS Chapter 3, Section 3.4.1	The assessment of existing production wells lies outside the scope of this EIS. However, as noted in EIS Chapter 13, Agriculture, Section 13.4.7, Arrow's experience indicates that construction of a typical production well, together with associated gas and water gathering infrastructure, will disturb 2% to 3% of land. As part of the 12 commitments made to coexistence on intensively farmed land (IFL) in the Surat Basin, Arrow has committed to minimise its operational footprint to less than 2% of total IFL area. As gas field development is based on a series of production spaces, this estimate provides an indication of the overall area of disturbance across the gas field area. Rehabilitation of gathering systems and temporary workspaces around wells reduce this area. Arrow is also exploring means to further increase production spacing through the use of multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1) which will further reduce the area of

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R10032	S134			disturbance.
R10033	S114, S141, S144	There are no absolute assurances that Arrow can operate in a manner that avoids degradation of high quality agricultural land. The Codes appear to be something that Arrow aspires to, but provides no commitment that they will be fully achieved.	EIS Chapter 13, sections 13.6 and 13.7 SREIS Chapter 2, Section 2.4.1	EIS Chapter 13, Agriculture, Section 13.7 acknowledges that the success of rehabilitation will determine whether there are any residual impacts from project activities and their severity. The type and location of coal seam gas infrastructure (e.g., production wells, gathering systems, pipelines, or production facilities) will determine the techniques, effort and investment required to achieve successful rehabilitation and reinstatement of former land use and productivity. The Strategic Cropping Land Standard Conditions Code for Resource Activities was released after the EIS was prepared. Part 3 of the code requires financial assurances for particular activities. This is in addition to other assurances required under an environmental authority.
R10034	S050, S086	The Jimbour Plain does not have areas outside of cultivation except public roadways, we don't have corners in cultivation, we use strip farming with controlled traffic and GPS technology, we don't have boundary fences or areas of low quality soil to locate the proposed infrastructure. EIS Chapter 13, Section 13.6.2, Reduced Productivity and Increased Costs, highlights Arrow's lack of understanding of the farming systems we use and the fragile nature of our land. Arrow should not be permitted to proceed on strategic cropping land, especially on the Jimbour Plain, until certain of the impact on the land, and landholders are satisfied their concerns have been addressed.	SREIS Chapter 3, Figure 3.1	In the case of the Jimbour Plain, further knowledge of the gas reserves has been gained since the publication of the EIS and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1. Arrow continues to engage with the Condamine River floodplain community through a range of forums including Arrow Intensively Farmed Land Committee, Arrow Surat Community Reference Group, Gas Fields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups to resolve concerns about project activities on strategic cropping land.
R10035	S134, S159	Arrow must comprehensively address strategic cropping land (SCL) and good quality agricultural land (GQAL) policies, including cumulative impacts on agricultural land. Given the percentage of the project development area made up of SCL and GQAL, the cumulative effect of multiple developments on high value agricultural land is extensive.	EIS Chapter 13, Section 13.6 SREIS Chapter 2, Section 2.4.1	EIS Chapter 13, Agriculture noted that 2 to 3% of land is potentially impacted by coal seam gas infrastructure. This is based on Arrow's current operations and their experience in working with landholders to site coal seam gas infrastructure on their properties. Although 49% of the project development area is included in potential strategic cropping land (SCL), as defined in trigger maps, only a small proportion of that land will be affected by wells, gathering lines and access tracks. Production facilities (central gas processing facilities, water treatment plants and brine treatment plants) will be sited to avoid SCL and IFL. As part of the 12 commitments that Arrow has made to coexistence on IFL in the Surat Basin, Arrow has committed to minimise its operational footprint to less than 2% of the total IFL area. Arrow will negotiate conduct and compensation agreements with landholders. This will include discussion and agreement on where coal seam gas infrastructure should be located on the property, and will take into consideration existing and proposed farm management practices and plans.

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R10035	S134, S159			EIS Chapter 13, Agriculture, Section 13.6 sets out the performance objectives for project activities on good quality agricultural land (GQAL), SCL and IFL, as well as a suite of management measures to enable the project activities to meet the performance objectives.
R10036	S123	<p>Department of Agriculture, Fisheries and Forestry requests baseline data and monitoring from agricultural trials.</p> <p>Since Arrow has been operating in parts of the region for over 6 years, it is reasonable to expect that within this time, Arrow have undertaken agricultural trials.</p> <p>Any information pertaining to the beneficial use approval is requested as well as the results of application and disturbance recovery.</p>	EIS Chapter 5, Section 5.6.4	Arrow has only recently commenced its first agricultural demonstration using coal seam gas water on its Theten property in late December 2012. The site has been set up in advance of the project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the Australia and New Zealand Environment and Conservation Council guidelines which outline specific soil and water parameters. Arrow provides updates on work at Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure.
R10037	S088	Expresses “total fear” that should the project be approved, Australia will lose one of its most valuable farming assets.	EIS Chapter 5, Section 5.7 and Chapter 13 SREIS Chapter 7, Section 7.6.2	<p>Noted. Disruption to activities on agricultural land from wells and access tracks will be greatest during construction and will generally decrease during operations. For example, while the typical short-term construction footprint for each single production well is 1 ha and the operational footprint is reduced in accordance the Strategic Cropping Land Standard Conditions Code for Resource Activities. The design life of facilities is 25 years with wells having a production life of 15 to 20 years and is dependent on depletion rate of the gas reserves years. Decommissioning and rehabilitation will be a progressive process (EIS Chapter 5, Project Description, Section 5.7). Following decommissioning, the well sites will be rehabilitated to a standard consistent with the surrounding land use, or as agreed with the landholder (Section 5.7.1). No permanent alienation or diminished productivity of the land is expected.</p> <p>Arrow recognises the concerns that the community has in relation to the project and is working with the community and landholders to resolve how their interests can be considered and addressed through planning, design, construction and operation of the project.</p> <p>Arrow has only recently commenced its first agricultural demonstration using coal seam water on its Theten property in late December 2012 (SREIS, Chapter 7, Agriculture, Section 7.6.2). The site has been set up in advance of the project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the Australia and New Zealand Environment and Conservation Council guidelines which outline specific soil and water parameters. Arrow provides updates on work at</p>

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R10037	S088			Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure.
R10038	S108	The submission indicates that where the technical report states that use of cracking and Gilgai clays as backfill could be problematic, that this means that fill must be imported to stabilise the ground. This is interpreted to prevent full restoration to pre-disturbance strategic cropping land conditions.	EIS Chapter 5, Section 5.7 and Chapter 13 SREIS Chapter 2, Section 2.4.1	No permanent alienation or diminished productivity of the land is expected. Pipelines and gathering lines will be designed to take into consideration gilgai where applicable. Arrow will aim to return to the original contours during rehabilitation. Following decommissioning, the well sites will be rehabilitated to a standard consistent with the surrounding land use, or as agreed with the landholder (EIS Chapter 5, Project Description, Section 5.7.1). The Strategic Cropping Land Standard Conditions Code for Resource Activities sets out rehabilitation requirements for activities undertaken on strategic cropping land.
R10039	S002, S003, S009, S011, S014, S018, S019, S020, S025, S032, S037, S039, S044, S050, S053, S055, S059, S064, S065, S070, S076, S079, S085, S087, S088, S095, S096, S097, S098, S108, S114, S123, S139, S140, S143, S150, S152, S154, S167	Concerned that land deemed strategic cropping land (SCL) will not be able to be reinstated or fully restored to the SCL condition due to the number of activities proposed in this EIS that involve major soil movement, long term storage ponds or facilities or have inherent contamination risks. Thorough and detailed rehabilitation research programmes have not yet demonstrated that mining prime agricultural land is only a temporary cessation to agricultural production and that disturbed landscapes and soils can be reconstructed to pre-mine capability and productivity. There needs to be a demonstration that areas of disturbed SCL can be restored to the original productivity for cropping. The concept of “make good” for any damage to land and waters in many cases is not physically possible. This is the case for the vertosols on the Darling Downs. Further research and assessment of impacts and potential impacts needs to be completed before any possible intrusion should be attempted on intensively farmed good quality agricultural land.	EIS Chapter 13, sections 13.6 and 13.7 SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.6	To clarify Arrow’s intentions with regard to the placement of project infrastructure on intensively farmed land (IFL), strategic cropping land (SCL) and good quality agricultural land (GQAL): <ul style="list-style-type: none"> • Arrow will ensure dams for coal seam gas water and brine are not constructed on IFL (Commitment C092). • Arrow will not locate major infrastructure facilities (e.g., central gas processing facilities) on IFL as part of the 12 commitments that Arrow has made to coexistence on IFL in the Surat Basin,. It is Arrow’s intention to avoid locating CGPFs on GQAL and SCL. • Wells, gathering lines and access tracks are proposed on IFL, SCL and GQAL. Gathering lines will be rehabilitated following installation of the pipes and ancillary infrastructure (low point drains, high point vents, gas and water nodes) enabling former land uses to resume and continue for the duration of coal seam gas production from the associated production wells. Production wells will be decommissioned after 15 to 20 years of operation when gas resources are exhausted or become uneconomic to extract. The wells will be decommissioned in accordance with relevant guidelines. Access tracks, if not required by the landholder, will be removed and the land rehabilitated to its pre-development condition. <p>As per Section 13.6, the effectiveness of the proposed environmental management controls in addressing the identified impacts is being investigated through trials and case studies that are currently focused on rehabilitation of black soils (vertosols and dermosols) and construction methods for work on those soils.</p> <p>Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area</p>

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R10039	S002, S003, S009, S011, S014, S018, S019, S020, S025, S032, S037, S039, S044, S050, S053, S055, S059, S064, S065, S070, S076, S079, S085, S087, S088, S095, S096, S097, S098, S108, S114, S123, S139,			<p>along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.</p> <p>EIS Chapter 13, Agriculture, Section 13.7 acknowledges that the success of rehabilitation will determine whether there are any residual impacts from project activities and their severity.</p> <p>The type and location of coal seam gas infrastructure (e.g., production wells, gathering systems, pipelines, or production facilities) will determine the techniques, effort and investment required to achieve successful rehabilitation and reinstatement of former land use and productivity.</p>
R10040	S002, S003, S009, S014, S018, S019, S020, S032, S037, S039, S044, S050, S053, S055, S059, S064, S065, S070, S071, S076, S085, S088, S095, S096, S097, S098, S114, S139, S140, S149, S150, S152, S154, S167	<p>Potential impacts on strategic cropping land (SCL) should be assessed prior to government assessment (not during development of the project).</p> <p>If this project is to be approved, conditions will need to be put in place to ensure there is no development on strategic cropping land until Arrow can prove it possible to rehabilitate black soil floodplain farming land back to full productive capacity (pre-existing condition) at the completion of the proposed project.</p> <p>If this project is to be approved, the requirement to fully avoid damage to high quality agricultural land must be conditioned.</p>	<p>EIS Chapter 13, Section 13.6 SREIS Chapter 2, Section 2.4.1</p>	<p>Any resource activities that will have a permanent or temporary impact on strategic cropping land (SCL) or potential SCL must be assessed under the SCL Act. A resource authority will be required before activities can be undertaken. SCL requirements will be built into the environmental authority (EA) or EA amendment application processes, as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. This will occur after the completion of the EIS process.</p> <p>Environmental conditions which are considered relevant to the project will be set by EHP and other agencies. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.</p> <p>As per Section 13.6, the effectiveness of the proposed environmental management controls in addressing the identified impacts is being investigated through trials and case studies that are currently focused on rehabilitation of black soils (vertosols and dermosols) and construction methods for work on those soils.</p> <p>Arrow has shown at consultation and on its website that vertosols black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices.</p>
R10041	S014, S044, S081, S139	<p>Will coal seam gas infrastructure impact laser levelled farming, and what steps have been taken to mitigate these impacts?</p>	<p>EIS Chapter 13, Section 13.6</p>	<p>Project activities may occur in laser levelled paddocks. However, Arrow understands that work conducted on laser levelled paddocks will potentially require tailored management measures, agreed with landholders, prior to the commencement of project activities.</p> <p>In addition to a range of other mitigation and management measures as set out in EIS Chapter 13, Agriculture, Section 13.6, twelve performance-based objectives have been proposed that provide an opportunity for the proponent</p>

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R10041	S014, S044, S081, S139			<p>to work with the landholder to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices.</p> <p>Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land and irrigated strategic cropping land. Arrow is working with the Arrow Intensively Farmed Land Committee to work through these issues to demonstrate how development can proceed, including addressing such issues as Area Wide Planning and protocols for use of access tracks.</p>
R10042	S014, S044, S081, S139	<p>Will restrictions be placed on landholders regarding access to their properties for farming practices, e.g., spraying, irrigation, harvesting?</p>	<p>EIS Chapter 13, Section 13.6</p>	<p>Land access will be negotiated with landholders, and agreed upon by both parties under the terms of a conduct and compensation agreement. This negotiation includes disclosure of Arrow's and a landholder's planned and potential activities and the notification required to each party. Arrow will seek to plan and integrate construction and operations activities with harvesting, spraying and withholding periods (Commitment C080). There may be instances when Arrow's activities will take precedence for safety reasons and these instances will be negotiated with landholders.</p>
R10043	S002, S003, S009, S018, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S085, S087, S088, S095, S096, S097, S098, S108, S114, S140, S141, S144, S149, S152, S154, S167	<p>While the intensive irrigated industry has dramatically reduced its reliance on chemicals over the past decades, it is still the case that agricultural chemical application remains an important part of the industry, and one that does not appear to be addressed in the EIS.</p> <p>Arrow's need to access coal seam gas infrastructure at any time will impact on landowners' ability to apply pest control measures (egg sprays) as part of their integrated disease and pest management plans. Spraying can only occur when the weather is suitable, and therefore it is not practical to notify Arrow that this activity is planned – because it often occurs at short notice. There are health implications of spray drift on humans and infrastructure. There is a 300 m restriction between spraying and infrastructure, and this is incompatible with coal seam gas activities. If short notice chemical application is necessary on agricultural land, will the rights of the farmer have precedence, or will Arrow have to be given significant advance warning to clear the fields? Will Arrow have to wash down their infrastructure after each agricultural chemical application?</p>	<p>EIS Chapter 13, Section 13.6 and Chapter 25, Section 25.6.3</p>	<p>Arrow will seek to plan and integrate construction and operations activities with harvesting, spraying and withholding periods (Commitment C080). This issue of short notice agricultural chemical applications has been raised with Arrow in Arrow Intensively Farmed Land Committee and Area Wide Planning meetings. Arrow understands that activities and access conditions are specific to each landholder and are negotiated individually and documented as part of a conduct and compensation agreement including notifications required. There may be instances when a landholder's activity is delayed if Arrow's activities would need to be completed before clearing a site for safety reasons.</p> <p>Arrow does not require a buffer between chemical application and its unmanned infrastructure. As part of the disclosure negotiated between Arrow and a landholder, Arrow would request the names of chemicals that could be applied so it can comply with withholding or re-entry times as outlined in each chemical's material safety data sheet (MSDS).</p>

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R10044	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S059, S064, S065, S070, S071, S076, S085, S088, S096, S097, S098, S114, S139, S140, S152, S154,	A condition should be applied to ensure that the location of infrastructure is fully negotiated with landholders prior to work commencing and any change to the agreed layouts will be deemed a material change, and would trigger a re-negotiation of the agreement.	EIS Chapter 13, Section 13.6	Arrow will comply with the provision of the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) and the Land Access Code (DEEDI, 2010a) prior to accessing private land. In accordance with these requirements, a conduct and compensation agreement (with accompanying maps of the area of interest and detail on infrastructure development) will be in place prior to the entry onto the land. The conduct and compensation agreement will include a clause which sets out the proponent and landholder's obligations and requirements in the event that the proponent materially changes the activities described in the agreement. This may lead to compensation amounts being revised and/or other actions being necessary.
R10045	S157	Free range poultry operations require secure fencing. If coal seam gas activities are brought close to free range poultry operations, fencing would be required and the maximum poultry stocking densities required by the Queensland government legislation could not be met – parcels of land would be dissected. In addition, the required buffer zones would further reduce the carrying capacity of the farm, causing subsequent reductions in farm efficiencies.	EIS Chapter 13, Section 13.6	Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076).
R10046	S011, S022	EIS Appendix F, Agricultural Report, Section 5 (Agricultural activities) outlines the existence of various livestock industries in the region, but little further consideration is given to avoidance and/or mitigation of impacts, probably due to insufficient research into the range of problems that coal seam gas activities may occur. What guarantees can be given that animal welfare (cattle, pigs, sheep, horses and poultry industries) will not be affected?	EIS Chapter 13, sections 13.4.6 and 13.6	Arrow recognises the issues associated with intensive livestock operations, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). The conduct and compensation agreement will include the disclosure of animal husbandry activities and agreed measures to safeguard livestock. Further to this, the duties of Arrow Land Liaison officers include checking on any impacts to farming and agricultural activities. With existing gas processing facilities and gas fields in the Dalby area, Arrow has successfully conducted its activities in areas used by horses and cattle for many years.
R10047	S048	Concern over impacts to livestock health and wellbeing, resulting from mining activities, e.g., livestock eating mining gear and wastes or gates being left open on people's properties.	EIS Chapter 13, sections 13.6 and 13.6.3	Arrow's approach to working on private property is based on respect to the landholder and their business interests. For this reason Arrow will have systems in place to prevent issues of concern, e.g., leaving gates open. With existing gas processing facilities and gas fields in the Dalby area, Arrow has operated on private property for many years. Arrow is experienced in the necessity of cooperating and coexisting with agricultural needs and expectations and has developed Land Access Rules to address issues of coexistence. Land access will be negotiated with landholders, and agreed upon by both

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R10047	S048			parties under the terms of a conduct and compensation agreement. This negotiation includes disclosure of Arrow's and a landholder's planned and potential activities and the notification required to each party. Arrow has set out a number of proposed performance objectives to reduce impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6. Arrow will fence the exclusion zone of production well sites to exclude unauthorised personnel, stock and wildlife from that area (Commitment C097). Arrow will also maintain a minimum separation, as agreed with the landholder, between animal enclosures and production wells and facilities (Commitment C104).
R10048	S157	The EIS does not adequately address the potential impacts of the project on animal welfare. Potential animal welfare impacts are: chicken sensitivity to light and noise, negatively impacting on their well-being and worst possible case is stressful activities leading to death; and project activities leading to biosecurity issues with the potential for death of the animals. The statement that the impact assessment can be informed by 'typical impacts of project activities' is of absolutely no assistance, because there are no significant or meaningful 'typical impacts' for poultry operations presented in the EIS. The submitter's specific poultry operations are not identified or addressed in the EIS, nor is the significance of the associated environmental values presented. The submitter has provided details of specific responses of poultry to various impact sources and could provide additional information if warranted in the SREIS.	EIS Chapter 13, sections 13.3.5, 13.4 and 13.6 and Appendix F, sections 5.6.1, 7 and 8.	EIS Chapter 13, Agriculture, Section 13.4 and EIS Appendix F, Agricultural Report, section 7 and 8 identify and describe, at a high level, the key impacts of the construction and operation of coal seam gas developments on agricultural activities. EIS Chapter 13, Section 13.3.5 and EIS Appendix F, Section 5.6.1 recognises egg production can be affected by noise and vibration as chickens are sensitive to such disturbance. Disease is also a threat and is controlled through shed hygiene. Arrow recognises the issues associated with conducting petroleum activities in areas of intensive agriculture and has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Coal seam gas impacts can be clearly defined and appropriate monitoring, reporting and management systems put in place to reduce impacts. These measures will be discussed with landholders when negotiating conduct and compensation agreements.
R10049	S072	Impacts on livestock operations have not been adequately assessed. Particularly for smaller farms where coal seam gas infrastructure would take a proportionately larger percentage of the available land. Higher impact is therefore expected on paddock sizes, shelterbelts, air flow patterns and water delivery systems.	EIS Chapter 13, sections 13.4.6 and 13.6	Much of the infrastructure is buried, and can be located to avoid or reduce impact on farming or livestock operations. Impacts will be addressed through compensation. Arrow recognises the issues associated with intensive livestock operations including piggeries and poultry (EIS Chapter 13, Agriculture, Section 13.4.6). In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076).
R10050	S011, S072, S141, S144, S157, S160	There is very little consideration of the impacts of the project on livestock farming. Arrow has failed to	EIS Chapter 13, sections 13.4.6	Arrow recognises the issues associated with intensive livestock operations including piggeries and poultry, discussed in EIS Chapter 13, Agriculture,

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Issue No.	Submission No.	Issue	Reference	Responses
R10050	S011, S072, S141, S144, S157, S160	<p>recognise the significant biosecurity risks that will be incurred from their project activities. These include impacts on Biosecurity and Animal Welfare (e.g., piggery and poultry) which may have secondary economic impacts on the farmer, industry and/or State and Federal governments. Movement of people, vehicles and heavy equipment on to food production areas will threaten the Farm Biosecurity Plan, unless the coal seam gas proponents adopt the same biosecurity measures 100% of the time. This is especially important for vehicle movements between properties in an area where 'back yard poultry' flocks are extremely common. Farm workers are at risk of dismissal for breaching the Farm Biosecurity Plan, therefore it is reasonable that any external company claiming entrance rights to intensive production areas should also be required to meet the Farm Biosecurity Plan, and failure to comply should result in the same penalties. Arrow needs to identify the biosecurity risks and effective mitigation measures for all coal seam gas activities must be developed to avoid compromising the landholder's legal obligations regarding animal welfare and biosecurity. Arrow should prepare and publish an independent report which assesses the risks to biosecurity posed by the project to intensive livestock operations due to lack of information.</p>	and 13.6	<p>Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Further to this, a range of general commitments are described in the EIS to manage biosecurity in other locations. These include:</p> <ul style="list-style-type: none"> • Inspect work sites and access routes for notifiable weeds and pest plants and animals prior to accessing the site; and if detected, manage in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008) (Commitment C098). • Maintain a minimum separation, as agreed with the landholder, between animal enclosures and production wells and facilities (Commitment C104). • Fence the exclusion zone of production well sites to exclude unauthorised personnel, stock and wildlife from that area (Commitment C097). <p>Land access conditions will be negotiated with the landholder during the preparation of the conduct and compensation agreement and will address measures regarding biosecurity including weed, seed and disease free status of vehicles accessing a landholder's property.</p>
R10051	S011, S160	<p>Poultry and pig farmers are subject to Emergency Animal Disease Response Agreement (State and Federal Government); under their direction protocols established include vehicle control, quarantine, training and recorded site accesses which have not been addressed in EIS. Roadside vegetation buffering is vital to maintain the biosecurity of piggeries. Any reduction in the buffering vegetation would decrease the biosecurity and increase the risk of disease outbreak. Construction of coal seam gas wells and infrastructure across intensive livestock farms will reduce environmental buffers, increase wild animal movement and greatly increase biosecurity risks.</p>	EIS Chapter 13, sections 13.4.6 and 13.6	<p>Arrow recognises the issues associated with intensive livestock operations (EIS Chapter 13, Agriculture, Section 13.4.6). In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Land access conditions will be negotiated with the landholder during the preparation of the conduct and compensation agreement and will address measures regarding biosecurity including weed, seed and disease free status of vehicles accessing a landholder's property.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10051	S011, S160	A 200 m buffer is insufficient to protect intensive livestock operations from biosecurity risks. Commitment C104 'Maintain a minimum separation, as agreed with the landowner, between animal enclosures and production wells and facilities' is unenforceable, and provides no protection to intensive animal producers unless the commitment is included as a condition.		
R10052	S160	Concerned that if a disease outbreak occurs on intensive pig farming operations that it would be difficult to pinpoint coal seam gas operations, and Arrow would not be held legally responsible for the loss. Concerned about disease outbreak on intensive pig farming operations caused by indirect impacts, such as the increase in feral pig movement as a result of coal seam gas activities. Such an outbreak would be difficult to prevent, and Arrow would not be held legally responsible for the loss. In the interest of biosecurity, and to prevent individual piggery owners/ operators from suffering damages that are irrecoverable from Arrow, in any application for an Environmental Authority for the Surat Gas Project, Arrow should agree to, and request from EHP (formerly DERM) a condition that Arrow will not undertake any activities within 2 km of any existing, planned or proposed pig production unit. It is unreasonable that each individual piggery operation in the project area must seek declarations in the Land Court that the conduct of coal seam gas activities will cause unreasonable interference with those individual operations.	EIS Chapter 13, sections 13.4.6 and 13.6	Arrow's approach to working on private property is based on respect to the landholder and their business interests. Arrow recognises the issues associated with intensive livestock operations, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Irrespective of this, appropriate biosecurity controls will be put in place when accessing gas resources. The conduct and compensation agreement will include the disclosure of animal husbandry activities and agreed measures to safeguard livestock. With existing gas processing facilities and gas fields in the Dalby area, Arrow has operated on private property for many years. Arrow is experienced in the necessity of cooperating and coexisting with agricultural needs and expectations and has developed Land Access Rules to address issues of coexistence.
R10053	S123	Arrow to ensure all figures and information is provided on feedlot and piggery numbers and that it is up to date and accurate. The information should also include mapping of locations of intensive animal industries if affected by the project area.	EIS Chapter 13, sections 13.4.6 and 13.6	Arrow recognises the issues associated with intensive livestock operations (EIS Chapter 13, Agriculture, Section 13.4.6). In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Consequently, further assessment has not been undertaken.
R10054	S011, S157	The EIS is bias towards farming land use, and the	EIS	Intensive livestock industries are discussed in EIS Chapter 13, Agriculture,

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Issue No.	Submission No.	Issue	Reference	Responses
R10054	S011, S157	level of detail in the EIS regarding intensive livestock industries is inadequate. This type of land use is only identified in EIS Chapter 4, Section 4.3.2, Agricultural Activity, and then again briefly in the Agricultural technical report. The EIS therefore fails to identify a highly sensitive part of the environment. Proponent must undertake accurate "boots on the ground" research into locations of livestock operations in the entire project region, and update their project planning with regards to this information. The revised information should be submitted for review before any project activities are approved.	Chapter 13, sections 13.3.5, 13.4.6 and 13.6.5 and Appendix F, sections 5.6, and 5.7.2	sections 13.3.5 and 13.4.6, and EIS Appendix F, Agricultural Report, sections 5.6, 5.6.2, and 5.7.2. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Consequently, further assessment has not been undertaken.
R10055	S072	Performance objective (2) of the agricultural chapter offers no protection to grazing livestock, which are not typically kept in 'enclosures'. The Agriculture report needs to be redone, in order to properly consider impacts on livestock farming.	EIS Chapter 13, Section 13.6	Production wells, gathering lines and access tracks may be installed on private property. Arrow will work with landholders with regard to arrangements for grazing livestock while construction activities are underway (e.g., this may involve moving stock to unaffected parts of the property for the duration of activities). Once production wells are installed, Arrow has committed to fence the exclusion zone of production well sites to exclude unauthorised personnel, stock and wildlife from that area (Commitment C097).
R10056	S011	Concerned introduction of notifiable diseases to an area of intensive livestock operations could lead to the slaughter of the flock/herd and financial devastation to the farmer, and/or industry, as well as significant costs to State and Federal governments in attempting to control the disease. The EIS doesn't address the consequences of the introduction of a disease to a farm which vary and may range from increased costs, lower production and profitability, impacts on animal welfare due to suffering disease or death, loss of organic status (if medications have to be used), impacts of staff morale, and in the worst case scenario lead to the slaughter of the flock/herd. Chicken welfare may be compromised by the introduction of dangerous or poisonous plants to the free range area.	EIS Chapter 13, sections 13.4.6 and 13.6	Arrow's approach to working on private property is based on respect to the landholder and their business interests. Arrow recognises the issues associated with intensive livestock operations including piggeries and poultry, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Irrespective of this, appropriate biosecurity controls will be put in place when accessing gas resources. The conduct and compensation agreement will include the disclosure of animal husbandry activities and agreed measures to safeguard livestock.
R10057	S014, S024, S025, S026, S034, S036,	As creator of the term 'intensively farmed land' (IFL) Arrow must define its meaning, explain the	SREIS Chapter 7, Section 7.5	Intensively farmed land (IFL) is a term defined by Arrow to recognise land actively being used for broad acre cropping, using either dry land or irrigated

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Issue No.	Submission No.	Issue	Reference	Responses
R10057	S014, S024, S025, S026, S034, S036, S044, S054, S069, S079, S081, S083, S146, S162	criteria by which it identifies IFL and identify IFL on a map. Why is there no description of IFL under the heading EIS Section 13.3.5 Agricultural Activities? Is the EIS suggesting that there is no IFL in the Surat Gas Project area? How does the definition of IFL differ from 'intensive farming operations'? Once defined and located potential impacts will then be recognised and avoidance mitigation and management methods applied.		farming practices and having been altered to suit those cropping purposes e.g., laser levelled, irrigation channels and existing dams. IFL applies to areas including the Condamine Alluvium, on Authority to Prospect (ATP) 683 and 676. For further details, refer to SREIS Chapter 7, Agriculture, Section 7.5. IFL, like strategic cropping land, will be identified and mapped at the property level, and once mapped will be taken into consideration in determining the location and arrangement of coal seam gas infrastructure on the property to be resolved through consultation with the landholder.
R10058	S024, S069, S081, S162	What were the 'non-cereal broadacre crops' that were some of the major agricultural enterprises in the region?	EIS Appendix F, Section 4 and Table 5	EIS Appendix F, Section 4, Table 5 referred to the value of non-cereal broadacre crops as published by the Australian Government for the Darling Downs statistical division (Australian Bureau of Statistics, 2000). Non-cereal broadacre crops listed in this data include hay, oilseeds, legumes for grain and cotton.
R10059	S017, S024, S026, S034, S036, S050, S054, S055, S069, S079, S081, S083, S086, S123, S130, S143, S162	EIS Chapter 4, Table 4.4, Significant crop and livestock products in and around the project development area, has not identified 'intensive cropping' as a form of agriculture, although intensive livestock industries are identified. Intensive land uses are more sensitive to planned project development than broadacre land use. This results in the sensitivity of agriculture being understated by Arrow. The EIS needs to be rewritten, clearly describing and delineating broadacre cropping and intensive cropping within the project development area. Significant products that should also be added to Table 4.4 include wheat, barley and chickpeas. It should be noted that all the crops listed in Table 4.4 can and are currently grown under either a dryland or irrigated system. Greater information requested on the type of agricultural industries, amount and locations (ground-truthed) of them. Table 4.4 does not even accurately reflect the farming operations of Arrow Energy on their own farms in our area.	EIS Chapter 4, Table 4.4 and Chapter 13, sections 13.3.5, 13.4.6 and 13.6.5 and Chapter 30 SREIS Appendix 14	EIS Chapter 4, Environmental, Social and Economic Context provided a broad overview of the project development area. The examples in the EIS Chapter 4, Table 4.4 are typical of farming operations in the region and highlight the diversity of farming practices. A more detailed description of agriculture in the region was set out in EIS Chapter 13, Agriculture, Section 13.3.5 and EIS Appendix F, Agricultural Report. The EIS describes the range of crops grown in the development area and acknowledges in some cases crops are intensively farmed. EIS Chapter 30, Glossary defines intensively farmed land, with cropped land identified as an intensive agricultural enterprise. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends.
R10060	S108	The EIS does not take into consideration the use of existing access tracks for storage of cotton modules, grain silo bags, stockpiled feedlot manure and other fertiliser materials between cropping operations. This means that a separate road will be	EIS Chapter 13, Section 13.6	The EIS recognises that each agricultural enterprise is unique and has developed particular practices to maximise the productivity of the land (EIS Chapter 13, Agriculture, Section 13.6). Proposed performance objectives include the integration of development activities (and infrastructure) with farming operations, recognising and understanding the particular farming

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Issue No.	Submission No.	Issue	Reference	Responses
R10060	S108	needed to allow access to coal seam gas infrastructure. The assessment of amount of land lost from farming because of the coal seam gas operations has not been set out in appropriate detail.		practices and property-specific development and farming plans. Arrow will consult with landholders on the location of infrastructure and on construction methods to reduce overall impacts to the farming operation, including capital and operating costs and productivity.
R10061	S123	Greater detail requested of the five field development areas and should include good quality agricultural land/strategic cropping land and the amount of land expected to be impacted upon, ways in which it will be impacted and mitigation measures and where possible, provide alternative measures.	EIS Chapter 5, Section 5.3.1 and Chapter 13, sections 13.4 and 13.6 SREIS Chapter 3, sections 3.2 and 3.4.1	At the time the EIS was published, progressive development of five development regions (Wandoan, Chinchilla, Dalby, Millmerran and Goondiwindi) was proposed (EIS Chapter 5, Project Description, Section 5.3.1). The development sequence has been revised to the progressive development of eleven drainage areas, identified by sequential numbering, that correspond with the gas reserves that will be fed into each central gas processing facility (SREIS Chapter 3, Project Description, Section 3.2). Potential strategic cropping land (SCL) is generally coincident with good quality agricultural land (GQAL). As described in EIS Chapter 13, Agriculture, Section 13.4.7, SCL and GQAL cover 49% and 59% of the project development area respectively (with SCL generally coincident with GQAL). Based on Arrow's experience, operation of a typical production well, together with associated gas and water gathering infrastructure, will disturb 2% to 3% of land. As gas field development is based on a series of production spaces, this estimate provides an indication of the overall area of disturbance across the development area on SCL. Rehabilitation of gathering systems and temporary workspaces around wells will reduce this area. Arrow is also exploring means to further increase production spacing through the use of multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1) which will further reduce the area of disturbance. Potential impacts are described in EIS Chapter 13, Section 13.4. Management and mitigation measures are described in EIS Chapter 13, Section 13.6.
R10062	S108	The generalised concept of operation given in the EIS indicates that Arrow will abolish its legal responsibilities when operating on farms with vertosols.	EIS Chapter 2, Section 2.4 SREIS Chapter 2, Section 2.4.1	In undertaking project activities, Arrow must comply with relevant standards and legislation including but not limited to the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld), <i>Environmental Protection Act 1994</i> (Qld) and <i>Strategic Cropping Land Act 2011</i> (Qld).
R10063	S166	As we cannot travel over the pad area due to pumping equipment stationed there, then further cropland is lost to allow for a track around the pad to continue the right of way.	EIS Chapter 13, Section 13.6	Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation. Primary and secondary mitigation is to be achieved through the

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Issue No.	Submission No.	Issue	Reference	Responses
R10063	S166			implementation of 12 performance-based objectives that provide an opportunity for the proponent to work with the landholders to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices (EIS Chapter 13, Agriculture, Section 13.6).
R10064	S108	EIS Chapter 13, Agriculture and Appendix F, Agricultural Report do not address issues related to weeds, their introduction, control and weed and pathogen contamination by project vehicles. (The submission provides references to recent studies about the control of weeds in the area and techniques used.)	EIS Chapter 17, Section 17.4.5	EIS Chapter 17, Terrestrial Ecology discusses issues related to weeds, including the risk of the spread of weeds due to vehicle movements (Section 17.4.5). Arrow's approach to working on private property is based on respect to the landholder and their business interests. Appropriate biosecurity controls will be put in place when accessing gas resources. Land access conditions will be negotiated with the landholder during the preparation of the conduct and compensation agreement and will address measures regarding biosecurity including weed, seed and disease free status of vehicles accessing a landholder's property.
R10065	S002, S003, S009, S018, S020, S026, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S081, S085, S087, S088, S095, S096, S097, S098, S099, S114, S116, S139, S140, S149, S152, S154, S167	Impacts on soil and production capacity of crops and economic impacts from increases in weeds in the area surrounding production wells has not been adequately addressed (including where wells are being re-worked every 2 to 3 years). How will Arrow assure the road base aggregate to be free of weed seeds and any other pests and diseases not native to our area? Note that aggregate used by Santos found to be contaminated by weed seeds, not usually found on their farm. How will Arrow ensure farm hygiene standards are maintained, and that the spread of weeds and diseases is prevented? What processes will be put in place to ensure a cotton grower's BMP accreditation is not jeopardised i.e., no pesticides will be used?	EIS Chapter 13, Section 13.6 and Chapter 16, Section 16.6 and Chapter 17, sections 17.4.5 and 17.6.3	EIS Chapter 17, Terrestrial Ecology discusses issues related to weeds, including the risk of the spread of weeds due to vehicle movements (Section 17.4.5). Arrow has made the following commitments in relation to weed management: <ul style="list-style-type: none"> • Develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Undertake species-specific management for identified key weed species at risk of spread through project activities (mesquite, parthenium, African lovegrass and lippia). Increase weed control efforts in areas particularly sensitive to invasion. The pest management plan should include, as a minimum, training, management of pest spread, management of pest infestations, requirements for crossing and working around pest fences and monitoring effectiveness of control measures (Commitment C188). • Inspect work sites and access routes for notifiable weeds and pest plants and animals prior to accessing the site; and if detected, manage in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008) (Commitment C098). • When sourcing maintenance materials, check materials such as bedding sand, topsoil and sand bags for weeds and plant materials or animal pathogens. Request a weed hygiene declaration form from the supplier where there is possible risk of contamination in products or materials (Commitment C190). • Identify declared weeds during the preconstruction clearance survey (Commitment C193) • Limit the use of herbicides in the vicinity of watercourses or within riparian zones. Use non-toxic, non-persistent (i.e., biodegradable) herbicides to treat

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Issue No.	Submission No.	Issue	Reference	Responses
R10065	S002, S003, S009, S018, S020, S026, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S081, S085, S087, S088, S095, S096, S097,			weeds, except on properties where organic or biodynamic farming is practised, for which the method of weed treatment is to be agreed with the landowner (Commitment C199). • Train field personnel to identify key pest species and to maintain constant vigilance for weeds and pest fauna species throughout the project life to ensure early detection and intervention (Commitment C259). Arrow's approach to working on private property is based on respect to the landholder and their business interests. Arrow will negotiate with individual landholders any specific requirements required to maintain best management practice compliance on their properties.
R10066	S051	There are times when stubble on farming properties has to be burned to control fungal diseases on crops, and weeds which have become resistant to herbicides. The presence of coal seam gas wells on the farm land would interfere with the way farms are run.	EIS Chapter 13, Section 13.6	Noted. Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure. With existing gas fields in the Dalby area, Arrow has experience dealing with grass and bushfires. Grass and bushfires have not significantly affected existing wells and associated infrastructure. Design and construction of Arrow's infrastructure considers the need for fire management.
R10067	S046	The storage of brine and product water may impact on properties when the water evaporates and the wastes (salt and precipitates) are dispersed over the agricultural land. The storage of brine and product water may impact animals if they seek water and are unable to get out of the storage container.	EIS Chapter 5, Section 5.2.4 SREIS Attachment 5, Section 3.3	The use of evaporation ponds for brine disposal is not considered a viable option by Arrow, nor would this align with Queensland Government policy. Arrow's preferred solution for brine disposal is to treat it for beneficial use at a selective salt recovery plant however the worst-case scenario whereby brine is transported to a registered landfill is described in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, Section 3.3. The storage of brine will occur in closed tanks or open dams, which will reduce the risk of animals becoming trapped.
R10068	S014, S044	If the project is approved we request the administering authority impose conditions that prevent dams, for coal seam gas water and brine, from being constructed on good quality agricultural land and strategic cropping land.	EIS Chapter 13, Section 13.6	Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities. It is Arrow's intention to avoid locating central gas processing facilities (including associated water treatment facilities) on good quality agricultural land and strategic cropping land. As specified in the 12 commitments that Arrow has made to coexistence on IFL in the Surat Basin, Arrow will not locate central gas processing facilities (CGPFs) on IFL. It is Arrow's intention to avoid locating CGPFs on GQAL and SCL.
R10069	S086, S154	Submitter not opposed to the coal seam gas industry, and recognises that it can co-exist with many forms of agriculture, where there is goodwill and genuine cooperation on both sides. However, they are not convinced that coal seam gas is	EIS Appendix B, Section 5.2.2 SREIS Chapter 7, sections 7.5 and 7.6	Noted. Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land and irrigated strategic cropping land. Arrow is working with the Arrow Intensively Farmed Land Committee to work through

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Issue No.	Submission No.	Issue	Reference	Responses
R10069	S086, S154	compatible with intensively farmed land conducted on the Condamine Alluvium. Concerns over Arrows very little understanding of how the nature of intensive farming and the intended project will never be able to work in conjunction with intensive farming, without having a huge impact on a farmer's ability to operate on any successful level.		these issues to demonstrate how development can and will occur including addressing such issues as Area Wide Planning and protocols for use of access tracks.
R10070	S157	EIS Chapter 13, Section 13.6, Avoidance, Mitigation and Management Measures, states 'the primary mitigation for reducing potential impacts on agricultural land and agricultural enterprises is siting of infrastructure'. This does not provide context that allows decision making, because in areas where infrastructure could not be installed may result in a higher density if infrastructure in other areas. This is fundamental problem with not properly identifying and analysing the receiving environment.	EIS Chapter 13, Section 13.6 SREIS Chapter 7, sections 7.5 and 7.6	Noted. The most effective measure for reducing impacts is however site selection in consultation with landholders, as this allows the proponent to work with landholders to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices. Infrastructure placement is considered over wider areas than individual properties, and is seeking to locate facilities on less productive land. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This planning will seek to balance individual needs of landowners with the needs of neighbouring properties and avoid fragmenting agricultural areas.
R10071	S004, S006, S014, S017, S044, S088, S110, S167	The EIS claims Arrow will maximise the opportunity to schedule development and routine maintenance activities with the cropping cycle. Cropping cycles change annually and are dependent on weather influences. While each property will have a basic crop rotation plan these plans are subject to change at a moment's notice depending on weather patterns and commodity prices, e.g., when rain falls at the right time cotton fields are worked and immediately planted with winter crops (wheat, chickpeas or barley). Equipment for farming can occupy tracks for months at a time and cannot be removed to allow for coal seam gas at short notice. Fallow periods do not necessarily mean there is no activity in the field. Spraying for weed control must be continued through these periods requiring specific weather conditions and limiting the opportunities for chemical application. The EIS fails to address the potential impacts from variable farming practices (e.g., farms sometimes produce 3 crops every 2 years, or 2 crops on 30% of the area, 3 crops per 2 years on 30% of an area)	EIS Chapter 13 and Appendix B, Section 5.2.2 SREIS Chapter 7, sections 7.5 and 7.6	Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land (IFL) and irrigated strategic cropping land. Issues pertaining to scheduling drilling with minimal impact to farming practices have been raised with Arrow in Arrow Intensively Farmed Land Committee meetings. Options under investigation include focusing on IFL during the dryer winter months when there is less agricultural activity. Disclosure of farming activities and required notice periods are also under discussion. Arrow is committed to working with landholders to reduce disruption through ongoing disclosure of planned activities. Any unavoidable impacts will be addressed through conduct and compensation agreements with individual landholders.

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Issue No.	Submission No.	Issue	Reference	Responses
R10071	S004, S006, S014, S017, S044, S088, S110, S167	<p>and how coal seam gas could be scheduled to align with these variable farming practices without being an 'unreasonable interference'.</p> <p>There are many operations that take place during the off season to prepare the ground for the following season. This is done within a 4 to 6 month time period after the crop has been picked. Also, many fields are planted to a crop each year. When will there be time for drilling with minimal impact to farming practices?</p>		
R10072	S002, S003, S004, S006, S008, S009, S010, S014, S018, S019, S020, S021, S024, S026, S028, S032, S034, S036, S037, S038, S039, S041, S044, S050, S051, S053, S054, S055, S058, S059, S064, S065, S069, S070, S071, S076, S079, S081, S083, S085, S087, S088, S095, S096, S097, S098, S110, S114, S117, S139, S140, S141, S144, S149, S152, S154, S162, S167	<p>The EIS has failed to demonstrate how it could be compatible with intensive, irrigated agricultural systems that are dominated across much of the project area.</p> <p>The installation of rigid coal seam gas infrastructure on the floodplain areas would seriously impede farmers' future ability to adapt farming practices to changes to allow their businesses to achieve higher productivity or profitability. This was their experience when cuts to water access in the past were accommodated due to their freedom to change farm layouts.</p> <p>How can this flexibility be maintained with the imposition of rigid coal seam gas infrastructure over farms? Will Arrow be required to move coal seam gas infrastructure to accommodate future changes that will be needed in farm layouts? Coal seam gas development would impose unreasonable interference with farming operations and will impact on day to day farm operations.</p> <p>The EIS provides little assurance that existing agriculture activities will be able to continue should the development proceed.</p> <p>The lack of detail associated with the location of gas field infrastructure and facilities and the overall footprint of the coal seam gas activities makes it almost impossible for landholders to appreciate the likely impacts of the proposed development.</p>	<p>EIS Chapter 13, sections 13.3.5, 13.4.6 and 13.6.2</p> <p>SREIS Chapter 7, sections 7.5 and 7.6</p>	<p>Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure.</p> <p>Arrow is working with the Arrow Intensively Farmed Land Committee to resolve how and when it will operate on intensively farmed land (IFL) to not unreasonably interfere with the ability to farm the property. Arrow will work with landholders to develop workable protocols.</p> <p>Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL.</p> <p>Siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, as well as locating of production facilities in less productive land are key strategies for reducing the potential for permanent alienation of IFL.</p> <p>Arrow has made 12 commitments to coexistence on IFL in the Surat Basin which are detailed on Arrow's website and which include no permanent alienation of IFL.</p>
R10073	S050	EIS Chapter 13, Section 13.4.4, Management Overheads, states cropping plans extend between four to eight years, when in fact future crop plans	EIS Chapter 13, Section 13.4.4	Noted.

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R10073	S050	normally extend for the next two season (winter and summer, one year) at best, and highly susceptible to change. It is dependent on moisture available and what will generate the best return.		
R10074	S010	Planning and integrating construction and operations activities with harvesting, spraying and withholding periods (Commitment C080) sounds simple but would be impossible on intensively farmed irrigated strategic cropping land due to a number of factors, including the integrated nature of the operations and that changes to the operation in one area of the site will impact on the ability to operate in another area.	EIS Chapter 13, Section 13.6	Noted.
R10075	S134	Commitment C084 'consult and agree with landowners on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines). Clearly identify the outcome of the discussions on scaled plans of the property and clearly indicate agreed access routes using signs, temporary fencing, barricade tape or traffic control measures.' Arrow to honour C084 for landholders in the Toowoomba Regional Council local government area.	EIS Chapter 13, Section 13.6 SREIS Attachment 4	Commitments are intended to apply across the project development area, including petroleum tenements located within the Toowoomba Regional Council local government area.
R10076	S134	Commitment C519 'monitor crop productivity or pasture health periodically to measure productivity on disturbed areas.' Commitment C520 'review landowner grievances regularly, including status of project actions and close-outs.' Arrow to provide additional information of the monitoring and inspection measures to be undertaken in commitments C519 and C520.	EIS Chapter 13, Section 13.8 SREIS Attachment 4	Inspection and monitoring of construction, operations and decommissioning activities will be undertaken to confirm appropriate implementation of standard operating procedures that incorporate the proposed environmental management controls as set out in EIS Chapter 13, Agriculture, Section 13.8. Arrow will develop this procedure including appropriate control and sampling sites. The new Land Access Code imposes mandatory conditions regarding the conduct of activities on private land. Arrow is committed to working to establish good relationships with landholders and to having: <ul style="list-style-type: none"> • An appropriate compensation scheme. • A standard approach to compensation and land access. • Informed discussions about how to work with landholders.
R10077	S110	Arrow should not rely on their committees to deal with impacts. There is concern that the Department of Environment and Resource Management (DERM, now EHP) will not condition Arrow on impacts because they believe that the committees are dealing with the issues.	EIS Chapter 13	Noted. Conditions which are considered relevant to the project will be set by EHP and other agencies.

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R10078	S141, S144	Arrow makes mention of its two committees and reliance on these committees to deal with a number of their impacts. The process followed within Arrow's committees has not filled the local industry with any confidence that they are an appropriate mechanism to comprehensively identify and enforce actions to manage risk to farming activities or resources. These committees need to be independent resources and conditions applied to Arrow to ensure that discussion leads to actions and modifications to project design and implementation.	EIS Chapter 13	Noted. Conditions which are considered relevant to the project will be set by EHP and other agencies.
R10079	S050, S141, S144, S162	There is a lack of detail, understanding and representation of agriculture in the EIS. Agriculture is painted in a very negative light, depicting it as a struggling industry that is in decline. Arrow has been selective with the facts chosen and many are not true reflections of agriculture in the region. The EIS deliberately understates the role of agriculture, especially intensive cropping within the EIS area, after review of the Department of Environment and Resource Management's Final Terms of Reference.	EIS Chapter 13, Appendix F and Appendix O SREIS Appendix 14	The EIS recognises the importance of agriculture in the region. The contribution of agriculture to the regional economy is described in EIS Appendix O, Economic Impact Assessment, and EIS Chapter 13, Agriculture provides a summary of the agricultural values within and surrounding the project development area. Further detail is set out in Appendix F, Agricultural Report. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends.
R10080	S095, S096, S167	EIS Chapter 13, Section 13.2 'Assessment Methods' is an indication of the contempt Arrow has had in regards to its impact on agriculture with this proposed project.	EIS Chapter 13, Section 13.2 and Appendix F	EIS Appendix F, Agricultural Report, was commissioned by Arrow in response to concerns raised by landholders and the community about coexistence of coal seam gas and agricultural activities on intensively farmed land.
R10081	S092	Imposition of wells across tree-less floodplains have the potential to impact significantly on farmers' operational efficiency.	EIS Chapter 13, Section 13.6	Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure and address impacts through compensation.
R10082	S032	There is a total ignorance of the farming industry highlighted in the simplistic response to raised concerns such as lowering pumps and drilling new bores.	EIS Chapter 13, sections 13.4.6 and 13.6	Project activities with the potential to cause adverse impacts on agricultural enterprises during the construction, operations and decommissioning phases are listed in EIS Chapter 13, Agriculture, Section 13.4.6. The EIS recognises that each agricultural enterprise is unique and has

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R10082	S032			developed particular practices to maximise the productivity of the land (EIS Chapter 13, Agriculture, Section 13.6). Proposed performance objectives include the integration of development activities (and infrastructure) with farming operations, recognising and understanding the particular farming practices and property-specific development and farming plans. Arrow will consult with landholders on the location of infrastructure and on construction methods to reduce overall impacts to the farming operation, including capital and operating costs and productivity.
R10083	S050, S123, S134, S159	Data presented for agricultural crop production figures are from 2006 a drought year which presents no reflection of the production potential of the area. At the very least an average of the number of years production should be utilised and the production should also indicate the high and low yield potentials that may occur over time. Arrow to add detail regarding long term production values and trends, and period of drought declarations to EIS Chapter 4, Section 4.3.2, Agricultural Activity.	EIS Chapter 4, Figure 4.12 and Chapter 13 and Attachment 8 and Appendix F SREIS Appendix 14	At the time of preparing the EIS, Australian Census data from 2006 was the most recent census data available. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends. EIS Chapter 4, Environmental, Social and Economic Context, Figure 4.12 shows drought declarations for 2009 and 2010. Current drought declaration maps are regularly updated on the Department of Agriculture, Fisheries and Forestry website, at www.daff.qld.gov.au .
R10084	S050	EIS Appendix F shows a complete lack of understanding of modern agricultural practices on the Darling Downs. In Table 7, the average yield displayed is from 1996, which was over 16 years ago. This was before controlled traffic, zero till farming was adopted on a widespread basis and is not reflective of the current yields. It was also before advances were made in crop varieties, disease resistance and drought tolerance, which has seen yields increase substantially as well. Concern about incorrect data used for wheat and barley yields, as their own farm yielded higher than the average for the Northern Downs and for Wambo Plains.	EIS Chapter 13 and Appendix F, Table 7 SREIS Appendix 14	Data presented provides an average of yields. Yields will fluctuate depending on a number of factors including weather and crop variety. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends.
R10085	S119	Have recent floods and good rainfall changed the usage of land back into cropping land again? If so, to what extent has this occurred? Arrow to review data in EIS Chapter 4, Section 4.3.2 regarding cropping land lost since the drought.	EIS Chapter 4, Figure 4.12 and Section 4.3.2 SREIS Appendix 14	SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends. EIS Chapter 4, Environmental, Social and Economic Context, Figure 4.12 shows drought declarations for 2009 and 2010. Current drought declaration maps are regularly updated on the Department of Agriculture, Fisheries and Forestry website, at www.daff.qld.gov.au .

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Issue No.	Submission No.	Issue	Reference	Responses
R10086	S026, S081, S146, S162	In EIS Chapter 13, Section 13.6.5, Increased Cost Farm Management, intensively farm land isn't listed in the same category as other intensive industries listed, requests it must be changed. Project development must avoid infrastructure and associated farm management areas of intensive cropping enterprises.	EIS Chapter 13, Section 13.6	As per EIS Chapter 13, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Arrow has stated it will not develop on IFL until it has satisfactorily addressed community concerns which it is working through in various forums, principally the Arrow Intensively Farmed Land Committee.
R10087	S081, S139	Will the design techniques used to install drill pads on intensive farming areas impact on current farming practices?	EIS Chapter 13, Section 13.6	As discussed in EIS Chapter 13, Agriculture, Section 13.4, the installation of production wells on intensively farmed land (IFL) has the potential to impact on current farming practices. Proposed measures to manage these impacts are set out in Section 13.6. Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with IFL and irrigated strategic cropping land. Arrow is working with the Arrow Intensively Farmed Land Committee to work through these issues to demonstrate how development can and will occur including addressing such issues as Area Wide Planning and protocols for use of access tracks.
R10088	S014, S044, S110, S141, S144	The EIS does not adequately address impacts to visual amenity, rural amenity, and lifestyles on the floodplain. In EIS Chapter 13, Section 13.6.6, Loss of Amenity, none of the three commitments made touch on the impacts caused by the industrialisation of the rural amenity and lifestyle or minimising the loss of amenity for floodplain residents. As this is not addressed adequately in previous sections, this issue won't be mitigated and communities will have to put up with it. We request that the supplementary report to the EIS include avoidance, mitigation and management measures for loss of amenity on the Condamine Floodplain.	EIS Chapter 13, Section 13.6.6 and Chapter 18, Table 18.5 and Appendix L, Section 8	Arrow recognises that the community is concerned about the potential loss of amenity due to the project. EIS Appendix L, Landscape and Visual Impact Assessment, Section 5 describes the landscape character types across the project development area, including the Condamine Flood Plain, which is classified as landscape character Type B: Settled Arable Plains. Proposed mitigation measures to reduce these impacts during operations, discussed according to the various landscape character types, is presented in EIS Chapter 18, Landscape and Visual Amenity, Table 18.5 and EIS Appendix L, Landscape and Visual Impact Assessment, Section 8. Mitigation measures to address potential amenity issues due to contractors and employees entering and working on properties, disruption to lifestyle, increased levels of noise and dust, and the visual impact of project infrastructure are also set out in EIS Chapter 13, Agriculture, Section 13.6.6.
R10089	S010, S081, S134, S146, S162	How can the EIS outline mitigation measures when it fails to list many of the project impacts? The EIS needs to be rewritten, after consultation with landholders and their peak bodies and representative groups, to accurately report the impacts of coal seam gas activities on agriculture. The agricultural report should provide detail of the avoidance, mitigation or rehabilitation methods. Arrow has not demonstrated they fully understand	EIS Chapter 13, sections 13.3, 13.4 and 13.6 and Appendix F, Section 9	EIS Chapter 13, Agriculture, Section 13.3 provides a summary of the agricultural values within and surrounding the project development area and an assessment of the potential for these values to be affected by direct and indirect impacts associated with the construction, operations and decommissioning phases of the project (Section 13.4). The EIS recognises that each agricultural enterprise is unique and has developed particular practices to maximise the productivity of the land (Section 13.6). Arrow has set out a number of proposed performance objectives and management measures to reduce impacts on agricultural land and enterprise

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R10089	S010, S081, S134,	the risks to the Condamine Alluvium or the fertile soils of the flood plain.		as set out in Section 13.6 and EIS Appendix F, Agriculture Report, Section 9.
R10090	S146	Requests Arrow Energy provide detail as to the extent that agricultural production will be affected.	EIS Chapter 13, Section 13.4.7 SREIS Chapter 3, Section 3.4.1	Arrow's experience indicates that construction of a typical production well, together with associated gas and water gathering infrastructure, will disturb 2% to 3% of land associated with a typical 160-acre (65 ha) production spacing. As gas field development is based on a series of production spaces, this estimate provides an indication of the overall area of disturbance to each property. Rehabilitation of gathering systems and temporary workspaces around wells will reduce this area. Arrow is also exploring means to further increase production spacing through the use of multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1) which will further reduce the area of disturbance.
R10091	S079	The heavy vehicles (road based) used in the gas industry can weigh in excess of 50 tonnes but cannot traverse our farms without having large adverse effects.	EIS Chapter 13, Section 13.6 SREIS Chapter 2, Section 2.4.1	Noted. Arrow is reviewing the best method to limit soil compaction including swamp mats, types of vehicles, tracks and access methods. Any resource activities that will have a permanent or temporary impact on strategic cropping land (SCL) or potential SCL must be assessed under the <i>Strategic Cropping Land Act 2011</i> (Qld). A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the <i>Strategic Cropping Land Act 2011</i> (Qld) and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10092	S014, S044	It must be considered that the 2 to 3% of the land that is directly affected by coal seam gas infrastructure will have a flow on effect to the remainder of the land associated with reticulated irrigation infrastructure, additional impacts could lead to wetter and drier sections of fields and interrupted flow of water which will create major income losses that will be difficult to assess and calculate.	EIS Chapter 13, Section 13.6	The location of infrastructure will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Where infrastructure is placed in cultivation paddocks, it will be developed in such a way as to maintain the existing hydrologic and hydraulic regime of the site. Arrow is reviewing the best methods to limit and manage soil compaction around project-related infrastructure including when soils are saturated. Arrow will suspend works when rainfall or storm events produce onsite conditions that, if trafficked or worked, would compromise the effectiveness of erosion and sediment control structures, or would lead to rutting and compaction of soils or mixing or inversion of soil horizons (Commitment C105).
R10093	S051	Irrigated broadacre farming in no way describes the intensity of operating an irrigated property. The difference between broadacre farming and irrigation farming is tremendous, both in labour capacity, day to day activities, flexibility of the cropping pattern and the machinery used. The very layout of the farms are total different and consequently the activities of coal seam gas operations would be so much more impacting on	EIS Chapter 13	Noted.

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Issue No.	Submission No.	Issue	Reference	Responses
R10093	S051	irrigation land.		
R10094	S143	Impacts to soil health and productivity from stockpiling, removal and replacement activities should be assessed.	EIS Chapter 12 and Chapter 13, Section 13.6.4 and Appendix E	EIS Chapter 12, Geology, Landform and Soils and EIS Appendix E, Geology, Landform and Soils Impact Assessment describes the potential impacts of the project on soils. A number of commitments in the EIS Chapter 13, Agriculture, Section 13.6.4 aim to protect the soil profile.
R10095	S150	The stockpiling of soils which would be necessitated because of the restraints of the mining process would result in organic matter breakdown in the surface layer and in the dispersion and erosion of the subsoil layers. If Arrow stockpiled topsoil for 10 years, most of it would be anaerobic, and therefore lose its biology and structure.	EIS Chapter 12, Section 12.6 and Chapter 13, Section 13.6.4 and Appendix E	Noted. Arrow has made a number of commitments in EIS Chapter 12, Geology, Landform and Soils, Section 12.6 and EIS Chapter 13, Agriculture, Section 13.6.4 which seek to protect the soil profile. Arrow has committed (Commitment C034) to the development of an erosion and sediment control plan and the installation and maintenance of site-specific appropriate controls. Commitment C062 has been amended in the SREIS to state 'strip, salvage and stockpile topsoil near the work site separately to subsoils (in consultation with landowners). Ensure topsoil stockpiles are designed in accordance with best practise principles and are protected from erosion by wind, rain and floods. Stockpile topsoil to a maximum height of 2.5 m to maintain fertility and if stored for extended periods, sow with appropriate vegetation to maintain organic matter and microbial activity.' Any resource activities that will have a permanent or temporary impact on strategic cropping land (SCL) or potential SCL must be assessed under the <i>Strategic Cropping Land Act 2011</i> (Qld). A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the <i>Strategic Cropping Land Act 2011</i> (Qld) and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10096	S139	What is the potential impact to farming soils if a spill occurs, and have any trials been undertaken in regards to subsequent remediation of these soils?	EIS Chapter 12, Section 12.6.3	Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). Arrow will also adhere to design and construction standards defined in AS 2885.1-2012 for gas pipelines, and for gathering lines constructed on cracking clays. Arrow is required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as part of a remediation action plan (RAP). A validation sampling program will be conducted to confirm the site has been successfully remediated according to the objectives identified in the RAP. Impacts specific to saline wastes will be assessed and managed in accordance with the Queensland Guidelines for the Assessment and Management of Saline/Sodic Wastes (DERM, 1995).
R10097	S026, S050, S082, S086, S108, S117,	Concerns over topsoil removal and the consequences of not restoring to existing contour,	EIS Chapter 13, Section 13.6	The location of infrastructure will be agreed with landholders under the terms of a conduct and compensation agreement prior to the commencement of

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R10097	S026, S050, S082, S086, S108, S117, S123, S141, S144, S149	diverting water on to a floodplain or in irrigation creating an interference with farming practices and cultivation.	SREIS Chapter 2, Section 2.4.1	works. Arrow will consult with landholders on the most appropriate methods to reduce disruption to cultivation paddocks. Access tracks developed in cultivation paddocks will be designed to maintain the existing hydrologic and hydraulic regime of the site (EIS Chapter 13, Agriculture, Section 13.6, Performance Objective 8). Any resource activities that will have a permanent or temporary impact on strategic cropping land (SCL) or potential SCL must be assessed under the <i>Strategic Cropping Land Act 2011</i> (Qld). A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the <i>Strategic Cropping Land Act 2011</i> (Qld) and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10098	S145	EIS does not adequately describe or assess impacts of using treated coal seam water for irrigation in irrigated agricultural systems.	SREIS Chapter 2 and Attachment 5 and Attachment 7	Arrow has developed a demonstration project on its Theten property. The purpose of the project is to demonstrate the beneficial use of coal seam gas water and the effective integration of coal seam gas infrastructure with farming operations. Arrow is collecting meteorological data, and data on soil water content and other soil fertility indicators to inform future development and refinement of water management procedures. Arrow provides updates on work at Theten on its website and has invited numerous research organisations to review and participate in understanding the sustainable use of coal seam gas water and sustainable development of coal seam gas infrastructure. Beneficial use of treated coal seam gas water is a separate approvals process. Beneficial use requirements are set out in SREIS Attachment 7, Legislation Update. Further details on the post-EIS permitting requirements are set out in SREIS Chapter 2, Project Approvals. The Coal Seam Gas Water and Salt Management Strategy is provided in SREIS Attachment 5.
R10099	S035, S117	Do not have confidence that the economic viability of farming practices can be maintained for future generations. Holds sincere concerns about the impacts of coal seam gas on existing farmer's futures and the future of the generations that will farm the land.	–	Noted.
R10100	S086	Venting excess untreated water from pipelines onto strategic cropping land (SCL) will result in permanent alienation of the high quality agricultural land like the Jimbour plains. This practice should not be allowed on SCL.	SREIS Attachment 5	Releasing untreated coal seam gas water onto strategic cropping land (SCL) is not proposed. Arrow has developed a strategy for the management of coal seam gas water (SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy) under which the use of treated coal seam gas water is proposed. Arrow has only recently commenced its first agricultural demonstration using coal seam gas water on its Theten property in late December 2012. The site

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R10100	S086			has been set up in advance of the project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the ANZECC guidelines which outline specific soil and water parameters. Arrow provides updates on work at Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure.
R10101	S157	Concern about Arrow's plans to discharge protection of environmental values to the landholder under a Conduct and Compensation Agreement. Under this scenario how are landholders protected from activities conducted on neighbouring properties? How does this ensure that Arrow and the regulator minimise environmental harm?	EIS Chapter 2, Section 2.4 SREIS Chapter 2, Section 2.4.1	Arrow has obligations to protect environmental values under a range of state and Federal legislation, including but not limited to the <i>Environmental Protection Act 1994</i> (Qld), <i>Aboriginal Cultural Heritage Act 2003</i> (Qld), <i>Water Act 2000</i> (Qld) and the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> (Cwlth). A range of land management matters can be agreed between landholders and Arrow; however this does not abrogate Arrow's statutory responsibilities. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This planning will seek to balance individual needs of landholders with the needs of neighbouring properties. Area Wide Planning considers at issues at a local scale, including such matters as overland flow.
R10102	S014, S044, S050, S079, S157, S162	EIS Chapter 4, Plate 4.2 is labelled as 'Agricultural block typical of the project development area'. This is atypical for the ATP683 area, and the use of that photo and the associated label only adds to the perception that Arrow does not understand the area in which it seeks to operate. It also adds to the perception that Arrow seeks to underplay the extent of variation within the project development area, thereby incompatible with the broad generalised approach the EIS adopts. Arrow should include a photo of each land use including intensively farmed land.	SREIS Chapter 7, Section 7.5	Noted. The EIS acknowledges variation within the region. SREIS Chapter 7, Agriculture, Section 7.5 contains a number of plates of intensively farmed land.
R10103	S117	Due to the reductions in underground water allocations, we are seriously considering the use of overhead lateral move infrastructure. This would be impossible to install in the future if a well was in the lateral move footprint. Ultimately, this would	EIS Chapter 13, Section 13.6	Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering

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R10103	S117	significantly hinder our potential productivity. This EIS fails to comprehensively address this vital consideration.		existing and future land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure and will seek to locate wells, gathering lines and associated access tracks in a manner that does not significantly interfere with swept paths (effective coverage) of centre-pivot and lateral and low-pressure boom irrigators (EIS Chapter 13, Agriculture, Section 13.6).
R10104	S075, S077	The effects of treated water on the productivity of the various soil types are unknown.	EIS Attachment 9 SREIS Attachment 5	Arrow has only recently commenced its first agricultural demonstration using coal seam gas water on its Theten property in late December 2012. The site has been set up in advance of the project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the ANZECC guidelines which outline specific soil and water parameters. Arrow provides updates on work at Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure.
R10105	S034, S069	Any escape of pigging waste water on to high quality intensive agricultural land will lead to permanent damage to the soil and loss of productive capacity severely impacting on Queensland's capacity to double its agricultural production.	SREIS Chapter 3, Section 3.6.2	As set out in SREIS Chapter 3, Project Description, Section 3.6.2, water purged by pigging will be of the same quality as the produced water from wells that feed the gathering system serviced by the field compression facility. The sludge will comprise water, coal fines and other impurities produced from the well. The water and sludge will be collected in a chamber at the central gas processing facility (CGPF) and then disposed of to a regulated waste facility or treated at the CGPF and disposed of along with the other waste streams generated at the facility.
R10106	S014, S017, S024, S026, S044, S069, S081, S162	The supplementary report to the EIS must broaden the agriculture assessment to include an in depth (ground-truthed) field study of all types of agricultural enterprises in the project development area.	EIS Chapter 13, Section 13.6 and Appendix F, Section 5 SREIS Appendix 14	A broad description of the agricultural enterprises in the region is provided in EIS Appendix F, Agricultural Report, Section 5. Arrow acknowledges that each agricultural enterprise is unique and has developed particular practices to maximise the productivity of the land (EIS Chapter 13, Agriculture, Section 13.6). SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends.
R10107	S150	By focussing on existing land use the opportunity to secure strategic cropping areas that will prove invaluable as climate refugia for cropping in the future is being overlooked.	–	Noted.

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R10108	S157	The initial work program for ATP683 lacked detail. Therefore, there is little faith that any subsequent work programs prepared for the Surat Gas Project will contain sufficient detail for landholders.	–	The requirements for exploration programs are different to production projects. Exploration programs are often broad due to the speculative nature of the activity and therefore adaptive based on the results obtained. A greater level of detail and certainty of gas reserves is required for gas field development. Exploration activities are addressed under a separate approvals process.
R10109	S015	If project infrastructure will not be in towns, then it can be concluded that project infrastructure will be located on prime agricultural land. What happens to our food production sites?	EIS Chapter 13, Section 13.7	Towns are excluded from the project development area. Key strategies for reducing impacts to prime agricultural land, i.e., strategic cropping land and intensively farmed land (IFL) include the siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, and locating production facilities on less productive land, not IFL. In undertaking site selection, Arrow will consider low value agricultural land in preference to high value agricultural land, to reduce potential residual impacts to land use (EIS Chapter 13, Agriculture, Section 13.7).
R10110	S014, S044	Why acknowledge there will be impact after claiming coexistence between coal seam gas and intensively farmed land (IFL) can happen without alienating the land or reducing its productivity. We request the supplementary report to the EIS explain what are the impacts that Arrow 'understands' it will have on IFL?	EIS Chapter 13 Section 13.6	To date, agricultural enterprises in the project development area have operated largely without the presence of gas production activities. Gas production is a new activity that requires access to private land and integration of third-party infrastructure with existing and future activities. In this way, coal seam gas development impacts property holders. Arrow will seek to reduce this impact on individual properties through consultation and agreement with landholders.
R10111	S026, S069, S081, S162	Project development will lead to a loss of agricultural production and generally less efficient agriculture in these areas.	EIS Chapter 13, Section 13.1	Noted. The location of infrastructure will be agreed with landholders under the terms of a conduct and compensation agreement prior to the commencement of works. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses.
R10112	S150	Recommends that Section 310V of the Environmental Protection Act is upheld requiring Arrow to complete an EIS for all future land spraying, whether drilling activities or trials.	–	The Department of Environment and Heritage Protection 'Guideline: Environmental Impact Statements' (EHP, 2012c) describes the trigger criteria for an EIS under the <i>Environmental Protection Act 1994</i> (Qld).
R10113	S108	Landowners have a legal obligation to manage surface water flows on their property to ensure that they do not affect the neighbours' properties. Any activities conducted by Arrow that have the potential to change the surface water regime on the property must be agreed with the landowner in writing.	EIS Chapter 13, Section 13.6	Noted. A scaled plan showing the agreed location of infrastructure and access routes will be prepared as part of conduct and compensation agreements negotiated with landholders (refer to Commitment C084). Arrow will seek to site wells in consultation with landholders in locations which reduce impacts on productive areas and maintain the existing hydrologic and hydraulic regime of the site. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This planning will seek to balance

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R10113	S108			individual needs of landholders with the needs of neighbouring properties. Area Wide Planning considers issues at a local scale, including such matters as overland flow. Further to this, Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.
R10114	S141, S144	The first point of avoidance measures in EIS Chapter 13, Section 13.6.5, Increased Costs of Farm Management, if applied to intensively farmed and irrigated strategic cropping land, would mean no coal seam gas on the floodplain.	EIS Chapter 13, Section 13.6	Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, as well as locating of production facilities in less productive land are key strategies for reducing the potential for permanent alienation of IFL.
R10115	S108	It will be difficult to enforce the requirement 'ensure construction activities do not extend beyond the work site boundaries' when there are several crews working concurrently (drilling, pipeline crews etc.).	–	Requirements for contractors will be set out in their contract in accordance with conditions of development and project commitments. All personnel and contractors will be inducted and trained in the implementation of the avoidance, mitigation and management measures. An Arrow representative will be present on site to oversee construction activities. Further, there are defined boundaries ('battery limits') that are typically marked out ahead of any works commencing, so as to delineate the agreed work area.
R10116	S141, S144	How can the appropriateness of any mitigation measures on strategic cropping land be made if the final grid spacing of wells is unknown?	EIS Chapter 13, Section 13.6 SREIS Chapter 3, Section 3.4.1	As part of the 12 commitments made to coexistence on intensively farmed land (IFL) in the Surat Basin, Arrow has committed to maximise spacing between wells on IFL (between 800 m and 1.5 km). The use of deviated drilling technology may allow the surface well pad sites for multi-well pads to be separated over a distance of up to 2,000 m where practicable; see SREIS Chapter 3, Project Description, Section 3.4.1. The development of multi-well pads also offers other advantages including the reduction in above ground infrastructure, and flexibility in placement of wells.
R10117	S159	Site-based mitigation of impacts to agriculture is inappropriate; a collaborative approach is required.	SREIS Chapter 7, Section 7.6.1	As described in SREIS Chapter 7, Agriculture, Section 7.6.1, Arrow has commenced Area Wide Planning which will integrate individual farming plans into an integrated plan to demonstrate catchment wide integration. This planning will seek to balance individual needs of landholders with that of neighbouring properties.
R10118	S024, S026, S081, S162	If production facilities, electricity substations and associated access tracks cannot avoid being located on cultivation areas, what mitigation and management measures will Arrow employ to reduce the loss of these cultivation areas? Isn't it just a case of these infrastructure either being	EIS Chapter 5 and Chapter 13, Section 13.6 SREIS Chapter 2, Section 2.4.1	To clarify Arrow's intentions with regard to the placement of project infrastructure on intensively farmed land (IFL), strategic cropping land (SCL) and good quality agricultural land (GQAL): <ul style="list-style-type: none"> • Arrow will ensure dams for coal seam gas water and brine are not constructed on IFL (Commitment C092). • As specified in the 12 commitments that Arrow has made to coexistence on

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R10118	S024, S026, S081, S162	located in these cultivations areas, or not, as their very presence creates the loss.		<p>IFL in the Surat Basin, Arrow will not locate central gas processing facilities (CGPFs) on IFL. It is Arrow's intention to avoid locating CGPFs on GQAL and SCL.</p> <ul style="list-style-type: none"> Wells, gathering lines and access tracks are proposed on IFL, SCL and GQAL. Gathering lines will be rehabilitated following installation of the pipes and ancillary infrastructure (low point drains, high point vents, gas and water nodes) enabling former land uses to resume and continue for the duration of coal seam gas production from the associated production wells. Production wells will be decommissioned after 15 to 20 years of operation when gas resources are exhausted or become uneconomic to extract. The wells will be decommissioned in accordance with relevant guidelines. Access tracks, if not required by the landholder, will be removed and the land rehabilitated to its pre-development condition. <p>In the case of cultivation, Arrow will seek to align gathering lines and new access tracks parallel to the direction of cultivation, soil conservation structures and controlled traffic runs and avoid perpendicular or lateral connections.</p> <p>Any resource activities that will have a permanent or temporary impact on SCL or potential SCL must be assessed under the <i>Strategic Cropping Land Act 2011</i> (Qld). A resource authority will be required before activities can be undertaken. Arrow will need to separately address SCL requirements, as set out in the <i>Strategic Cropping Land Act 2011</i> (Qld) and as described in SREIS Chapter 2, Project Approvals, Section 2.4.1. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities.</p>
R10119	S014, S044	In relation to Commitment C085 that Arrow will 'study methods to reduce impacts and maintain soil profile...' the stakeholder refutes that a study be considered a mitigation measure, as the outcomes cannot be assumed. Water contamination has not been adequately addressed in EIS, especially in relation to organic farming practices.	EIS Chapter 13, Section 13.6	Noted.
R10120	S035	Water contamination has not been adequately addressed in EIS, especially in relation to organic farming practices.	EIS Chapter 14 and Chapter 15	Groundwater and surface water are integral to agriculture and the management of these aspects are addressed in EIS Chapter 14 Groundwater, and EIS Chapter 15, Surface Water.
R10121	S002, S003, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S059, S064, S065, S070, S071, S076,	Aerial spraying required for agricultural purposes is incompatible with the installation of additional overhead transmission lines. Installation of additional power lines should be buried to a suitable depth so as not to interfere with farming operations.	SREIS Chapter 3, Section 3.4.5	Reticulated power is proposed to be installed with the gathering systems (either in the trench or as overhead transmission lines). Underground cables to production wells will have a typical burial depth of 1.2 m, and be laid in the same trench or easement as the gas and water gathering systems. Ultimately, the burial depth will be decided in consideration of the surrounding land use, landholder requirements and other subsurface features, such as

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R10121	S002, S003, S009,			pipelines.
R10122	S002, S003, S004, S006, S009, S018, S019, S020, S027, S032, S034, S037, S039, S053, S055, S059, S064, S065, S069, S070, S071, S076, S085, S087, S088, S096, S097,	Given that field operations are conducted across the whole field, the laying of pipelines and associated right of way areas is a major impost on cropping and the farming system, as is the risk of leakage.	–	Noted. Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). Arrow will also adhere to design and construction standards defined in AS 2885.1-2012 for gas pipelines, and for gathering lines constructed on cracking clays. In the case of cultivation, Arrow will seek to align gathering lines and new access tracks parallel to the direction of cultivation, soil conservation structures and controlled traffic runs and avoid perpendicular or lateral connections.
R10123	S002, S003, S009, S018, S020, S032, S034, S037, S039, S050, S051, S053,	Potential impacts of the greater right of ways, greater burial depths and longer construction times associated with high pressure gas lines on high quality intensively farmed land are not adequately detailed in the EIS.	–	Arrow will adhere to design and construction standards defined in AS 2885.1-2012 for gas pipelines, and for gathering lines constructed on cracking clays.
R10124	S024, S026, S034, S069, S081, S162	How will medium-pressure pipelines be routed in areas where there are no boundary fences for many kilometres in every direction and all soils are of an exceptionally high quality?	EIS Chapter 5, Section 5.2.6	As discussed in EIS Chapter 5, Project Description, Section 5.2.6, pipeline route selection will be informed by environmental and social considerations in addition to constructability, technical and cost constraints. Specific alignment through properties will be agreed with landholders under a conduct and compensation agreement. Landholders will be consulted to determine land use practices and pipelines will be buried to a depth that reduces risk of damage.
R10125	S024, S025, S026, S036, S051, S079, S081, S083, S146, S162, S166	What is the range of heights that fences are constructed to, since the higher the fence, the greater the interference? EIS Chapter 13 and EIS Appendix F need to be rewritten, giving regard to the impacts of fencing on agriculture. What is the area of completed well sites that will be fenced to prevent access?	EIS Chapter 13 and Appendix F	The conduct and compensation agreement which will be developed with landholders will take fencing into account. Fence design will need to take into consideration security, impacts on surrounding land use and overland flow. Fences will encompass the well site and the design determined in consultation with landholders.
R10126	S108	Pilot wells drilled as part of the exploration program in ATP 683 will prevent any agricultural production on the field in which these facilitates are located. 25 exploration wells are planned to be drilled within ATP 683 at the start of this year, without any indication of the location of the wells. It should be incumbent on Arrow to disclose the location of these wells so that landholders can understand the potential impacts	–	Exploration activities are addressed under an existing approval. The exploration program in ATP683 is largely complete. The majority of remaining wells proposed to be drilled are primarily in support of groundwater studies, particularly connectivity between groundwater aquifers. In relation to pilot wells, the location and establishment of a pilot well program would be agreed in consultation with the relevant landholder and constructed in accordance with Arrow's environmental authority conditions for exploration works.

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R10127	S123, S157	The EIS is silent on any plans Arrow has for specific properties, their neighbours or specific areas within the project development area. More detail is required on proposed layout of major infrastructure locations, route selection and any additional infrastructure required for the project (i.e. electricity lines, venting and access infrastructure).	SREIS Chapter 2, Section 2.1 and Chapter 3, Figure 3.6	Since the publication of the EIS, properties have been identified on which four central gas processing facilities and a construction camp may be placed; see SREIS Chapter 3, Project Description, Figure 3.6. The remainder of the field development will be developed in stages over time. Further detail about the EIS process and subsequent approvals required before Arrow can develop the project are discussed in SREIS Chapter 2, Project Approvals, Section 2.1. Each stage of the assessment process provides opportunities for stakeholders to comment on the information provided by Arrow and the approvals sought (SREIS Chapter 2, Figure 2.1).
R10128	S099	The term 'unsuccessful rehabilitation and temporary loss of arable land' is contradictory (EIS Chapter 13, Section 13.4.8, Summary of Potential Impacts). Further information is required on what is meant by 'unsuccessful rehabilitation' as it is believed that this indicates there will be permanent impacts.	EIS Chapter 13, sections 13.6 and 13.7	It is acknowledged that it may not be possible to rehabilitate production facility sites back to their former land use, if for example, the previous land use was cropping (EIS Chapter 13, Agriculture, Section 13.7). In stating the above, note Arrow will seek to acquire land on which to place production facilities, water treatment and power generation facilities, or enter into long term lease arrangements for the use of land. Arrow's preference is to select facility sites in sparsely populated areas (Commitment C309). Furthermore, Arrow will not locate central gas processing facilities (CGPFs) on intensively farmed land; and it is Arrow's intention to avoid locating CGPFs on good quality agricultural land and strategic cropping land. As specified in the 12 commitments that Arrow has made to coexistence on IFL in the Surat Basin, Arrow will not locate central gas processing facilities (CGPFs) on IFL. It is Arrow's intention to avoid locating CGPFs on GQAL and SCL.
R10129	S134	Arrow to inform landholders of the extent of construction and the potential impacts/losses if rehabilitation cannot be achieved on their property, prior to works.	–	Noted. Arrow has an obligation to rehabilitate land disturbed by petroleum activities.
R10130	S108	Building roads and laying pipes etc. across good quality agricultural land and strategic cropping land that are made up of highly productive vertosols should have a detailed rehabilitation program outlined and this has not been done.	EIS Chapter 12, Section 12.6	The EIS Chapter 12, Section 12.6.2 outlines avoidance, mitigation and management measures will be implemented for all activities that have the potential to cause land degradation. This includes Arrow's commitment to develop rehabilitation plans based on environmental sensitivities that address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landowner requirements (Commitment C070).
R10131	S014, S044, S139	Have remediation technologies (with respect to salt/brine) been used on intensive farmed soils? It would be beneficial for Arrow to make public the location of farms that form part of Arrow's three case studies on farms of differing land uses, which were selected to have Arrow work with landowners	EIS Chapter 13, Section 13.6	Arrow has only recently commenced its first agricultural demonstration using coal seam gas water on its Theten property in late December 2012. The site has been set up in advance of the project commencement with water, soil and weather monitoring stations which will provide data throughout the project. The operational conditions for this demonstration are set in government conditions that refer to the ANZECC guidelines which outline specific soil and

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R10131	S014, S044, S139	to design developments on their land that minimises the impact on the landowners farming activities. If landholders selected for these trials are happy for their farm to be used for Arrow's experimental purposes, they may also be happy for other landholders within the region to scrutinise these works first hand.		water parameters. Arrow provides updates on work at Theten on its website and will transparently provide future information in support of stakeholder engagement and the demonstration project. Arrow has to date hosted various stakeholder groups and research organisations to visit, review and participate in an ongoing understanding of the sustainable use of coal seam gas water and the appropriate development of coal seam gas infrastructure. In addition to its own farms, Arrow has undertaken research in Area Wide Planning in which conceptual field development plans are developed with the input of landholders so that Arrow can understand how to place gas infrastructure on individual farms and across catchment areas to reduce disruption to farming activities. This research has been identified by and reported to the Arrow Intensively Farmed Land Committee.
R10132	S017, S081, S108, S134	Information from the agricultural trials and case studies being undertaken by Arrow should be made public and subject to peer review. Operations on strategic cropping land (SCL) should not commence until these trials have demonstrated that the soils can be rehabilitated to the original SCL condition, otherwise Arrow's claims remain unproven.	–	Noted.
R10133	S014, S044, S085, S097, S110	We request the supplementary report to the EIS accurately describe the environmental value of all soil types within the project development area, particularly soil types associated with the Condamine flood plain, good quality agricultural land and strategic cropping land, and follow the Impact Assessment Method taking into account the precautionary principal as described in the EIS. Restricted access is the only option to protect the environmental value and productive capacity of vertosol soils. Given the nature and resource importance to the State of Queensland of the floodplains that overlay the Condamine alluvium, it is disappointing that the assessment of agriculture was a desktop one.	EIS Chapter 12 and Appendix E and Appendix F	The purpose of EIS Appendix F, Agricultural Report was to identify the substantive issues that need to be considered and would be impacted by the proposed development. The agriculture report adequately addresses this objective in that it identifies the types of farming activities and the major constraints those activities might pose on coal seam gas development. The agriculture report was presented to the Arrow Intensively Farmed Land (AIFL) Committee in advance of its publication in the EIS. Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land and irrigated strategic cropping land. Arrow is working with the AIFL Committee to work through these issues to demonstrate how development can and will occur including addressing such issues as Area Wide Planning and protocols for use of access tracks. Soils properties are integral to agriculture and the management of these aspects are addressed in EIS Chapter 12, Geology, Landform and Soils and EIS Appendix E, Geology, Landform and Soils Impact Assessment.
R10134	S014, S044	The EIS states 'The environmental values of agriculture are embodied in...', however this list omits water. Agricultural enterprises that have ground and surface water allocation in conjunction with desirable soil types are of the highest value and most productive.	EIS Chapter 14 and Chapter 15	Groundwater and surface water are integral to agriculture and the management of these aspects are addressed in the EIS Chapter 14 Groundwater, and EIS Chapter 15, Surface Water.

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R10135	S002, S003, S004, S006, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S070, S071, S076, S085, S087, S088,	A condition should be applied to ensure agricultural land use is able to contribute to the Queensland Government's commitment of doubling agricultural production.	–	Based on Arrow's experience, operation of a typical production well, together with associated gas and water gathering infrastructure, will disturb 2% to 3% of land. Arrow has commenced Area Wide Planning which will integrate individual farming plans into an integrated plan to demonstrate catchment wide integration. This planning will seek to balance individual needs of landholders with the needs of neighbouring properties and reduce disruption to agricultural production. Environmental conditions which are considered relevant to the project will be set by EHP and other agencies.
R10136	S002, S003, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S069, S070, S071, S076, S085,	If this project is to be approved, conditions will need to set specific, minimum conditions ensuring the landholders 'right-to-farm' as part of any Conduct and Compensation Access Agreement.	EIS Chapter 13, Section 13.6	Environmental conditions which are considered relevant to the project will be set by EHP and other agencies. Arrow's approach to working on private property is based on respect to the landholder and their business interests. Siting of gas field infrastructure will be negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements. Arrow has set out a number of proposed performance objectives to reduce impacts on agricultural land and enterprise, as set out in EIS Chapter 13, Agriculture, Section 13.6.
R10137	S002, S003, S009, S018, S020, S032, S034, S037, S039,	A condition should be applied to recognise intensively farmed irrigation land in the same context as other intensively farmed industries listed.	–	Environmental conditions which are considered relevant to the project will be set by EHP and other agencies.
R10138	S146	Requests administering authority should appropriately condition the project so that decommissioning does not result in the loss of agricultural production.	–	Environmental conditions which are considered relevant to the project will be set by EHP and other agencies. Where applicable, this will include requirements under strategic cropping land legislation protect agricultural land from permanent alienation.
R10139	S119	Was EIS Chapter 4, Figure 4.10 developed during the drought? If so, Arrow to review and refresh to reflect current agricultural activity post flood.	EIS Chapter 4, Figure 4.10	EIS Chapter 4, Environmental, Social and Economic Context, Figure 4.10 was developed in 2011 utilising local government planning scheme data which was in force at the time.
R10140	S108	The use of the landholder access and negotiation process to identify site specific impacts is inadequate because it does not capture all the potential issues of conflict between agriculture and coal seam gas activities. For example, do normal farming operations constitute a 'reasonable excuse' under Section 805 of the Petroleum and Gas Act to obstruct a petroleum authority holder from conducting their activities?	EIS Chapter 13, Section 13.6	Irrespective of legislation, Arrow's intention is not to obstruct the landholder in carrying out his or her activities. Through the conduct and compensation agreement process, Arrow will seek to work through issues that could cause conflict with normal farming operations and reach agreement on protocols for access.
R10141	S010, S014, S017, S027, S032, S044,	In the interests of preserving good quality agricultural land (GQAL) and strategic cropping land (SCL), avoiding the disturbance of established	EIS Chapter 13, Section 13.6	The need for access tracks will be agreed with landholders. Where developed, access tracks will be designed to not impede overland flow, and to avoid or reduce interference with the normal operation of the farm. When

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R10141	S010, S014, S017, S027, S032, S044, S050, S067, S099, S108, S110	irrigation infrastructure and maintaining overland flow drainage paths, gravel access tracks should be avoided at all costs. Stones and gravel imported for well pads and access tracks etc. disrupt farm machinery operation and precision considerably. Furthermore, gravel required for well sites, production facilities and some roads is a contaminant on cropping land and is impossible to remove without taking good soil with it. Significant quantities will be required for all-weather access. Arrow has committed to 'use existing roads and tracks, where practicable', which indicates in many cases there will be additional access tracks built creating a maze of gravel roads interfering with cropping activities of GQAL and SCL across the project development area. This issue is of major concern to landholders on the floodplain as it has not been established how farm access tracks will be rehabilitated when the project is completed. The use of gravel to construct and support access tracks will be almost impossible to remove completely and the land beneath will not be able to be restored to SCL or GQAL. How does the proponent propose to rehabilitate these access tracks back to their pre-existing state?		access tracks are no longer required, they will be rehabilitated to enable the pre-existing land use to proceed. This will include removing gravel if necessary. It is possible to use a range of construction techniques, such as laying geotech mat or sieving, to facilitate the removal of gravel during rehabilitation. Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which address requirements regarding impacts on soils.
R10142	S157	Any water that pools around well heads has the potential to attract wild birds and reduce farm biosecurity. Flying water fowl may spread infection disease (e.g. avian influenza) onto range areas. Wild waterfowl may carry infectious diseases, but not be affected themselves.	EIS Chapter 13, sections 13.4.6 and 13.6	Arrow recognises the issues associated with intensive livestock operations, discussed in EIS Chapter 13, Agriculture, Section 13.4.6. In undertaking project activities, Arrow has committed to avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Irrespective, Arrow will seek to install infrastructure such that water is shed and does not pool.
R10143	S079, S110, S116	If normal farming operations are not able to be continued then that is a permanent obstruction and should be reflected in the footprint. Will continuation of normal farming operation be allowed over and above the pipelines, regardless of the weight or size of the machinery used? There is concern that various farming machinery is not compatible with coal seam gas. Will a 22,000	EIS Chapter 25, Section 25.4.1 and Appendix S, Section 6.6 and Appendix 1	As set out in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1, high pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Section 6.6). Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444).

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R10143	S079, S110, S116	kg cotton picker be able to operate over buried coal seam gas infrastructure? Will a 36 m wide spray application rig be compatible? If markers/signs are used to identify the pipelines, at what distance would they be placed? This could greatly affect our normal farming operations as it will cause further obstructions to have to manoeuvre around, causing inefficiencies and greater running costs.		Property-specific requirements will be discussed with landholders during the negotiation of conduct and compensation agreements and pipelines will be designed to account for land use in accordance with applicable standards including the depth of burial which is influenced by traffic on the easement, e.g., cotton pickers.
R10144	S004, S006, S010, S024, S025, S026, S027, S034, S036, S069, S081, S083, S088, S099, S108, S123, S139, S162	The prospect of a coal seam gas industry being approved on the Condamine flood plain raises serious concerns due to the physical footprint of coal seam gas infrastructure on irrigated farming land. Actual area required for well workovers is not clearly presented in EIS. Well sites are claimed to be only 10 m by 10 m, but during construction the area required is 85 m by 85 m. Regular workovers are required every 2 to 4 years and would require more than the 10 m by 10 m. The extent of disturbance to good quality agricultural land and strategic cropping land is very vague about the potential for disruptions. The larger amount of 0.5 ha should be considered and not the 0.1 ha currently used. Access roads and infrastructure need to be captured when estimating the amount of land affected.	EIS Chapter 5, Section 5.5.1 and Chapter 13, Section 13.4.7 SREIS Chapter 3 Section 3.4	SREIS Chapter 3, Project Description sets out typical footprints for various coal seam gas infrastructure. This includes: • Production wells: the typical short-term construction footprint is 100 m by 100 m (or 1 ha) for a single well and 200 m by 200 m for a multi-well pad. This requirement forms the basis of compensation. The operational footprint of well pads will be reduced to accord with the Strategic Cropping Land Standard Conditions Code for Resource Activities, or as agreed for multi-well pads. • Medium-pressure gas gathering lines: between 15 and 25 km in length, with a construction right of way up to 20 m to 25 m wide. • Footprint for production well work over activities: similar to that required to establish the well i.e., 100 m by 100 m (or 1 ha) for a single well and 100 m by 200 m (or 2 ha) for a multi-well pad. Landholders are compensated for the area required for construction and workover of wells, not the rehabilitated area.
R10145	S081, S139	What impacts will project activities place on controlled burning, aerial spraying and ground rigging around the various project infrastructure, particularly those located on third party properties? What methods of spraying will be compatible? Can aerial spraying still be undertaken?	–	Normal farming activities can continue. How activities coexist will be resolved through discussion with the landholder, and development of protocols, during the preparation of conduct and compensation agreements.
R10146	S014, S044, S146	In response to Table 6.2 of EIS Appendix P, Social Impact Assessment, 'Disruption to farm operations', some farming operations may be able to co-exist successfully with the project but as described in the response to EIS Chapter 13, this is not the case on the Condamine flood plain. There would be constant disruption to farm operations while attempting to integrate with intensive	EIS Chapter 13 and Chapter 22, Table 6.2 SREIS Chapter 3, Section 3.7, Chapter 8 and Attachment 5	Arrow continues to engage with the Condamine River flood plain community through a range of forums including Arrow Intensively Farmed Land (AIFL) Committee, Arrow Surat Community Reference Group, GasFields Commission Queensland, irrigator groups, community information sessions and ongoing consultation with individuals and interested groups. Arrow is working with the AIFL Committee to resolve how and when it will operate on intensively farmed land (IFL) to not unreasonably interfere with the ability to farm the property. Arrow will work with landholders to develop

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R10146	S014, S044, S146	<p>agriculture. Site selection will be very difficult on intensively farmed land and the EIS states siting is the primary mitigation for reducing potential impacts on agricultural land. We request the supplementary report to the EIS provide details on how Arrow would integrate with farming systems on the Condamine Floodplain with irrigation infrastructure. The EIS clearly shows a lack of understanding of farming issues on the flood plain despite the issues raised through the Arrow Intensively Farmed Land Committee. The areas of predominate concern include:</p> <ul style="list-style-type: none"> • The long term effects of soil compaction. • Farm management constrictions. • Protection of groundwater resources. • Disposal of by-product coal seam water. 		<p>workable protocols. Arrow has made 12 commitments to coexistence on IFL in the Surat Basin, which are published on Arrow's website. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This will seek to balance individual needs of landholders with the needs of neighbouring properties. The SREIS provides updated details on impacts to groundwater and the disposal of coal seam gas water. See SREIS Chapter 3, Project Description, Section 3.7, SREIS Chapter 8, Groundwater, and SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy for further information.</p>
R10147	S139	<p>Will future farming research be undertaken regarding the coal seam gas infrastructure on intensively farmed areas?</p>	<p>SREIS Chapter 3</p>	<p>Arrow is presently researching ways to reduce impacts on intensively farmed land. Project demonstrations currently underway include multi-well pad drilling and pitless drilling. Other applications such as the use of a 'spider plow' to install gathering system pipeline or standard power line installations have been found to work and can be included in planning considerations.</p>
R10148	S088, S141, S144	<p>It must be considered that the landholders are the ones best equipped to judge whether or not Arrow's activities will successfully integrate with our own and what adverse effects the project will have on our businesses viability and the potential of the land. The statement 'Arrow aims to integrate its activities with agricultural enterprises in a way that does not adversely affect their viability or the agricultural potential of the land' clearly demonstrates that Arrow and the authors of the EIS have absolutely no understanding of the impacts their activities will have on the lifestyle and asset of landholders.</p>	<p>EIS Chapter 13, Section 13.6 SREIS Chapter 3, Section 3.4</p>	<p>Noted. Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL. Siting of wells in consultation with landholders in locations which reduce impacts on productive areas and provide the best opportunity for rehabilitation, as well as locating production facilities in less productive land are key strategies for reducing the potential for permanent alienation of IFL. In addition to a range of other mitigation and management measures as set out in EIS Chapter 13, Agriculture, Section 13.6, twelve performance-based objectives have been proposed that provide an opportunity for the proponent to work with the landholders to develop appropriate methods for the development of coal seam gas infrastructure on the property, having regard to the property-specific values and farming practices. The EIS conceptualised that vertical wells be drilled with a separation distance between wells averaging a minimum of 800 m across the project development area. The use of deviated drilling technology will allow for multi-well pads with separation distances of up to 2000 m where technically and economically feasible (SREIS Chapter 3, Project Description, Section 3.4).</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10149	S002, S009, S010, S017, S018, S020, S024, S026, S032, S036, S037, S039, S050, S053, S055, S057, S059, S064, S069, S070, S071, S076, S079, S081, S083, S085, S086, S088, S095, S096, S097, S098, S108, S110, S114, S139, S140, S141, S144, S149, S152, S154, S167	<p>What is Arrow's definition of 'normal cultivation practices', as used in Commitment C047?</p> <p>Cultivation practices are continuously changing, and the farming landscaper must be able to accommodate these changes. Reference should also be given to other common practices such as laser levelling, heavy machinery, ditches, drains, etc.</p> <p>This commitment omits other farming operations not considered as 'normal' from occurring over pipeline right of ways.</p> <p>If the right of way will be adjacent to an access track in every instance, and therefore because the track will be elevated, all farming operations (whether 'normal' or not) will be impeded.</p> <p>Numerous other activities that may fall outside of Arrow's definition of normal are carried out on irrigated flood plain farms, how will these impacts on existing businesses be dealt with?</p> <p>There is no reference made to the fact that 'cultivation practices' are continuously changing and the farming landscape must be able to accommodate these changes. The focus on cultivation ignores the many other normal agricultural practices such as irrigating, laser levelling and pest spraying that need to occur.</p>	<p>EIS Chapter 12, Section 12.6.2 and Chapter 13, Section 13.6</p>	<p>Normal cultivation practices include the full range of typical cultivation methods used, but does not include such practices as blade ploughing.</p> <p>Property-specific requirements will be discussed with landholders during the negotiation of conduct and compensation agreements.</p> <p>As far as practicable, access will be designed to not impede farming operations. Pipelines and gathering systems will be designed to account for land use in accordance with applicable standards including the depth of burial which is influenced by traffic on the easement.</p> <p>Where impacts cannot be avoided, compensation will be negotiated.</p>
R10150	S134	<p>EIS to include specific and clear commitments relating to the proposed agricultural management plans and also for agriculture as a land use.</p>	<p>SREIS Chapter 7, Section 7.5</p>	<p>Arrow is working with the Arrow Intensively Farmed Land Committee to resolve how and when it will operate on intensively farmed land to not unreasonably interfere with the ability to farm the property. Arrow will work with landholders to develop workable protocols.</p> <p>Environmental management plans for the construction and operation of the project will include (where relevant) management plans that detail methods to address issues common to agriculture, e.g., deep ripping, erosion and sediment control, biosecurity.</p>
R10151	S014, S044	<p>Arrow had made commitments in the EIS regarding intensively farmed land, will the administering authority recognise these commitments without the land being defined?</p>	<p>EIS Chapter 13, Section 13.6 SREIS Chapter 7, Section 7.5</p>	<p>Intensively farmed land (IFL) has been defined to identify and address those properties which, on account of the agricultural practices undertaken and sensitive soils (i.e., black soils), are particularly susceptible to change. Arrow is working with the Arrow Intensively Farmed Land Committee to resolve how and when it will operate on IFL to not unreasonably interfere with the ability to farm the property. Arrow will work with landholders to develop workable protocols.</p> <p>Arrow will negotiate with every landholder on how coal seam gas infrastructure is developed on their property so that project activities integrate</p>

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R10151	S014, S044			to the greatest extent possible with existing and proposed farming operations. Arrow's obligations with respect to each property on which it conducts activities will be set out in conduct and compensation agreements with the landholder.
R10152	S050, S109, S134	EIS Chapter 13, Section 13.6 discusses the Arrow Intensively Farmed Land (AIFL) Committee and the trials and case studies currently in progress. Concerns are raised about the committee's lack of results to date and raises the question of how an approval can be given to a project when they are yet to demonstrate any mentioned in the EIS. Shouldn't Arrow complete the trials and case studies before they get approval to proceed with the project, rather than approving it on the assumption they will get it right? Feedback from the AIFL Committee to farmers has been almost non-existent because so few case studies or trials have been concluded.	EIS Chapter 13, Section 13.6 and Appendix F SREIS Chapter 3, sections 3.4.1 and 3.6.1 and Chapter 7, Section 7.5	EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report, have identified potential impacts on agriculture and provided a broad range of management measures in the EIS. Further measures to address identified impacts including access protocols are being worked through with the Arrow Intensively Farmed land (AIFL) Committee. Arrow is presently researching ways to reduce impacts on intensively farmed land. Project demonstrations currently underway include multi-well pad drilling and pitless drilling (SREIS Chapter 3, Project Description, sections 3.4.1 and 3.6.1). Additional work is being done on minimal disturbance drilling and pipeline installation. The Arrow coexistence commitments were developed using knowledge gained through the AIFL Committee. Arrow's development of Area Wide Planning as an input into the development of gathering systems was also identified by the AIFL Committee as a key priority to minimising Arrow's impacts on agricultural businesses.
R10153	S024, S025, S026, S036, S054, S069, S079, S081, S083, S143	How was the definition of 'concentrated agriculture' arrived at?	EIS Chapter 4, Section 4.1.1 and Chapter 13, Section 13.6	Concentrated agriculture (EIS Chapter 4, Environmental, Social and Economic Context, Section 4.1.1) is a figure of speech used to recognise the intensive agricultural activities carried out on the Condamine flood plain. Arrow has defined 'intensively farmed land' to reflect agricultural areas on sensitive soils (i.e., blacksoils) that are currently intensively farmed (i.e., irrigated, cropped) where relatively minor changes to the landform and farming activities can have a disproportionate impact on the productivity of the land (EIS Chapter 13, Agriculture, Section 13.6).
R10154	S034, S069	The proponent describes the area in which we are located as having 'large, rectangular fields'. What does Arrow define as 'large' when referring to field size?	EIS Chapter 18, Section 18.3	This term is used in EIS Chapter 18, Landscape and Visual Amenity, Table 18.3, to describe Landscape Type B: Settled Arable Plains. It is used as a figure of speech to distinguish the land from smaller lots (e.g., acreage).
R10155	S050	A figure shown in EIS Appendix F, Agricultural Report on page 45 suggests changing the angle that land is farmed to allow for a well. They argue that it is not a simple matter of just changing the direction you farm to add a well into the paddock. If this did occur, you would have a difficult time with existing wheel marks and trying to fill them in, as well as the loss in yield from effectively having compaction on the new wheel marks, as well as old. It shows a complete lack of understanding for intensively farmed land, and underlines the fact the	EIS Appendix F, Section 7.2.1	EIS Appendix F, Agricultural Report, Section 7.2.1 notes that controlled runs are periodically alternated to reduce compaction and that angling the runs to account for a production well may maximise the cultivation area. The decision to angle runs as shown in Section 7.2.1, Figure 6 would need to be considered in the broader context of the particular farming activities on that property. Arrow has committed to negotiating with landholders to place infrastructure so that it reduces the impact on their cropping practices. This is part of Arrow's 12 coexistence commitments for conducting operations on IFL in the Surat Basin.

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R10155	S050	EIS is incomplete in relation to agriculture.		
R10156	S017, S025, S091	Agricultural activities within the project development area have not been accurately assessed, and therefore have been inadequately described. EIS has not adequately highlighted the intensity and productivity of cropping, especially on the irrigated black cracking clay strategic cropping land. This is essential to understanding the incompatibility of the gas mining and agriculture on the same land. The EIS needs to be rewritten to properly describe agricultural activities.	EIS Chapter 13, Section 13.3.5	EIS Chapter 13, Agriculture, Section 13.3.5 highlights the farming techniques utilised in the region. EIS Appendix F, Agricultural Report, recognises the activities affecting the productivity of cropping on irrigated soils, including the importance of soil water content, cultivation methods, crop rotation and constraints imposed by irrigation infrastructure on other development. Arrow is working with the Arrow Intensively Farmed Land Committee to resolve how and when it will operate on IFL to reduce the impact on a landholder's ability run their farm businesses. Arrow will work with landholders to develop workable protocols that will allow coal seam gas operations to be integrated to the greatest extent possible with farming activities. These negotiations will be undertaken and documented as part to the conduct and compensation agreement process.
R10157	S134	Arrow should expand coverage of the GIS constraints mapping data to include verified strategic cropping land data.	–	Potential strategic cropping land (SCL) is currently identified in Arrow's geographic information system (GIS) but not as a constraint. Validated SCL will be maintained in the GIS and will inform site and route selection.
R10158	S099	The nature of intensive cropping is that there is likely to be a large biomass at the times when seasonally there is a greater risk of bushfire. The classification of low/medium bushfire risk must be reassessed in the context of the introduction of 150 highly combustible wells with pipelines and flares per 10 km by 10 km land grid.	EIS Chapter 25, Section 25.6.3	Noted. The EIS contains a number of commitments in relation to managing bushfire risk. See EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3, which details specific controls.
R10159	S017	If farming operations are not carried out in a timely manner, we can expect a reduction in crop yield or worse, still performing operations at a high soil moisture content which will create compaction issues and further reduced yields for years to come. The gross margin in a farming enterprise does not cater for increases in operation costs or a decrease in crop yield as suggested. The proponent has neglected to identify gross margins associated with growing each individual crop in the project development area. The disturbances of farming and increased overheads are grossly understated.	EIS Appendix F SREIS Appendix 14	EIS Appendix F, Agricultural Report presents Australian Bureau of Statistics and Queensland Department of Employment, Economic Development and Innovation (DEEDI) statistics to indicate the level of agricultural production across the region. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends. The specific impact on individual properties will be resolved through the negotiation of a conduct and compensation agreement.
R10160	S014, S044	The Upper Condamine Irrigation Project adds considerable economic value to the Darling Downs. This category C environmentally sensitive area	–	Available literature on the Upper Condamine Irrigation Project does not indicate that it holds the status of category C environmentally sensitive area (ESA) but if such information is available, Arrow will consider it.

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R10160	S014, S044	<p>(ESA) overlaps a significant portion of good quality agricultural land and potential strategic cropping land (Queensland Environmental Protection Agency, 2001) and the project development area. This environmentally sensitive area has not been mentioned in the EIS.</p> <p>The EIS states, a buffer zone is proposed but will not be applied if 'the activity occurs in pre-existing cleared areas or significantly disturbed land within the buffer'. An irrigation project cannot be developed without clearing or disturbing the land and in this instance (clearing and disturbance for the purpose of irrigation) has given the project area a category C environmentally sensitive area classification worthy of protection under legislation. We request the supplementary report to the EIS include a description of the Upper Condamine Irrigation Project and assess the relative Project development impacts.</p> <p>If the project is approved, we request the administering authority impose conditions that prevent coal seam gas activities within the Upper Condamine Irrigation Project area and from interfering with irrigation infrastructure within the Surat Gas project area.</p>		
R10161	S026, S081, S162	<p>The authors of the EIS Appendix F, Agricultural Report have a lack of knowledge of the impacts of coal seam gas activities on intensive cropping land use are evident as found in the statement 'increased headlands may require smaller tractors and planters to negotiate the introduced corners leading to increased capital and operating costs.' The actual impact of changes in farm layout as a result of inappropriate coal seam gas infrastructure will be tracts of land that are uncropped, or in the case of irrigated cropping, tracts of land that cannot be irrigated.</p>	EIS Appendix F	EIS Appendix F, Agricultural Report identified potential options for addressing impacts, however the report identifies where impacts cannot be avoided, compensation will be negotiated.
R10162	S014, S044	<p>Mechanised farming on intensively farmed land is also sensitive to:</p> <ul style="list-style-type: none"> • Overhead transmission lines, as they present safety issues and crop losses from operating equipment around them leave tillage gaps and creating weed banks. 	EIS Chapter 13, Chapter 25 and Appendix S SREIS Chapter 3, Section 3.4.5, Chapter 15 and Appendix 11	Potential hazards and risks of the project are summarised in EIS Chapter 25, Preliminary Hazard and Risk and EIS Appendix S, Preliminary Hazard and Risk Assessment. Updates to this assessment are described in SREIS Chapter 15, Preliminary Hazard and Risk and SREIS Appendix 11, Supplementary Preliminary Hazard and Risk Assessment. Landholders will be consulted during field planning and as part of the

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R10162	S014, S044	<ul style="list-style-type: none"> • Limitations on weight (e.g., a load limit for crossing gathering lines and medium pressure pipelines). • Fire hazard. Raw cotton is extremely flammable and fires can be started easily from the mechanics of picking equipment. <p>We request the supplementary report to the EIS consult with machinery experts to identify the risk and sensitivities associates with coal seam gas development.</p>		<p>negotiation of conduct and compensation agreements to determine land use practices. One of Arrow's 12 commitments to coexistence on IFL in the Surat Basin (as detailed on Arrow's website) is to provide landholders the option of above or below ground power supply and Arrow anticipates that most landholders will opt for underground power which will be co-located with the gathering pipelines.</p> <p>Where possible, electrical cables will be placed underground (SREIS Chapter 3, Project Description, Section 3.4.5).</p> <p>Limitations on weight are part of the risk assessment for the bearing of pipelines, which will be constructed in accordance with AS 2885.1-2012 (for high pressure gas pipelines) and the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444).</p> <p>Well pads will not contain flares and include a buffer area to reduce the risk from fire.</p>
R10163	S108	<p>The recovery times stated (prior to the implementation of mitigation measures) of up to 25 years for soils which are highly sensitive. The submitter is interpreting this to mean that a large part of the project may be affected by erosion and are likely to extend well beyond the immediate project development area, and for up to 25 years. The time it takes for vertosols to resettle to their original levels after disturbance (e.g., after the installation of gathering lines) is not known. Therefore the time period before land can return to effective use is unknown.</p>	<p>EIS Chapter 12, Section 12.6.4</p>	<p>Recovery time for soils is dependent on the characteristics of the soil and to the extent that macro and micropores are re-established. All disturbed soils will require rehabilitation to limit this time.</p> <p>An erosion and sediment control plan will be developed for the project as outlined in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.4.</p>
R10164	S158	<p>'Soil profile function' warrants further clarification. The community and decision making authorities need to know precisely what impact there will be to soil profiles and the effect on function. Impacts such as 'crop losses' surely also demand further detail and analysis.</p>	<p>EIS Chapter 13 and Appendix F, Section 10</p>	<p>The potential impacts on soil profile function and measures to reduce impacts on soils profiles are described in EIS Appendix F, Agriculture Report. Compensation will address issues such as the ability of the agricultural enterprise to absorb the impacts of lost productive land, reduced or lost productivity, and changed practices resulting in increased capital and operating costs.</p> <p>Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which address requirements regarding impacts on soils.</p>
R10165	S134	<p>Arrow to adequately address the extent of residual impacts on agricultural land. More information or additional studies to be undertaken in order to more accurately quantify the impacts.</p>	<p>EIS Chapter 13, sections 13.6, 13.7 and 13.8 and Appendix F, Section 9.2.5</p>	<p>Residual impacts on agricultural land are discussed in EIS Chapter 13, Agriculture, Section 13.7. As noted in the EIS, residual impacts will be identified through the inspection and monitoring methods outlined in Section 13.8.</p> <p>The <i>Strategic Cropping Land Act 2011</i> has been implemented to protect</p>

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R10165	S134			cropping lands for long term production. Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which address requirements regarding impacts on soils.
R10166	S014, S044	In the instance where there is not a total crop loss, assessing the percentage of loss directly associated with coal seam gas activity will be difficult. Stating that the project 'may' introduce new management overheads is a gross understatement. We request this subject be explored in more depth in the supplementary report to the EIS.	EIS Appendix F, Section 9.2.5	As set out in EIS Appendix F, Agricultural Report, Section 9.2.5, a method for assessing impacts to productivity (crop yields) shall be developed and should incorporate an appropriate number of control and sampling sites in the adjacent and rehabilitated areas. A typical assessment method involves the sampling and analysis of the rehabilitated and adjacent undisturbed land using ten quadrats with area of one metre squared in each area to assess crop yield or pasture health.
R10167	S017, S051, S110, S141, S144	Concern over the use of the agriculture specialist. The company is not well known amongst the community and there is no confidence in their ability to understand agricultural practices on the Condamine flood plain. There has been no consultation with farming businesses and therefore potential impacts are likely to remain unaddressed. The assessment was conducted via a 'desktop study'. A 'desktop study' is an inadequate. This leads to the question, how familiar are they with the intensive agriculture carried out on the Condamine flood plains of the Darling Downs? No one can achieve a correct and accurate understanding of such enterprises unless working with local growers and consultants. The report needs to be undertaken again by a professional and reputable consultant that has had extensive experience in the project development area.	EIS Appendix F	The purpose of EIS Appendix F, Agricultural Report was to identify the substantive issues that need to be considered and would be impacted by the proposed development. The agriculture report adequately addresses this objective in that it identifies the types of farming activities and the major constraints those activities might pose on coal seam gas development. The agriculture report was presented to the Arrow Intensively Farmed Land Committee in advance of its publication in the EIS. The specific issues of planning and operating infrastructure will be addressed with individual landholders through the negotiation of a conduct and compensation agreement.
R10168	S014, S044	The pre-mitigated impacts have been identified in general terms but are grossly understated. Impacts on intensively farmed land have not even been mentioned. The Gilbert and Sutherland desktop Agriculture Study has detailed more severe impacts that have not carried through to the EIS chapter. Considering there has been no field study conducted the EIS has understated the projects true impacts on agriculture.	EIS Chapter 13, Section 13.6	Severe impacts would arise where mitigation is not employed. Mitigation has been proposed through a set of objectives (EIS Chapter 13, Agriculture, Section 13.6). Objectives will be worked through with the Arrow Intensively Farmed Land Committee and translated where relevant into environmental management plans for the project.
R10169	S099, S150	No assessment of impacts on potential future food crops (e.g., vegetables) that may be grown if	EIS Chapter 13, Section 13.6	Arrow will avoid existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards,

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R10169	S099, S150	demand increases. There is a risk that development will result in a fragmented landscape with inadequate buffers due to its location in existing and /or proposed food production areas.		orchards, horticultural enterprises, poultry farms and small-lot plantations (EIS Chapter 13, Agriculture, Section 13.6, performance objective 2 – Intensive Farming Operations). The negotiation process for a conduct and compensation agreement with landholders includes the disclosure of current and planned activities by the landholders and Arrow. In addition, the agreement will include a clause which sets out the proponent and landholder's obligations and requirements in the event that the proponent materially changes the activities described in the agreement. This may lead to compensation amounts being revised and/or other actions being necessary. Arrow's 12 commitments to coexistence on IFL in the Surat Basin see to reduce the impacts on current and future cropping activities. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This process aims to balance individual needs of landholders with the needs of neighbouring properties to understand the potential impacts gas field infrastructure may have on farming operations and address how these impacts can be mitigated or reduced.
R10170	S141, S144	Impacts to farm management operations have not been appropriately considered by the EIS and must be clarified.	–	Arrow is required to negotiate with individual landholders for land access. This includes the mutual disclosure of activities and farm operations so that the impact of coal seam gas operations on a landholders business can be reduced and appropriately addressed through compensation.
R10171	S099	Flow on impacts from surface water erosion on flood plain soils is not addressed in the geology or surface water chapters. More information is required on impacts to the strategic cropping land productive capacity from project caused erosion.	SREIS Chapter 12, Section 12.6	EIS Chapter 12, Geology, Landform and Soils, Section 12.6 sets out the processes that will be put in place to manage erosion, including in more sensitive environments. Arrow will also seek to utilise existing access tracks and trafficked areas (see Commitment C111). Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which requires infrastructure not cause diversion to overland flow.
R10172	S014, S044	Stakeholder requests that the supplementary report to the EIS accurately describes all environmental, social and physical attributes of the Condamine flood plain.	EIS Chapters 12 to 26 SREIS Attachment 3, Appendix 12 and Appendix 14	The social, environmental and physical attributes of the Condamine flood plain have been described in the 'Existing Environment' section of EIS Chapters 12 to 26. SREIS Attachment 3, Social Impact Management Plan Update, Appendix 12, Supplementary Social Assessment of changes to the project description, provides an update to key social indicators using 2011 Australian Bureau of Statistics census data. SREIS Appendix 14, Supplementary Agricultural Economics Report, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends.

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R10173	S004, S006, S027, S046, S067, S086, S088	<p>The criss-crossing of connecting lines, roads, water lines, gas lines and heavy machinery lines compacts soil and damages cropping, ploughing and other farming activities.</p> <p>The impact of pipelines crisscrossing the flood plain will have irreversible effects on pristine areas such as erosion damage, changes to the water flows and the reduction in farm profits.</p> <p>It is impossible to maintain current farming methods with roads crisscrossing properties, e.g. on laser planed land, it is impossible to water a crop when a road interrupts the flow of the water which is a considerable expense for owners. It would be a huge loss to have the laser plane work damaged by the impact of roads and inadequate drainage which would arise from road construction. Access roads are a major interference to farming operations and will affect overland flow of water and risk waterlogging of crops and create soil erosion.</p>	<p>EIS Chapter 13, sections 13.4.6 and 13.6</p>	<p>The potential of project activities to cause adverse impacts on agricultural enterprises during the construction, operations and decommissioning phases of the project was described in EIS Chapter 13, Agriculture, Section 13.4.6. Measures to avoid, mitigate and manage these impacts were discussed in Section 13.6.</p> <p>The location of infrastructure will be resolved in the negotiation of a conduct and compensation agreement. This is included in Commitment 088 which states that Arrow will 'consult with landowners on the most appropriate method to minimise disruption to cultivation paddocks (including the introduction of additional headlands) and loss of productive land in controlled-traffic paddocks.' This commitment also lists a number of measures that Arrow will consider in reaching agreement including aligning gathering lines and new access tracks parallel to the direction of cultivation, soil conservation and controlled traffic runs and avoid perpendicular and lateral connections. Arrow will also seek to utilise existing access tracks and trafficked areas.</p>
R10174	S027	<p>Holds concerns and considers that the disadvantages and risks associated with the project outweigh the advantages. The now decommissioned Moonie to Brisbane oil pipeline runs through the submitter's property, with a valve in the centre of the cropping area. This has provided the submitter with insight into what may occur with coal seam gas wells, due to inspections and sometimes heavy vehicles driven over soft damp soil to access the structure.</p>	–	<p>The Moonie to Brisbane pipeline was constructed in 1964 and has been operated successfully until its decommissioning in 2007. At that time, the design and location of such pipelines did not consider all the issues being addressed through the Surat Gas Project EIS.</p>
R10175	S010, S110	<p>Will Arrow indemnify the farm operator from damages caused to Arrow operations when the farm operator's normal legal activities cause damage or lost to coal seam gas operations?</p>	–	<p>Arrow is responsible for accidental damage to its infrastructure caused by a landholder unless the damage is caused by deliberate or wilful actions or an act of omission.</p>
R10176	S026, S081, S162	<p>Changes to state and federal regulatory requirements necessitate modifications to landholders' agricultural practices from time to time. Coal seam gas development will significantly hamper landholders' abilities to comply with these requirements and remain productive and financially viable.</p>	–	<p>Noted. Negotiation of conduct and compensation agreements will take into account both existing and future planned land use. In the event that changes to legislation occur that necessitate changes to farm practices after the installation of the infrastructure, Arrow and landholders can renegotiate conduct and compensation agreements to take these matters into consideration.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10177	S010, S014, S017, S044, S141, S144, S157	<p>The statements in EIS Chapter 5, Section 5.5.1, Production Wells, regarding operational footprints and progressive rehabilitation do not account for other restrictions placed on the landholder under existing land access agreements in place between landowner and Arrow.</p> <p>The EIS does not disclose these ongoing right of way and land use needs which stipulate acceptable and non-acceptable activities that can be conducted by the land owner and fails to inform the decision maker.</p> <p>Landholders need to know what rights they would be conceding on pipeline right of way areas and what rights they retain.</p> <p>Who has the right to use the right of way? Arrow or landowner? Does the landowner have the right to drive in this location or are they required to drive in their paddock and create even more unnecessary compaction and even more crop losses? Do third parties such as contractors or agronomists have the right to drive on the right of way and if they are met by an Arrow personnel who gives way?</p>	<p>EIS Chapter 5, Section 5.5.1</p>	<p>Arrow's intention is not to obstruct landholders in carrying out their activities. How activities coexist will be resolved through negotiation with individual landholders during the preparation of conduct and compensation agreements. Arrow will seek to work through issues that could cause conflict with normal farming operations and reach agreement on protocols for access (including what notice landholders require prior to company personnel or contractors entering property).</p> <p>With respect to pipeline and gathering system right of ways, the greatest impact will be experienced during construction. Pipelines will be constructed in accordance with AS 2885.1-2012 (for high pressure gas pipelines) and the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444).</p> <p>Following the reinstatement of the right of way, it is expected normal farming activities can continue.</p> <p>There are no specific rules or restrictions on a landholder other than a normal duty of care. Arrow will seek disclosure from landholders on the activities they undertake that may interface with coal seam gas infrastructure and production to develop operating procedures.</p>
R10178	S024, S026, S079, S081, S162	<p>Arrow must list and describe all the various work practices involved with gas field development.</p> <p>Arrow must list and describe all the modified work practices and provide evidence of their success in reducing and/or managing potential impacts.</p>	<p>EIS Chapter 5 SREIS Chapter 3, Section 3.6.1</p>	<p>EIS Chapter 5, Project Description and SREIS Chapter 3, Project Description set out the activities involved in coal seam gas development.</p> <p>A number of modified work practices and protocols are being discussed with the Arrow Intensively Farmed Land Committee in relation to conducting activities on intensively farmed land including pitless drilling. Arrow will meet HSSE best practice and legislative requirements and EIS conditions in field and project development.</p>
R10179	S017	<p>What processes are going to be put into place to safeguard us when we perform farming operations in a timely manner?</p>	<p>EIS Chapter 13, Section 13.6</p>	<p>Arrow's intention is not to obstruct the landholder in carrying out his or her activities. Through the conduct and compensation agreement process, Arrow will seek to work through issues that could cause conflict with normal farming operations and reach agreement on protocols for access.</p>
R10180	S139	<p>Will on-going monitoring and testing be done in regards to environmental monitoring at specific (infrastructure) sites be undertaken?</p>	<p>EIS Chapters 9 to 26</p>	<p>A range of ongoing monitoring and inspection will be undertaken, as set out in EIS Chapters 9 to 26 and in accordance with the conditions of the project environmental authority.</p>
R10181	S014, S044	<p>EIS Chapter 13, Section 13.4 identifies a number of sensitive areas that will cause interruption to agricultural production on individual farms. The suggested mitigation and management measures</p>	<p>EIS Chapter 13, Section 13.4</p>	<p>Arrow's intention is not to obstruct the landholder in carrying out his or her activities. Through the conduct and compensation agreement process, Arrow and landholders will disclose activities and practices where there may be timing conflicts with normal farming operations and negotiate protocols for</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R10181	S014, S044	defined to combat the impacts will rarely be successful because of the unpredictability of weather influences and intensive nature of cropping on the Condamine flood plain. If the project were to proceed in this area, on a daily basis there will be landholders and coal seam gas workers requiring access to the same parcel of land at the same time, resulting in conflict. It is not acceptable that the State Government administering authority ignore this fact, deferring it to be dealt with in a conduct and compensation agreement and leaving landholders and their businesses susceptible to exploitation.		notification and access.
R10182	S014, S044	The EIS states 'develop or facilitate the development of a method for assessing impacts on productivity (crop yields) that incorporates statistical analysis and appropriate control and sampling sites'. While this is an appropriate proposal it could not be considered a mitigation measure to reduce crop losses as it is merely a method for assessing loss. Could it be clarified in the supplementary report to the EIS, which points in EIS Chapter 13, Section 13.6.3 are mitigation and management measures specific to crop losses?	EIS Chapter 13, Section 13.6.3	Noted. All commitments set out in EIS Chapter 13, Agriculture, Section 13.6.3 (with the exception of Commitment C097 and Commitment C104 which pertain more to disturbance to stock) are mitigations for crop losses. Each commitment seeks to prevent impacts that could reduce the productivity of land and thereby result in crop losses.
R10183	S139	Will farming management practices be impacted, and what mitigation measures will the proponent put in place to minimise the impacts?	EIS Chapter 13 and Appendix F	EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report, have identified potential impacts on agriculture and provided a broad range of management measures in the EIS. Arrow and landholders will negotiate conduct and compensation agreements that seek to reduce the impacts on a landholder's farming practices.
R10184	S014, S044, S086, S108	Top soil on the Condamine flood plain east of Cecil Plains is 120 mm deep. Stockpiling this quantity of topsoil for short or long term rehabilitation in 2 m high piles is not feasible on the flood plain. It would further reduce the availability of land for cropping and create diversions for overland flow. It has also been made clear in EIS Appendix E, that soils on the flood plain are not suitable for stockpiling and using for rehabilitation purposes. Nowhere does Arrow indicate what area will be used to store stockpiles. How will the 2 m high	-	Topsoil stripped for insulation of gathering systems and medium pressure pipelines will be stockpiled to the side of the right of way in piles at approved heights for the duration of pipelining activities which last for a relatively short period of time. Following the laying of the pipe the soil horizon will be reinstated including redistribution of stockpiled topsoil over the right of way. The management of topsoil stripped to establish well pads will be resolved with the landholder. On strategic cropping land, Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities which address requirements regarding impacts on soils.

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Issue No.	Submission No.	Issue	Reference	Responses
R10184	S014, S044, S086, S108	stockpiles be created without compacting the vertosols? How will erosion of stockpiles be managed? We would request further details on managing topsoil on good quality agricultural land and strategic cropping land be provided in the supplementary report to the EIS.		
R10185	S108	The technique described in the EIS whereby soils are removed in 10 cm layers does not account for the compaction that will result from taking several passes to cut the soil, load the truck and each new load requiring movement over the previously stripped site. Given that the cropping vertosols and the vertosols are kept wet to maximise cropping productivity, these soils removal activities are unlikely to occur when the soils are dry – resulting in additional compaction. Once soils are stripped, where are they stored? Will Arrow truck the soil outside of the strategic cropping land area for storage?	SREIS Chapter 7, Section 7.3	Arrow is reviewing the best methods to limit and manage soil compaction around project-related infrastructure including when soils are saturated. Arrow will suspend works during rainfall events that will compromise erosion and sediment control or leading to rutting or compaction (Commitment C105). Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which address requirements regarding impacts on soils.
R10186	S108	How will Arrow manage the logistics of returning the soil horizons in order? The contractors who remove the soils are unlikely to be the same ones to return it – how will this be controlled? When the soils are returned, the same compaction processes that occurred when the soil was removed will be repeated again. Who will ensure that the machinery does not traverse out of the right of way and compact more soil? Who will supervise and document these tasks?	SREIS Chapter 7, Section 7.3	Topsoil is typically removed using a grader which blades the soil to one side of the right of way and into stockpiles. It does not (typically) involve the removal from site. Subsoils are removed according to their layers and stockpiled to the opposite side of the right of way to maintain segregation of the various soil horizons. They are replaced in the same order that they are removed and compacted as close as possible to in situ material properties. Right of ways will be clearly identified so that drivers are aware of authorised access routes on properties. Site supervision by Arrow will so that contractors observe such controls. Arrow will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which address requirements regarding impacts on soils.
R10187	S051	How will the growers and agents involved in supplying products (such as maize, sorghum, soybeans, wheat and barley in a clean green environment) be compensated if the inevitable happens and the ability to supply these clean green products is lost because of coal seam gas mining on our strategic cropping land.	EIS Chapter 13, Section 13.6 and Appendix F, Section 10	Impacts will be resolved in conduct and compensation agreement when the specifics of each farm can be addressed. Compensation will address issues such as the ability of the agricultural enterprise to absorb the impacts of lost productive land, reduced or lost productivity, and changed practices resulting in increased capital and operating costs. As set out in Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land (IFL) and coal seam

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Issue No.	Submission No.	Issue	Reference	Responses
R10187	S051			gas developments can coexist without causing permanent alienation of, or diminished productivity from IFL.
R10188	S024, S025, S026, S036, S046, S054, S079, S081, S083, S108, S110, S141, S144, S162	The addition of transmission lines transecting the landscape to service the power requirements of the well heads will have a significant effect on farming practices and equipment. New power lines traversing strategic cropping land are not supported. Overhead transmission lines may limit farming operations and the ability of future changes to farming practices. EIS Chapter 13 and EIS Appendix F must be rewritten to incorporate the impact of power poles and overhead distribution lines on agriculture.	SREIS Chapter 3, Section 3.4.5	The specific issues of planning and operating infrastructure will be addressed with individual landholders through the negotiation of a conduct and compensation agreement. Arrow has committed to provide landholders on intensively farmed land (IFL) the option of above or below ground power supply as part of Arrow's 12 commitments to coexistence on IFL in the Surat Basin. Arrow anticipates that most landholders will opt for underground power which will be co-located with the gathering pipelines.
R10189	S001, S002, S003, S009, S017, S018, S019, S020, S024, S026, S032, S034, S036, S037, S039, S050, S053, S055, S057, S058, S059, S064, S065, S067, S069, S070, S071, S076, S079, S081, S083, S085, S086, S087, S088, S095, S096, S097, S098, S114, S130, S139, S140, S149, S152, S154, S167	A 20 m right of way for the laying of pipelines will severely interrupt the farming system. If a right of way intersects a field it will be virtually impossible to conduct field operations across the whole field. Farming practices occur all year round especially for a crop of cotton which requires the whole year to produce. Pipelines should be laid at depth suitable for intensive cropping and to account for the swell cracking nature of soils; they must be constructed of material that can withstand expected pressures; and trenches should be filled with stabilising material to resist subsidence. It is suggested that the maximum load tolerated by these pipelines regardless of the depth they are buried, should be included in the landholder agreement with Arrow.	EIS Chapter 25, Section 25.4.1 and Appendix S, Section 6.6 and Appendix 1	As set out in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1, high pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Section 6.6). Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). Property-specific requirements will be discussed with landholders during the negotiation of conduct and compensation agreements and pipelines will be designed to account for land use in accordance with applicable standards including the depth of burial which is influenced by traffic on the easement, e.g., cotton pickers. The location of infrastructure will be resolved in the negotiation of a conduct and compensation agreement. This is included in Commitment 088 which states that Arrow will 'consult with landowners on the most appropriate method to minimise disruption to cultivation paddocks (including the introduction of additional headlands) and loss of productive land in controlled-traffic paddocks.' This commitment also lists a number of measures that Arrow will consider in reaching agreement including aligning gathering lines and new access tracks parallel to the direction of cultivation, soil conservation and controlled traffic runs and avoid perpendicular and lateral connections. Arrow will also seek to utilise existing access tracks and trafficked areas.
R10190	S099, S166	When the pipes are laid for the gas and water transfer, it will leave the ground uneven. These areas will sink from irrigation and rain, causing water logging of the crop. If subsidence of pipelines occurs there is concern	EIS Chapter 12, sections 12.1 and 12.6.2	Arrow will develop an erosion and sediment control plan and install and maintain site-specific appropriate controls (Commitment C034). The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan, along with topographic LIDAR data, Altamira reports and landholder information.

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R10190	S099, S166	over the potential workplace health and safety risks and machinery damage risks in areas of good quality agricultural land and strategic cropping land. There is also concern over potential subsidence along road reserves limiting access to properties.		Where Arrow is operating on strategic cropping land it will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which set out the requirements for rehabilitation.
R10191	S024, S026, S034, S036, S038, S050, S069, S081, S083, S150, S162	The Environmental Authority for ATP683 states land must be returned to 'their previous use and suitability class', however the statement to return the land to 'as near as possible' the predisturbed state, provides no guarantee of a minimum standard as to the outcome. If this information regarding rehabilitation of lands cannot be provided, then project activities must not be permitted to proceed in areas where it has been identified that rehabilitation to the predisturbance condition will be difficult, until such a time as this information is forthcoming. In the submitter's opinion this illustrates that Arrow believe that it is acceptable that only an attempt is necessary to fulfil their obligation to rehabilitate to the predisturbed state. The submitter views this as a flawed approach by Arrow to decommissioning and rehabilitation, especially in respect of the 60% good quality agricultural land and 49% strategic cropping land the project will impact on.	SREIS Chapter 7, Section 7.3	Where Arrow is operating on strategic cropping land it will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities, which set out the requirements for rehabilitation. Regardless, conditions of Arrow's environmental authority require it to rehabilitate land to the predisturbed land use unless otherwise agreed to between Arrow, the landholder and the administering authority. In addition, the environmental authority sets out the requirements for rehabilitation.
R10192	S024, S026, S034, S069, S081, S162	If Arrow plans to use site selection as the primary management tool to minimise residual impacts, then investigations of all of the relevant environmental values needs to be undertaken prior to project activities commencing, to determine which sites can be successfully rehabilitated.	–	The location and extent of blacksoils (vertisols and dermasols) is an important consideration in site selection. They comprise a range of environmental values sought to be protected through appropriate management including their handling and rehabilitation.
R10193	S014, S017, S044, S081, S139	Using a pipeline as an example of rehabilitation on black (vertisol) soils is poor and cannot in any way be compared to rehabilitation of well sites or access tracks as part of the decommissioning process. Landholders on the Condamine Floodplain have been burying pipes and rehabilitating the trench during the establishment of irrigation infrastructure for many years and know	SREIS Chapter 7, Section 7.6	Arrow acknowledges the advice that rehabilitation of trenches for irrigation pipes has successfully been undertaken. To date, well pads on cropping land have not been decommissioned and rehabilitated. Well pads will be sited to reduce impact on cultivation paddocks with multi-well pads being investigated to consolidate impacts and increase the separation of wells. Arrow has established a demonstration property at Theten on which it is and

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R10193	S014, S017, S044, S081, S139	that it is achievable to a certain extent. Have crops been grown on remediated drill pads in the past? What tests have been undertaken? To truly gauge the impact coal seam gas activities will have, there needs to be a simulated well and its associated tracks and right-of-way set up on a working irrigated farm with coal seam gas staff members simulating their daily activities for a 2 to 3 year period. The trial would need to take in all impacts of works carried out over time, including a well workover (3 year period).		will continue to conduct a number of trials into the use of coal seam gas water for irrigation, as well as management and rehabilitation of blacksoils.
R10194	S162	Coal seam gas companies have trust issues with landholders at the moment, and Arrow are considered one of the worst. It is unlikely that landholders would view this EIS confidently, however, with the insulting data (EIS Appendix F, Table 7), using data in drought conditions, no field assessment, no strategic cropping land (SCL) assessment and without any risk analysis of possible impacts with existing farming enterprises it raises the mistrust. This chapter must be rewritten to include an assessment of SCL, accurate Queensland data from recent sources (less than 3 years ago, or averaged 10 years), field trials to show actual impacts and interaction risks with intensive cropping, and a case study of successful rehabilitation of black cracking clay soils. Commitments such as plans and methods must be spelt out in more detail.	EIS Chapter 13, Section 13.1 SREIS Chapter 2, Section 2.4.1 and Chapter 7, Section 7.3	Noted. At the time of preparing the EIS, Australian Census data from 2006 was the most recent census data available. SREIS Appendix 11, Economics, contains an Analysis of Agricultural Production and Issues in Darling Downs Report. This report provides updated agricultural production data and analysis of trends from the 2011 census. The legislative context for strategic cropping land (SCL) is provided in the EIS Chapter 13, Agriculture, Section 13.1. A further update is provided in SREIS Chapter 2, Project Approvals, Section 2.4.1 and SREIS Chapter 7, Agriculture, Section 7.3. At the time the Surat Gas Project EIS was submitted to DERM for adequacy review against the Terms of Reference (which is required before public exhibition), the <i>Strategic Cropping Land Act 2011</i> (Qld) had not been enacted. Arrow will need to separately address SCL requirements consistent with the act. Arrow has established a demonstration property at Theten on which it is and will continue to conduct a number of trials into the use of coal seam gas water for irrigation, as well as management and rehabilitation of blacksoils.
R10195	S014, S044	The quantity and impacts of core and chip wells are relatively minor in comparison to production wells. Arrow would gain more credibility with landholders if they were establishing trials and case studies that demonstrated rehabilitation methods following long term impacts from all activities associated with production wells and access tracks on black soils.	SREIS Chapter 3, Section 3.6.5	Arrow is presently researching ways to reduce impacts on intensively farmed land. Project demonstrations currently underway include multi-well pad drilling and pitless drilling. Other applications such as the use of a 'spider plow' to install gathering system pipeline or standard power line installations have been found to work and can be confidently included in planning considerations (SREIS Chapter 3, Project Description, Section 3.6.5).
R10196	S157	The mapping presented by Arrow in response to Section 4.2.1.5 (Land Use) of the Terms of Reference are not presented at a suitable scale to show existing land uses and tenure, and the project location. Nor do they show the land use suitability	EIS Appendix A, appendices C to J	Further land use maps, which are presented at a larger scale, are available in EIS Appendix A, Planning Assessment, appendices C to J.

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R10196	S157	of the affected area.		
R10197	S014, S044	EIS Chapter 13, Agricultural Development and Production, Section 13.3.3 neglects to point out that agricultural production was significantly reduced during 2009/2010 due to prolonged drought. Is this statement (last paragraph of Section 13.3.3, Agricultural Development and Production), suggesting that an increase in regional production at this time (which is attributed to the mining industry) is an acceptable reason for underestimating the significance of the agriculture industry?	EIS Chapter 13, Section 13.3.3 and Appendix O, sections 4.2.2 and 4.3.1 SREIS Appendix 14	Noted. The significance of agriculture is identified throughout the EIS, with the Darling Downs agricultural reliance on weather patterns and climatic and seasonal conditions acknowledged (EIS Appendix O, Economic Impact Assessment, Section 4.3.1). Section 4.3.1 further highlights in the past decade many agricultural producers in the region have been severely affected by drought conditions. Between 2000 and 2009, parts of Toowoomba Regional Council, Western Downs Regional Council and Southern Downs Regional Council were either partially or fully drought declared, while parts of Goondiwindi Regional Council were drought declared between 2002 and 2009. Additional analysis of agricultural production and issues in the Darling Downs, including agricultural trends around drought and flood, is provided in SREIS Appendix 14, Supplementary Agricultural Economics Report includes the analysis of agricultural production and issues in the Darling Downs.
R10198	S034, S042, S069, S078	EIS Chapter 13, Agriculture, Section 13.4.3 states that smaller farming equipment (e.g., tractors and planters) may be required to negotiate increased headlands and introduced corners and the development may limit the ability of farmers to change farm plans. How does Arrow propose agricultural businesses absorb such financial pressure (especially given farming is the only means of employment and superannuation), when it is not practicable or profitable to revert back to smaller machinery?	EIS Chapter 13, sections 13.6.2 and 13.6.5	The option of using smaller farming equipment was provided to demonstrate a possible means of overcoming the constraints imposed by inappropriately sited wells (e.g., well sites located the middle of a cultivation paddock) and to recognise that additional costs would be incurred in such circumstances. The preferred solution is to work with landholders to agree the location of wells that cause the least disturbance to land and avoid the need to change farming practices. Arrow will negotiate conduct and compensation agreements with individual landholders. This includes the mutual disclosure of activities and farm operations so that the impact of coal seam gas operations on a landholders business can be reduced and/or appropriately addressed through compensation. Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This process aims to balance individual needs of landholders with the needs of neighbouring properties to understand the potential impacts gas field infrastructure may have on farming operations and address how these impacts can be mitigated or reduced.
R10199	S010, S014, S044, S079, S088, S108	Stakeholder requests information on width and average length of access tracks. There is no mention of the use of access tracks during prolonged wet periods. Will Arrow be using gravel on new tracks required for all weather access and to meet safety requirements at wellheads?	SREIS Chapter 3 and Chapter 7, Section 7.3	Arrow will comply with the requirements of the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities when operating on strategic cropping land. The width of access track will depend on existing access tracks and safety requirements. The length will be determined by the proximity of the well to existing access tracks or public roads. All weather access tracks will be constructed to maintain the existing

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Issue No.	Submission No.	Issue	Reference	Responses
R10199	S010, S014, S044,			hydrologic and hydraulic regime of the site, particularly the maintenance of overland flows (Commitment C089).
R10200	S034, S069	Will landholders have the right to keep their current roads, or will Arrow have the right to build gas field infrastructure forcing the landholder to construct new roads in cultivated areas?	–	Arrow's intention is to use existing tracks for access where possible. The use of existing and the placement of new access tracks will be part of the negotiation of a Conduct and Compensation agreement with individual landholders.
R10201	S014, S044	What method is used to construct an all-weather access track that maintains the 'existing hydrologic and hydraulic regime of the site'? Has Arrow conducted trials on black soil to demonstrate and prove the outcome of this design? We request the supplementary report to the EIS answer these questions.	SREIS Chapter 7, Section 7.3	All weather access tracks will be constructed to maintain the existing hydrologic and hydraulic regime of the site, particularly the maintenance of overland flows (Commitment C089). Arrow has constructed access tracks on blacksoils that have been exposed to overland flows without any evidence of erosion or disturbance of cultivation areas. Arrow will comply with the requirements of the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities when operating on strategic cropping land.
R10202	S014, S044, S139	What considerations have been taken into account in regards to design of drill pads on intensive farming areas? Will this impact current farming practices? Will future farming research be undertaken?	SREIS Chapter 3, Section 3.4.1 and Chapter 7, sections 7.3 and 7.6.2	Arrow is working actively to design and develop the gas field to reduce impacts on intensive farming land. This includes the investigation of multi-well pads and undertaking Area Wide Planning, which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. Where Arrow is operating on strategic cropping land it will be required to comply with the <i>Strategic Cropping Land Act 2011</i> and the Strategic Cropping Land Standard Conditions Code for Resource Activities. Arrow is presently researching ways to reduce impacts on intensively farmed land. Project demonstrations currently underway include multi-well pads (SREIS Chapter 3, Project Description, Section 3.4.1).
R10203	S024, S025, S026, S034, S036, S069, S081, S083, S162	If the wellhead areas will not be able to be reduced down to 10 m by 10 m in certain areas, what are the additional impacts to these landholders, property values, agriculture and agricultural productivity?	–	Where land is rendered unavailable for agricultural production the landholder will be compensated in accordance with the conduct and compensation agreement.
R10204	S014, S026, S044	On the Condamine Floodplain, there are very few boundary fences and soil quality is uniform across each holding. If pipelines are routed parallel to the direction of cultivation, head ditches and tail drains, this would suggest that they could be within a cultivated field and cropped over the top of. The supplementary report to the EIS must describe in detail the activities that can be conducted over the top of medium-pressure pipelines and when the situation arises that Arrow requires access to the right of way during a crops growing cycle or while	–	Gathering systems and medium pressure pipelines will be designed (including depth of burial) to take into account existing land uses including farming practices. As such, typical farming activities can continue over buried pipelines. Access to a right of way once pipelines have been laid and the right of way rehabilitated is generally only required in emergency situations, which are not anticipated.

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Issue No.	Submission No.	Issue	Reference	Responses
R10204	S014, S026, S044	obstructed, what the process would be.		
R10205	S139	EIS Chapter 13, Section 13.6 Avoidance, Mitigation and Management Measures Here Arrow Energy makes mention of its two committees and their reliance on these committees to deal with a number of their impacts. DERM (now EHP) has in the past refused to condition Environmental Authorities issued to Arrow for exploration in ATP683 because they claim that these committees are dealing with the issues. Landholders and the community find this situation totally unacceptable as these committees have limited community acceptance and are wholly resourced and populated by Arrow appointees. The committee's Terms of Reference also clearly state that the existence of the committee is to facilitate Arrow's development of coal seam gas in the region and in no way compels Arrow to deal with issues to the communities satisfaction. We request that the regulator not defer its responsibilities to condition issues to Arrows committees for determination.	EIS Chapter 13, Section 13.6	Arrow seeks to work with all landholders to resolve issues associated with construction, operation and maintenance of coal seam gas infrastructure on agricultural land. Arrow's two committees provide a valuable forum for exploring issues raised by landholders and investigating options for the management of these issues. Arrow sought advice and invited expressions of interest to participate on the committee from parties that provided a broad cross-section of farming interests in the Surat Gas Project development area. These committees have no role in the conditioning process for environmental authorities issued to Arrow by EHP (previously DERM).
R10206	S010, S088, S104, S110	Concerned about subsidence of the land surface when pressures are altered due to aquifer depressurisation. Land subsidence and deformation due to gas and water extraction has the potential to cause disruption to overland flows and irrigation on laser levelled strategic cropping land. Arrow should provide further detail around environmental impact and mitigation strategies for land subsidence and land deformation as a result of gas and water extraction.	EIS Appendix G, Section 8.4 SREIS Chapter 8 and Chapter 9	EIS Appendix G, Section 8.4 presents a literature review of available publications relevant to subsidence as a result of coal seam gas extraction. No local examples were available. As part of the SREIS, a desktop assessment of additional information available since the EIS has been undertaken and included in SREIS Chapter 8, Groundwater and Chapter 9, Surface Water. The desktop study includes examples of potential subsidence associated with coal seam gas extraction, and presents the results of a collaborative baseline surface deformation study conducted by coal seam as proponents within the Surat Cumulative Management Area. The information has been used to expand on the description provided in the EIS that subsidence as a result of coal seam gas extraction is unlikely to occur in the region. SREIS Chapter 9, Surface Water provides an update on the data being collected to assist with understanding the potential for subsidence associated with project activities. If available, Arrow will review information available from the Office of Water Science (a group within SEWPac) in relation to subsidence to inform its understanding of potential impacts.
R10207	S024, S026, S081,	Arrow must provide detailed information about	–	Rehabilitation involves the reinstatement of the soil profile, appropriate

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R10207	S024, S026, S081, S162	rehabilitation of lands to their predisturbance condition. What are all the processes involved in rehabilitation? What materials are used?		compaction and cultivation to re-establish conditions as close as possible to the predisturbance conditions. Remedial works are sometimes required to complete rehabilitation to predisturbance conditions. Rehabilitation is carried out using graders and excavators and typical farm machinery.

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Table 19.11 Groundwater

Issue No.	Submission No.	Issue	Reference	Responses
R11001	S010, S088, S161	Provide further explanation as to how the impact from coal seam gas water extraction has been assessed as having a low to very low impact on existing and future groundwater users. There is concern this is misleading, and masks the potential severity of the impact on groundwater users in the long term.	EIS Chapter 14, sections 14.6 and 14.7.2	<p>The residual impact significance rankings associated with reduced groundwater supply to existing or future groundwater users are explained in EIS Chapter 14, Groundwater, Section 14.7.2.</p> <p>While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These requirements include a responsibility to make good any impairment of private bore groundwater supplies.</p> <p>Arrow is required by law to fulfil these obligations, as described in EIS Chapter 14, Groundwater, Section 14.6. The implementation of these commitments allows the residual significance rankings associated with reduced groundwater supply to existing or future groundwater users to be lowered. While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These underground water obligations include a responsibility to undertake baseline assessments (to identify the presence of existing groundwater bores), prepare (and comply with) underground water impact reports (including predictions of areas in each aquifer when drawdown impacts are likely to occur), undertake groundwater modelling (to verify groundwater modelling), and make good any impairment of private bore groundwater supplies.</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission, now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which water level impacts are expected to exceed the trigger threshold within three years. The Long-term Affected Area for an aquifer is defined as the area within which water level impacts are expected to exceed the trigger threshold at any time in the future.</p> <p>Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure</p>

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R11001	S010, S088, S161			holder must negotiate a make good agreement with the bore owner. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is now obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.
R11002	S113, S134, S157	<p>The groundwater desktop literature review was limited and does not consider:</p> <ul style="list-style-type: none"> • Research and information from local sources. • Moran report (2008). • Additional monitoring data for the gas fields (Tipton included) predating the occurrence of coal seam gas activities. Where is this monitoring data presented? 	<p>EIS Chapter 14, Section 14.2.1 Appendix G, Appendix B, Section 2.3.2</p> <p>SREIS Chapter 8 Appendix 4</p>	<p>The detailed desktop studies undertaken to inform the groundwater chapter of the EIS are outlined in EIS Chapter 14, Groundwater, Section 14.2.1. The desktop sources used to inform the description of the existing groundwater environment provide a regional understanding of the structure and behaviour of the system across the project development area and are adequate and appropriate for the purposes of the EIS.</p> <p>The Moran report (2008) documents the findings of a study with the objective of collating and documenting existing Queensland State Government information and subsequently proposing the basis for more detailed assessment of the potential impacts of coal seam gas extraction on groundwater systems. The preparation of the EIS and the associated numerical modelling post-date this publication and are based on more recent coal seam gas and groundwater extraction rates.</p> <p>The Moran Report has an implicit purpose for informing policy development. The objectives of the Moran Report were to:</p> <ol style="list-style-type: none"> 1. Provide background information on potential groundwater impacts resulting from the expansion of the CSG industry; 2. Provide a broad assessment of the water supply options resulting from the expansion of the CSG industry; and 3. Propose an approach for on-going monitoring of groundwater impacts during development of the CSG industry. <p>All of these objectives have been considered in the EIS.</p> <p>The Moran report was prepared in 2008, without a calibrated numerical groundwater model, and used many assumptions that are no longer relevant to the current situation.</p> <p>Available monitoring data that pre-dates coal seam gas extraction is presented in EIS Appendix G, Groundwater Impact Assessment, Appendix B, Section 2.3.2.</p> <p>Additional desktop sources published since the finalisation of the EIS, and in response to issues raised on the EIS are presented in SREIS Chapter 8, Groundwater, and Appendix 4, Supplementary Groundwater Assessment.</p>
R11003	S024, S026, S031, S081, S106	<p>Concerned about impacts on the Hutton Sandstone.</p> <ul style="list-style-type: none"> • Why does the groundwater model contain only one single measure of permeability for the entire Hutton Sandstone Formation? Are more measures known? How does this affect the model output? • Concerned the detrimental impact on the Hutton 	<p>EIS Appendix G, Appendix B, Section 2.5 and Table 2.6</p> <p>SREIS Appendix 4</p>	<p>The hydraulic parameters used to develop the numerical groundwater model are detailed in EIS Appendix G, Groundwater Impact Assessment, Appendix B, Section 2.5. A number of data sources were used to develop the model parameters, including published literature and information from similar projects conducted in the area including other EIS documents.</p> <p>The hydraulic parameters of the Hutton Sandstone used in the numerical model are based on a number of sources, and rely on more than one data</p>

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R11003	S024, S026, S031, S081, S106	Formation would continue to move westward for decades after peak drawdown in the proposed development area.		<p>point for permeability, for example 20 data points were available for the Hutton Sandstone as shown in EIS Appendix G, Groundwater Impact Assessment, Appendix B, Table 2.6. The EIS groundwater model is a regional model and is a simplification of the geological formations present within the model extent. The hydraulic parameter assigned to the Hutton Sandstone is a value that sits within a range of values available for that unit. The horizontal conductivity value assigned to the Hutton Sandstone in the EIS groundwater model sits within the range of values used in the Underground Water Impact Report (UWIR) and is close to the median value used in the UWIR. The UWIR and the groundwater model that supports it were approved by EHP in December 2012.</p> <p>In some instances, limited data sets were available. In these cases, the groundwater model adopted the more conservative values to ensure that the impacts predicted by the model presented the worst case, and therefore did not under-represent the potential impacts to groundwater values.</p> <p>The revised predicted groundwater drawdown profile for the Hutton Sandstone is presented in SREIS Appendix 4, Supplementary Groundwater Assessment. An updated numerical groundwater model has been prepared using the OGIA numerical model and updates to Arrow's field development plan and coal seam gas extraction profile since the finalisation of the EIS. The updated numerical groundwater model prepared for the SREIS relies on over 1,400 tests to assess horizontal hydraulic conductivity, of which permeability is a component.</p>
R11004	S134	Arrow to complete research on the impacts to groundwater systems to provide a foundation for any conceptual or field planning, and also contribute to the body of knowledge on groundwater systems.	EIS Chapter 14	<p>Arrow is undertaking and participating in a number of research and study projects associated with the groundwater systems of the Surat Basin. These include Arrow's involvement in the Office of Groundwater Impact Assessment's (OGIA) Condamine Interconnectivity Research Project, and participation in the Joint Industry Plan for an Early Warning System for the Monitoring and Protection of EPBC Springs. The Underground Water Impact Report (UWIR) also details the Office of Groundwater Impact Assessment (OGIA) future research directions. These research programs were developed to improve the capacity for OGIA to predict groundwater level impacts, and provide additional detail in future UWIRs. The future research directions include:</p> <ul style="list-style-type: none"> • Condamine Interconnectivity Research Project. • Influence of geological structure on groundwater flow in the Surat CMA. • Hydrogeology of the Walloon Coal Measures. • Re-conceptualisation of the groundwater systems in the Surat and Bowen Basins in the Surat CMA. • Second generation regional flow modelling for the Surat CMA. • Improving knowledge about springs. <p>As detailed in commitments C129 and C130 (described in EIS Chapter 14, Groundwater), Arrow is committed to aquifer testing programs, and the collection of relevant geological and hydrogeological data. This will enable the</p>

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R11004	S134			<p>calibration of the model with location specific hydrogeological data and will enable more accurate model predictions to be made as field development progresses.</p> <p>In addition, Arrow has provided, and will continue to provide information to OGIA as required by the UWIR to enable continual development and updates to the regional cumulative model administered by OGIA.</p>
R11005	S005, S079, S134	<p>Have all domestic bores been taken into account in the modelling when these bores are not registered with DERM (now EHP) and would therefore not be included in the DERM database? Why are domestic bores not clearly identified in the EIS in Chapter 14, Figure 14.8?</p>	<p>EIS Chapter 14, Figure 14.8 and Table 14.1 SREIS Appendix 4</p>	<p>The groundwater model prepared for the EIS did not include data from unregistered bores because information associated with these bores is not accessible, having never been provided to government authorities.</p> <p>The groundwater model prepared for the EIS included geological and hydrogeological data from registered private bores, however the pumping data was not included.</p> <p>While extraction rates from private bores were not included in the EIS, the dataset of registered bores was included in determination of baseline groundwater levels in the aquifers within the groundwater model extent. The effect of coal seam gas water extraction rates were then modelled to predict the drawdown response in aquifers. The model prepared for the EIS did not predict groundwater drawdown in response to non-coal seam gas extraction. Any drawdown simulated in the EIS model is therefore over and above any drawdown that would occur as a result of non coal seam gas extraction. The number of groundwater level points included in the model are presented in EIS Chapter 14, Groundwater, Table 14.1</p> <p>The regional model presented in the Underground Water Impact Report includes non coal seam gas groundwater extraction. This model has been revised to simulate Arrow's latest development case. This numerical modelling is presented in SREIS Appendix 4, Supplementary Groundwater Assessment.</p> <p>The percentage of groundwater use licenced for domestic purposes within the project development area is shown in the right-hand panel of EIS Chapter 14, Groundwater, Figure 14.8.</p>
R11006	S139, S148, S154, S157	<p>The use of a 10 m thick layer of shale in the model between the Juandah Coal Measures and the Springbok Sandstone is inaccurate and would limit the predicted groundwater drawdowns. It is interpreted as being used as a 'protective' cover to limit the predicted impacts of the extraction of groundwater from the Walloon Coal Measures.</p>	<p>EIS Appendix G, Section 5.4</p>	<p>Shale and silt in the coal measures is present in all Arrow boreholes above, below, and between the coal seams. With a numerical model of the size used for the Surat Gas Project EIS groundwater modelling, it was not possible to incorporate all of these geological features, although the shale and silt layers will limit the impacts. It was possible to incorporate a single additional layer, without impacting the model utility significantly. Of all these shale and silt layers, it was interpreted that the layer with the greatest potential to control the migration of impacts would be located at the top of the Juandah Coal Measures. The 10 m mudstone/siltstone layer was therefore used to simulate this material. An additional benefit of this modelling approach was to allow for the significance of this layer (10 m mudstone/siltstone at the top of the Juandah) to be tested. This was achieved in sensitivity run 5C, where the hydraulic parameters of the 10 m mudstone/siltstone layer were changed to</p>

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R11006	S139, S148, S154, S157			<p>equal exactly those that had been used for the Springbok Sandstone (a layer with much higher hydraulic conductivity). The results showed that with or without this low hydraulic conductivity layer, the predicted impacts in the aquifers above (including the Condamine Alluvium) were very similar (EIS Appendix G, Groundwater Impact Assessment, Section 5.4). Modelling conducted for and reported in the SREIS is based on the Underground Water Impact Report and accordingly utilises hydrogeological parameters that were developed by the Office of Groundwater Impact Assessment and endorsed by EHP.</p> <p>While a mudstone/siltstone layer may be interpreted as limiting impacts, this must be considered in the context of the overall simplification of the geology in a numerical model. Given that 10% of the Walloon Coal Measures is coal and most of the remaining sections are low permeability siltstone and mudstone, the upscaling of this unit and simplification of layering allows impacts to propagate more rapidly and to a greater extent than would occur in reality. The "averaging" of parameters for this unit and representations of aquitards are therefore a reasonable and defensible modelling procedure to represent the overall system behaviour.</p>
R11007	S146	What variations were used in the different hydrogeological characteristics of aquifers across the Surat Gas Project area?	EIS Appendix G, Section 5.4	<p>The hydraulic parameters used to develop the numerical groundwater model are detailed in EIS Appendix G, Groundwater Impact Assessment, Appendix B, Section 2.5. A number of data sources were used to develop the model parameters, including published literature and information from similar projects conducted in the area including other EIS documents.</p> <p>As more information becomes available through drilling and monitoring and the gathering of additional geological and hydrogeological information, the steady state groundwater model can be better calibrated to real conditions. The current steady state calibration is adequate for the purpose of the modelling study and does not compromise the predictions at the level of detail they are presented. The hydraulic parameters of the Condamine Alluvium and the hydrogeological units below them will control the speed and extent of impact migration from the coal seams into the Condamine Alluvium or into other aquifers. These parameters are based on the existing CSIRO Condamine Alluvium model (Barnett, B.G., and Muller, J. 2008) or on the literature review provided in EIS Appendix G, Groundwater Impact Assessment, Section 2.5. Modelling conducted for and reported in the SREIS is based on the Underground Water Impact Report and accordingly utilises hydrogeological parameters that were developed by the Office of Groundwater Impact Assessment and endorsed by EHP.</p>
R11008	S130, S139, S148, S154, S157	The assumptions made in the model regarding the thickness of the Springbok Sandstone could have been more conservative. That is a thickness of 0.1 m rather than up to 6 m.	EIS Appendix G	<p>At the scale of the model (453 km by 270 km laterally and up to 2 km deep) the suggested changes to the thickness of the Springbok Sandstone is unlikely to have any impact on the predictions. Furthermore, the model acknowledges that in some places the Springbok Sandstone is not physically present, and in these locations, 1 m thick layers are retained in the model and</p>

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R11008	S130, S139, S148, S154, S157			are assigned the hydraulic parameters of layers below. This provides the model with inherent conservatism. Modelling conducted for and reported in the SREIS is based on the Underground Water Impact Report and accordingly utilises hydrogeological parameters that were developed by the Office of Groundwater Impact Assessment and endorsed by EHP.
R11009	S024, S026, S081, S139, S148, S154, S157	The assumptions made in relation to recharge rates are grossly over simplified. No recharge from streams has been incorporated into the model, despite this being accepted as the main recharge source in the Condamine Alluvium and some other important streams. Arrow must assess the variation in the Condamine Alluvium's ability to recharge. Such investigations may alter the systems' level of sensitivity regarding resilience to change, system dynamics and rehabilitation potential. Arrow must provide figures to support the statement that significant aquifer recharge occurs via rainfall and irrigation runoff or correct this error.	SREIS Appendix 4	Where recharge is simplified as diffuse recharge rather than explicitly modelled as river leakage the result is a more conservative prediction. The simplified recharge rates add conservatism to the model. Condamine River leakage has subsequently been included into model development, and is a component of the SREIS groundwater model. Data available on surface water and groundwater recharge mechanisms has been included in the groundwater technical study presented in SREIS Appendix 4, Supplementary Groundwater Assessment.
R11010	S133	The EIS has provided raw water quality data for surface water within EIS Appendix I but not for groundwater within Appendix G. Queensland Health is concerned as groundwater quality, and particularly groundwater quality associated with coal seams, is determined by the ratio of common ions present as well as the actual concentrations of the ions. Data given in Tables 4.2 to 4.9 (EIS Appendix G) only give mean, maximum and minimum values. The full set of raw ground water quality data needs to be provided.	EIS Appendix G, Section 4.5.2 and tables 4.2 to 4.9 and Appendix A	Water quality data are provided in Appendix A to EIS Appendix G, Groundwater Impact Assessment. The groundwater data relied upon in that report is public data held by EHP (formerly DERM). The dataset is large (many hundreds of bore records) and this level of detail was not considered necessary to support EIS Appendix G. The ionic ratios are graphically presented in the Piper Plots presented for all the relevant formations in EIS Appendix G, Groundwater Impact Assessment, Section 4.5.2. The data in Appendix G, Groundwater Impact Assessment, tables 4.2 to 4.9 provide an appropriate summary of the key statistical data. The presentation of mean, maximum and minimum values for available groundwater parameters is suitable for the characterisation of groundwater chemistry associated with key aquifer units present within the project development area. The data available from the DERM registered bore database was not interrogated in relation to human health indicators, and so the full data suite is not relevant. The project area addressed in the model is large (453 km by 270 km laterally and up to 2 km deep) and there are so many regional and localised differences (in terms of geography as well as stratigraphy) in water quality that to be specific beyond summary information statistical interpretation of the data adds little value. Additional groundwater quality data available since the release of the EIS is presented in SREIS Appendix 4, Supplementary Groundwater Assessment.

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R11011	S032	Is there a location anywhere in the world where a shallow aquifer that is utilised for town water and extensive irrigation use, has been drilled through with thousands of wells to access coal seam gas, from an aquifer with very poor water quality without any detrimental effect to the water aquifer.	–	<p>All hydrogeological systems are unique and dependant on the geological strata present, surface water and groundwater systems, and regional and local climate. Reference to other systems with different geological properties is not considered appropriate. It is much more appropriate to consider the specific conditions of the system that will be subject to the development, and then model and assess the impacts on that system with consideration of the required underground water obligations defined in relevant legislation and application of available mitigation and management measures.</p> <p>Well integrity is of great importance to Arrow, not only for the purposes of protection of the environmental values of groundwater resources but also to ensure the effective recovery of the gas resource. For these reasons Arrow has committed to implement a well integrity management system during commissioning and operation of production wells (Commitment C143). Such a system will include components addressing well construction, assessment of the effectiveness of well completion, post construction monitoring and response to identified issues of well integrity.</p> <p>Arrow has also committed to decommission or repair all production wells and monitoring bores, either at the end of their operating life span or in the event of a failed integrity test in accordance with the minimum construction requirements for water bores in Australia (LWBC & NMBSC, 2003) and the P&G Act and regulations to that act. Arrow has committed to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150).</p> <p>Information available on similar projects is presented in the publication Ground-Water Monitoring Program in Prospective Coalbed-Methane Areas of Southeastern Montana: Year One (Wheaton & Donato, 2004).</p>
R11012	S004, S006, S011, S027, S032, S062, S072, S160, S161	<p>It is difficult to have confidence in the modelling results when the results of Arrow's model and the Queensland Water Commission model show a large difference (e.g., Arrow's model indicates a 5 m fall in the Condamine Alluvial aquifer where the Queensland Water Commission indicates a 0.5 m drop.)</p> <p>The impact of coal seam gas dewatering on groundwater resources of the Surat basin as indicated by Schlumberger (2011) is not considered credible. Queensland Water Commission (2012) study results appear more believable considering the distribution and thickness of aquicludes within</p>	SREIS Chapter 8	<p>The difference in predictions from each of the models is not considered substantial, with both predicting similar patterns of drawn and in general the EIS model predicted larger magnitude drawdowns (highlighting its conservatism). The differences in model predictions are a function of each model's structure and associated assumptions. The numerical groundwater model prepared by the Queensland Water Commission (QWC) (now the Office of Groundwater Impact Assessment (OGIA)) for the Surat Cumulative Management Area was released after the completion of the EIS.</p> <p>In general, numerical modelling is a continual process of updating and refinement with additional hydraulic and geological data that becomes available as field development progresses. The differences between the model predictions presented in the EIS and the OGIA model are a reflection of these refinements and the continual updates to regional models of this type</p>

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R11012	S004, S006, S011, S027, S032, S062, S072, S160, S161	the stratigraphic sequence of the Surat Basin (Extract from Douglas Partners Pty Ltd study.)		<p>over time and as more information becomes available. Based on this process of refinement and data collection, since the finalisation of the EIS, the SREIS presents a revised groundwater numerical model. The revised model is based on the structure of the OGIA model (endorsed by EHP). The OGIA model has been updated with Arrow production information that reflects the revised project description (i.e., updates to the project development area and the conceptual field development plan). Information on the revised model, including the conceptual structure, geological model, key assumptions and predictive outputs are contained in SREIS Chapter 8, Groundwater.</p> <p>Notwithstanding this, the results presented in the OGIA model show that the groundwater drawdown levels predicted by the model prepared for the EIS present a worst-case scenario, and a conservative assessment of aquifer responses to groundwater extraction. As such, and as reflected in SREIS Chapter 8, Groundwater, the groundwater drawdown levels predicted by the EIS numerical model adequately identified potential impacts, the effect of legislative underground water obligations and associated mitigation measures required to manage these impacts.</p> <p>The modelling method undertaken for the EIS was based on geological modelling of layers from Arrow's geological database. This method uses known stratigraphic depths and interpreted depths that considered both borehole data and geophysical data. Based on the data available, the geological modelling is considered to provide a satisfactory interpretation of the sub-surface data, for the purposes modelled. Note that the QWC report and model were not released in time for consideration in the EIS.</p> <p>Different predictions are made under different scenarios. For example, high extraction case scenarios with cumulative drawdown will provide the largest potential impact indications, and these results will therefore be expected to be conservative, and show much greater drawdown than later modelling under reduced extraction scenarios. In addition, model parameters describing connectivity between the Walloon Coal Measures and the Condamine alluvium are an important control against which the magnitude of impact can be assessed. The revised modelling presented in the SREIS accounts for this, and results are presented in SREIS Chapter 8, Groundwater.</p> <p>The modelling presented in the SREIS is considered to be reliably calibrated, and confirms that the original modelling presented by Arrow in the EIS was satisfactory in its predictions and for the purpose undertaken – that is, to provide an understanding of the level of impact that can be expected. Modelling conducted for and reported in the SREIS is based on the Underground Water Impact Report and accordingly utilises hydrogeological parameters that were developed by the OGIA, are consistent with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and are endorsed by EHP.</p>

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R11013	S002, S003, S009, S015, S018, S019, S020, S030, S032, S034, S037, S039, S053, S058, S059, S065, S069, S070, S076, S085, S088, S095, S096, S097, S098, S108, S114, S116, S139, S140, S149, S152, S167	Predicted drawdowns in the EIS and Queensland Water Commission are almost entirely based on modelling. Predictions need to be proven in the short and long-term through actual monitoring of drawdowns. We should be wary when using predictions. The precautionary principle should prevail until there is more information available on the hydrogeology of the region, particularly of the ATP 683 area.	EIS Chapter 14, sections 14.2.2 and 14.6.1	It is acknowledged in EIS Chapter 14, Groundwater, Section 14.6.1, that the collection of local and regional monitoring data informs and calibrates numerical models over time, forming a key aspect of Arrow's adaptive management framework. Arrow is committed to contributing to regular ongoing model calibrations through provision of well field development data to the Office of Groundwater Impact Assessment as part of the Underground Water Impact Report requirements (as described in Commitments C131 and C132). However, construction of the model included a variety of data sources, as detailed in EIS Chapter 14, Section 14.2.2. It is standard practice for groundwater models to be calibrated to the available data, and then over time, to be 'validated' as new data becomes available. This allows for the model to be recalibrated if necessary, therefore improving predictions. Hence, the approach is considered adaptive. The use of conservative groundwater drawdown predictions to define those areas within the Surat CMA with the potential to be impacted within three years enables higher risk areas to be identified and the management measures to be prioritised. Model predictions presented in the UWIR have undergone uncertainty analysis, and therefore represent the most conservative (maximum) potential drawdown within an aquifer. These up-front model predictions will be updated based on regular and ongoing model calibrations that will take account of observed responses in monitoring bores during coal seam gas water extraction. The UWIR will be republished every three years and will present any revisions to the number and location of bores likely to be impacted. Significant additional work has been and is currently underway to better assess the connectivity between the Walloon Coal Measures, and the effect of offsetting groundwater drawdown impacts with mitigation strategies such as substitution. This is consistent with a precautionary approach.
R11014	S008, S139	The Queensland Water Commission model does not account for coal seam gas extraction from the Walloon Coal Measures beneath the central Condamine Alluvium, and their modelled extraction was confined to the western edge of the alluvium.	SREIS Chapter 8 Appendix 4	The Office of Groundwater Impact Assessment (OGIA) model does account for production from beneath the Condamine Alluvium consistent with Arrow's development plan. The model has been updated with Arrow's current development case. Differences in the two cases are discussed in SREIS Appendix 4, Supplementary Groundwater Assessment. The Underground Water Impact Report (UWIR) model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). The model has been updated with Arrow production data, and results of the update are presented in the SREIS Chapter 8, Groundwater. The UWIR model has been endorsed by EHP; In addition, Arrow will continue to provide information to the Office of Groundwater Impact Assessment (OGIA), as required by the Underground Water Impact Report, to enable continual development and updates to the regional cumulative model administered by OGIA (Commitment C564).

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Issue No.	Submission No.	Issue	Reference	Responses
R11015	S108	<p>The Queensland Water Commission currently predicts that the drawdown in the Condamine Alluvium will not exceed the trigger thresholds. This needs to be confirmed using new data from the monitoring wells to be installed prior to any coal seam gas activities on the eastern part of the Condamine Alluvium, particularly the area used by the Central Downs irrigators in sub area irrigation zone 3 of the Condamine catchment.</p>	<p>SREIS Chapter 8</p>	<p>The Office of Groundwater Impact Assessment (OGIA) model and final Underground Water Impact Report (UWIR) are approved by the chief executive of EHP.</p> <p>Arrow's Water Monitoring Strategy for the Condamine Alluvium includes 10 existing monitoring bores, and the installation of 14 new ones, which exceeds their requirements detailed in the UWIR.</p> <p>Going forward, the UWIR requires a program of annual reporting and review, whereby proponents are required to submit the results of their monitoring programs to OGIA for summary and assessment of the data. In conjunction, proponents are required to notify OGIA of any changes to their field development plans.</p> <p>Arrow and the OGIA are also involved in the Condamine Interconnectivity Research Project, the results of which (when available) will be used in future model updates and UWIR revisions.</p> <p>Based on the provision of this information annually, OGIA will run the regional groundwater model using the updated information to determine any material changes to the defined Immediately and Long-term Affected Areas. In the event that there are material changes to these defined areas, the new predictions will be submitted to EHP.</p> <p>The predicted groundwater drawdowns in the Condamine Alluvium based on the revised model contained in the SREIS are presented in SREIS Chapter 8, Groundwater.</p>
R11016	S106	<p>The impacts of the Condamine Alluvium have been underestimated due to the 'Groundwater Model Extent' not including the entire Surat Basin as far west as the Nebine Ridge, west of St George (this may have been allowed for in the model as an outflow along the western boundary of the model extent but it is not described).</p> <p>The area west of St George has significant outflow and extraction and would result in contributing to the decline in water pressure in the Gubberamunda/ Mooga s/s equivalents (including the Hooray s/s), and Huttons and hence without supporting flow coming from the east, the area in the western extent of the groundwater model is artificially held with higher watertables/pressures than would actually be the case. As a result, it's expected the 0.5 impact line generated by coal seam gas activities in the east would travel faster to and through the strata beneath the township of Surat and probably once modelled correctly through and west of St George. This needs to be depicted in the modelling. The groundwater model</p>	<p>EIS Appendix G, Appendix B, Section 3.5 SREIS Chapter 8 Attachment 4</p>	<p>The model extents are as described in the groundwater modelling report (Schlumberger, 2011). This document is presented as EIS Appendix G, Groundwater Impact Assessment, Appendix B, and the model boundaries are described in Section 3.5 of this report. Time-variant constant heads were used for this boundary. This type of boundary allows for flow into and out of the model domain, dependent on gradient.</p> <p>Revised boundary conditions are adopted for the modelling presented in the SREIS, and these are described in SREIS Chapter 8, Groundwater.</p> <p>The boundary extents adopted for the modelling are considered satisfactory for the purposes of the model, and sufficiently distal to not constrain the model predictions. The areas noted in the submission are of a sufficient distance from the Condamine Alluvium, and are unlikely to impact on model predictions for this aquifer. In addition, the boundary conditions (as described above) are considered satisfactory.</p> <p>The groundwater model prepared for the SREIS contains a discreet model for the Condamine Alluvium. The boundaries of this model represent the most current and comprehensive understanding of the controls on groundwater levels in that aquifer. Details of this Condamine Alluvium Model are presented in SREIS Chapter 8, groundwater and Attachment 4, Supplementary Groundwater Assessment.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11016	S106	extent needs to be changed.		
R11017	S032	Models used by Arrow and the Queensland Water Commission have not considered water quality. Water quality deterioration is anticipated due to the potential structural/integrity failure of bores and the substantial connectivity between aquifers that such failures would cause.	EIS Appendix G, Table 9.7	This aspect has been identified as a potential impact, and mitigations provided accordingly in the EIS. Refer, for example, to EIS Appendix G, Groundwater Impact Assessment, Table 9.7, where depressurisation in adjacent aquifers due to leakage through coal seam gas wells is explicitly considered, and a range of mitigation measures are provided. An example of the mitigation measures include: <ul style="list-style-type: none"> • Construct all coal seam gas production wells in accordance with the standards described in the Petroleum and Gas (Production and Safety) Act 2004 and regulations to that act (Commitment C137). • Construct, decommission or repair all monitoring bores in accordance with the minimum construction requirements for water bores in Australia (National Uniform Drillers Licencing Committee, 2012) and the minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland (DERM, 2004) (Commitment C138). • Implement a well integrity management system during commissioning and operation of production wells (Commitment C143). • Install groundwater monitoring bores near dams as a leak detection measure: <ul style="list-style-type: none"> – The number of monitoring bores and their location will take into account site-specific hydrogeology, preferential pathways and potential receptors of impacts. – Monitoring bores installed near dams will have groundwater levels and relevant water quality parameters monitored on a routine basis. – The number of monitoring bores or associated monitoring frequencies will be increased and further investigation will be triggered where impacts are identified. (Commitment C504).
R11018	S157	There is a real question that no statistical inference can be properly drawn from such a limited data set associated with the Walloon Coal Measures (as identified in the Moran Report). Therefore EHP (formerly DERM) ought not grant licences on the basis of 'inductive supposition window-dresses by statistical modelling'. The regulator should reject the EIS on the grounds that other relevant stakeholders are unable to meaningfully comment on even the most basic foundations of the statistics contained with the groundwater report (because assumptions/exclusions/modifications are not exposed).	SREIS Chapter 8	Significant data analysis has been undertaken to support the EIS using both the available data and data collected specifically for the project. Appropriate analysis of these data have been made, using standard statistical methods. Modelling of groundwater systems was undertaken in accordance with groundwater modelling best practice. In addition, further modelling has been undertaken by Arrow, the results of which are presented in SREIS Chapter 8. The modelling undertaken for the SREIS is based on the Office of Groundwater Impact Assessment (OGIA) model, updated with revised Arrow production data. The OGIA model is consistent with the Australian Groundwater Modelling Guidelines (Barnett, B., et al. 2012) that were recently issued and has been endorsed by EHP. The presentation of data and statistical analyses are considered appropriate.

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Issue No.	Submission No.	Issue	Reference	Responses
R11019	S010, S051	Arrow's commitments to not harm groundwater resources are not enforceable and can be changed. The EIS does not commit to not harm a groundwater resource which is unacceptable in a region where the groundwater resources are already under stress. EIS Section 14.6.3 should have enforceable conditions rather than commitments.	SREIS Chapter 3 and Chapter 8	Arrow will be issued an environmental authority, or Arrow's existing environmental authority will be amended to cover the development described in the revised project description presented in SREIS Chapter 3, Project Description. It is anticipated that, in preparing the environmental authority, the Department of Environment and Heritage Protection (EHP) will consider Arrow's commitments to environmental mitigation and management measures and will interpret these commitments into enforceable conditions. Arrow will be required to operate in accordance with the environmental authority conditions. Compliance with the conditions will be enforced by EHP. Since finalisation of the EIS, the final Underground Water Impact Report (UWIR) was released and approved by EHP. This report details the management measures required to respond to potential cumulative impacts on groundwater associated with coal seam gas development. The UWIR defines Immediately Affected Areas and Long-term Affected Areas, as well as the responsible tenure holder obligated to manage the potential impacts to third party bore owners and groundwater dependent ecosystems. The UWIR also details the monitoring and reporting requirements required of each coal seam gas proponent. Under the Water Act 2000 (Qld) and the Underground Water Obligations determined by OGIA, Arrow is required to undertake bore assessments in the Immediately Affected Area to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. A range of make good measures are presented in the EIS. Arrow will enter into individual agreements with each potentially affected bore owner (as defined in UWIR) and the most suitable option will be agreed between the parties, i.e., it may be more suitable in one instance to deepen the bore, whereas in another instance, a more suitable option could be to lower the pumping infrastructure. Arrow is legislatively obligated to adhere to these requirements and has commenced this process for bores identified in the current UWIR.
R11020	S134	Commitment (C524) – Arrow to make information from the regional groundwater monitoring network publically available.	–	Information from Arrow's regional groundwater monitoring network will be made available via the Office of Groundwater Impact Assessment (OGIA) publically accessible website, as indicated in Section 10.4 of the Underground Water Impact Report (UWIR).
R11021	S031, S110, S130	Concern that removal of large quantities of groundwater will impact on groundwater systems. Mitigation options must include acceptable make good measures. Terminology such as 'where possible' is not acceptable.	EIS Chapter 14, Section 14.4 Chapter 28, Section 28.3.3	Impacts on groundwater systems as a result of the project are identified in the EIS Chapter 14, Groundwater, Section 14.4. Further modelling undertaken for the SREIS is presented in SREIS Chapter 8, Groundwater. The Surat Cumulative Management Area (CMA) and the Queensland Government Office of Groundwater Impact Assessment (OGIA) were

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Issue No.	Submission No.	Issue	Reference	Responses
R11021	S031, S110, S130	Mitigation measures contain few actions that will actually manage or reduce the impacts, therefore risk and impacts cannot be reduced as they are in EIS. There have been no definite management responses established with respect to cumulative impacts on groundwater predicted by both Arrow and the Queensland Water Commission.		established in response to concerns in relation to the growing coal seam gas industry. EIS Chapter 28, Cumulative Impacts, Section 28.3.3 presents the findings to the cumulative groundwater impact assessment, identifying that Arrow will support the Queensland Water Commission (now OGIA) and adhere to management measures identified through this regulating body. Since finalisation of the EIS, the final Underground Water Impact Report (UWIR) was released and approved by EHP. This report details the management measures required to respond to potential cumulative impacts on groundwater associated with coal seam gas development. The UWIR defines Immediately Affected Areas and Long-term Affected Areas, as well as the responsible tenure holder obligated to manage the potential impacts to third party bore owners and groundwater dependent ecosystems. The UWIR also details the monitoring and reporting requirements required of each coal seam gas proponent. Under the Water Act 2000 (Qld) and the Underground Water Obligations determined by OGIA, Arrow is required to undertake bore assessments in the Immediately Affected Area to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. A range of make good measures are presented in the EIS. Arrow will enter into individual agreements with each potentially affected bore owner (as defined in UWIR) and the most suitable option will be agreed between the parties, i.e., it may be more suitable in one instance to deepen the bore, whereas in another instance, a more suitable option could be to lower the pumping infrastructure. Arrow is legislatively obligated to adhere to these requirements and has commenced this process for bores identified in the current UWIR.
R11022	S143	Cumulative impacts need to be addressed in more detail (in EIS Appendix G). There appears to be no mention of potential impacts from fracking chemicals nor of BTEX chemicals in coal seams.	EIS Chapter 14	Arrow has committed to enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079). As such, no direct or cumulative impacts are anticipated from fracking chemicals. Arrow's commitment to industry standard well design and installation (including steel casing and concrete through sensitive aquifers not associated with coal seams) will serve to inhibit the migration of coal seam gas water to other aquifers. The commitment to no fracking, the avoidance of the use of chemicals containing BTEX compounds, and the commitment to industry standard well design and installation all serve to limit the potential for impact associated with BTEX compounds.
R11023	S005, S027, S082, S104, S137, S145, S150	7,500 wells is an unprecedented invasion on groundwater, particularly when added to the other coal seam gas ventures. Submitters are concerned	SREIS Chapter 8	Presently, there are 21,000 private water bores within the Surat Cumulative Management Area (QWC, 2012c). At the time the EIS was published, Arrow anticipated 7,500 production wells

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Issue No.	Submission No.	Issue	Reference	Responses
R11023	S005, S027, S082, S104, S137, S145, S150	<p>about the cumulative value of large volumes of water extracted and modelling uncertainty. How can the groundwater models be accurate, particularly when forecasting levels out to 2071? The EIS does not adequately address cumulative impacts to groundwater. Arrow should take into consideration the activities of other coal seam gas proponents that are impacting on water resources already. Given the drawdowns predicted, additional details are required.</p> <p>It is urgent that cumulative impacts and risks are quantified in order to be accounted for in Arrow's modelling and reporting, especially with regards to aquifers and water sources. Arrow's Surat Gas Project is only project to affect both Alluvial and Great Artesian Basin aquifers. The Great Artesian Basin aquifer is over-allocated. Extra caution, time, science and experience is needed to make an informed decision on the risk involved.</p>		<p>would be required. This has been revised to 6,500 wells, as set out in SREIS Chapter 3, Project Description. It should be noted that the number of wells is not as important a consideration as the volume of extraction from each well. These volumes have been taken into account in the SREIS together with estimates from other coal seam gas producers.</p> <p>The Queensland Government Office of Groundwater Impact Assessment (OGIA) has been tasked with preparing the UWIR for the Surat Cumulative Management Area (CMA). The UWIR details predicted impacts, accounts for uncertainty in groundwater modelling, assigns responsibility to tenure holders for making good impacts to existing groundwater water users and defines a groundwater monitoring program (including installation of almost 500 monitoring points) which must be completed by tenure holders.</p> <p>The OGIA model is recognised as the authoritative model for the Cumulative Management Area of the Surat Basin and is the model that forms the basis of the OGIA 2013 Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA). It was developed independently in consultation with state and commonwealth regulators and the UWIR was then approved by EHP. The UWIR was finalised following the public exhibition of the EIS and came into effect on 1 December 2012.</p> <p>The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The UWIR model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). There is an annual review requirement to assess whether new production or hydrogeological data would result in material changes to predictions made. Also the UWIR must be republished every three years. For the purposes of the SREIS, the OGIA model has been updated with Arrow's current production data, the results of the update are presented in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow will continue to work with the OGIA to manage cumulative impacts within the Surat CMA.</p> <p>Through the periodic review process described in the UWIR, and as coal seam gas developments progress, the UWIR model will be updated. The updates will consider revised field development plans and new geological and hydrogeological information, allowing greater accuracy in the prediction of impacts, consideration of risks and appropriate avoidance, mitigation and management actions to be implemented. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.</p>
R11024	S118	<p>The cumulative impacts can be further broken down into the same or interconnected aquifers, exacerbating the predicated impacts incrementally over time based on the number of wells in</p>	<p>SREIS Chapter 8</p>	<p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11024	S118	production at a given point in time. The drawdown will relate to several factors, such as interconnected aquifers and any variation in pressure used in the extraction process, due to the geology of particular strata.		regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The UWIR model takes into account parameters such as aquifer connectivity and drawdown rates over time. The final UWIR has been approved by the Chief Executive of the Department of Environment and Heritage Protection (EHP). Through the periodic review process described in the UWIR, and as coal seam gas developments progress, the UWIR model will be updated. The updates will consider revised field development plans and new geological and hydrogeological information, allowing greater accuracy in the prediction of impacts, consideration of risks and appropriate avoidance, mitigation and management actions to be implemented. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.
R11025	S133, S150	The EIS has not assessed the impact on the environment (i.e., water quality) and community (availability of safe drinking water) from all coal seam gas and other significant projects (coal mines etc.) in the area under normal operating conditions, as well as under duress. Aware that coal seam gas companies already operating in the region are having a major impact on town water supplies. In light of the impacts identified by Arrow they are going to have on groundwater bores it is important to understand how town water supplies are also going to be affected.	EIS Chapter 5, Section 5.6.4 Chapter 14, Section 14.6 Chapter 15 SREIS Chapter 9	While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These requirements include a responsibility to make good any impairment of private bore groundwater supplies. Arrow is committed to fulfilling these obligations, as described in EIS Chapter 14, Groundwater, Section 14.6. Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The Long-term Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold at any time in the future. No town water supplies are located within an Immediately Affected Area of Arrow's the project development area (as currently predicted in the UWIR). The potential for the project to impact on water quality is discussed in EIS Chapter 15, Surface Water and SREIS Chapter 9, Surface Water.

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Issue No.	Submission No.	Issue	Reference	Responses
R11026	S157	The groundwater cumulative impact assessment does not attempt to address the real prospect of adverse cumulative impacts; instead it refers to continued monitoring. In order to properly analyse the potential impacts of Arrow activities in addition to those already underway, a proper study based on stated assumptions and transparent data is needed – as per the nature of the study that is required by Section 255AA Mitigation of unintended diversions of the Commonwealth Water Act 2007.	–	Since the finalisation of the EIS, the Queensland Government released the Underground Water Impact Report (UWIR). The UWIR comprises a cumulative groundwater numerical model that is publically available. Ongoing monitoring data collected by proponents and provided to the Queensland Government Office of Groundwater Impact Assessment (OGIA) will also be made available to the public (via the OGIA web site). For the SREIS, Arrow has utilised the numerical model developed by OGIA to evaluate impacts from Arrow's revised field development plan. As coal seam gas developments progress, the UWIR model will be updated by OGIA with new geological and hydrogeological information allowing greater accuracy in the prediction of impacts, consideration of risks and appropriate avoidance, mitigation and management actions to be implemented.
R11027	S106	Concerned about timing of the extraction planned as shown in EIS Figure 15, Executive summary, showing four other extractors in the same time period as that of Arrow. Suggests that Arrow extract after 2030 when the other producer's water production is reducing. In the interim, Arrow's current works and those of other producers could supply any required gas to meet Arrow's small existing domestic contract requirements.	–	Noted. The model presented in the Queensland Government's Underground Water Impact Report (UWIR) shows that cumulative impacts of multiple coal seam gas extraction operations occurring concurrently in the Surat Cumulative Management Area are manageable. The numerical model prepared for the SREIS is based on the Office of Groundwater Impact Assessment model (used to prepare the UWIR) and evaluates Arrow's revised field development plan and production information. Modelling undertaken for the SREIS also indicates Arrow's impacts are manageable.
R11028	S001, S023, S118, S157	Concerned climate change and the likelihood of severe droughts will contribute to the drop in water table/drawdown, including the water table within the Condamine Alluvium. What is the risk potential associated with significantly lowered groundwater levels during a prolonged drought period combined with coal seam gas activities? Even after good rain allocations for irrigation have not returned to 10% due to unrestricted pumping practices by coal seam gas companies. Any depletion of water is going to devalue 'in place infrastructure' as the drawdowns predicted in the Condamine Alluvium would most likely lower bore yields and make it that much harder to extract.	–	Climatic variation and/or climate change will affect the water table in the Condamine Alluvium. As expected, a reduction in rainfall due to a drought will reduce recharge to the Condamine Alluvium and therefore the water table will drop. The magnitude of this drop will largely be a function on the climate (rainfall versus evapotranspiration) and non-coal seam gas extraction. Modelling undertaken by both Arrow (for the EIS) and the Office of Groundwater Impact Assessment (OGIA) has shown that the flux out of the Condamine Alluvium as a result of cumulative coal seam gas production is relatively minor compared to existing non-coal seam gas groundwater take. Reductions in allocations associated with the Condamine Alluvium are unrelated to the coal seam gas industry and pertain to sustainable use of the resource by other users. Additional scenarios were not modelled in the Office of Groundwater Impact Assessment (OGIA) model for the Surat Cumulative Management Area (CMA) to assess the effects of climate change (such as long periods of drought), however long-term average calibrated rainfall recharge has been assumed (based on data from 1/1/1910 to 31/12/2010) which are broadly consistent with diffuse rainfall estimates included in Kellett et al. (2003). Other initiatives and further work is described in water monitoring strategy described in the UWIR. One of the objectives of the Water Monitoring Strategy is to establish background trends to be able to separate the impacts

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R11028	S001, S023, S118, S157			<p>of coal seam gas development from other factors such as climate. Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders within the Immediately Affected Areas (IAA). The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation.
R11029	S010, S088, S110	<p>Section 14.7.2 of the Groundwater Chapter seems to directly conflict with the Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan (GAB WRP) Area which outlines the impact on the resource from existing licenced users, particularly in the Eastern Downs and Surat East management areas. CSG could not operate if it had to comply with the sustainability of the Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area.</p>	<p>EIS Chapter 5, Section 5.6.4 SREIS Chapter 8</p>	<p>Petroleum tenure holders are afforded underground water rights by the Petroleum and Gas (Production and Safety) Act 2003. Under Section 185 of the Petroleum and Gas (Production and Safety) Act 2003, "the petroleum tenure holder may take or interfere with groundwater to the extent that it is necessary and unavoidable during the course of an activity authorised under the petroleum tenure, including coal seam gas extraction". The aforementioned underground water rights also attract underground water obligations with which petroleum tenure holders must comply. These obligations are described in chapter 3 of the Water Act which provides a framework for identification of existing groundwater users within and in the vicinity of petroleum tenure, prediction of impacts on aquifers in these areas, establishment of a monitoring network to verify predicted impacts, and a process whereby petroleum tenure holders enter into 'make good' agreements with bore owners (including the provision of make good measures where the predicted impacts are likely to result in an impaired capacity of existing water bores).</p> <p>The Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan (NRM, 2005) indicates "Sustainable management of the GAB requires management of extraction to keep pressure and flow impacts within acceptable bounds." The provisions of the relevant state legislation seek to apply frameworks that contribute to inherent sustainability.</p> <p>Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As identified in EIS Chapter 5, Project Description, Section 5.6.4, Arrow's preferred management option for coal seam gas water is beneficial use.</p> <p>As described in SREIS Chapter 8, Groundwater, those impacted by coal seam gas water extraction by way of impaired groundwater bore capacity will enter into 'make-good' agreements as required under the Water Act 2000. The responsible tenure holder a given bore is assigned by the Office of Groundwater Impact Assessment (OGIA) under the Underground Water Impact Report, for the Surat Cumulative Management Area, and is therefore responsible for implementing measures agreed in the make good agreement.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11030	S137, S150	<p>The effect of groundwater extraction on the Great Artesian Basin must be properly explored in the EIS.</p> <p>Arrow must demonstrate how it will prevent adverse impacts caused by direct disturbance to, or extraction from, groundwater flow systems by: not permitting activities that may, or will cause in impact to the groundwater quality, quantity and pressures in the Great Artesian Basin.</p>	<p>SREIS Chapter 8</p>	<p>Groundwater resources that form part of the Great Artesian Basin present within the project development area were included in the numerical groundwater model that was prepared for the EIS. Given the application of mitigation measures as presented in the EIS it was found that impacts to groundwater values were manageable.</p> <p>The SREIS presents a revised groundwater model which is based on the Queensland Government Office of Groundwater Impact Assessment model. The results of this model are described in SREIS Chapter 8, Groundwater.</p>
R11031	S088, S110, S113, S166	<p>Existing landholder water access bores could be impacted from gas migration caused by nearby coal seam gas extraction. This risk is not dealt with anywhere in the EIS and needs assessment and possible mitigation measures outlined.</p> <p>The description of indirect impacts as a result of groundwater drawdown must be expanded to include the percolation of gas to the surface of the Earth in areas where the geology is suitable for this event.</p>	<p>–</p>	<p>Arrow will extract coal seam gas water from the Walloon Coal Measures in order to depressurise the coal seams to release entrained gas.</p> <p>Notwithstanding coal seam gas activities, the presence of entrained gas with this water has historically been observed.</p> <p>There is anecdotal evidence that migration of gas to the surface can be a naturally occurring process that has occurred within the Surat Basin prior to the commencement of coal seam gas production activities. It is identified however, that coal seam gas extraction activities can cause pressure reductions allowing gas desorption and migration to the surface.</p> <p>Gas flow is proportional to the cone of depression created around a production well, the gas content of the coal within the cone of depression and the coal permeability. Proximity of groundwater bores completed in the coal seams to production wells will determine the extent to which the bore might be exposed to the cone of depression and therefore exposed to the potential for fugitive gas flows. The cone of depression around a production well will promote gas flow to the production well drawing it away from the peripheries of the cone of depression.</p> <p>Wells that draw water from the Walloon Coal Measures are predominantly exposed to this risk, as this is the aquifer from which Arrow will produce coal seam gas water. These wells are also more likely to experience drawdown as a result of coal seam gas extraction, and therefore gas migration issues will be detected and managed through the make good process.</p> <p>Potential impacts on other aquifers would be indirect; arising through connectivity between groundwater aquifers and the propagation of pressure reductions away from the Walloon Coal Measures to overlying and underlying units. This risk is partly managed through bore integrity requirements which are designed to limit the potential for gas migration. It is also managed through operation of the production wells which aims to achieve only a sufficient reduction in reservoir pressure to promote gas flow.</p> <p>Notwithstanding this, a number of gas migration investigations are currently proposed by Arrow and other parties. Work underway by Arrow will better quantify the nature of the interface between the Condamine Alluvium and Walloon Coal Measures, and whether legacy coal and mineral exploration bores are conduits for fugitive gas emissions.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11032	S032, S067, S110, S134, S139, S146, S153	<p>Potential de-watering of the Condamine Aquifer from coal seam gas activities is of major concern. More explanation is required on the Condamine Alluvium and the drawdown impacts. Figure 14.4 and Table 14.8 require more explanation. Drawdowns in the Condamine Alluvium (current and any future estimates) should be expressed as volumes lost from the aquifer.</p> <p>A five metre fall in water levels in the Condamine Alluvium will dramatically reduce access to financially viable irrigation.</p> <p>Arrow must ensure that no net drawdown or depressurization will occur to the Condamine Alluvium. If they cannot, DERM (now EHP) should not grant approval. Coal seam gas activity should be postponed until appropriate and effective mitigation measures are put in place.</p>	<p>EIS Chapter 14, Section 14.4</p> <p>SREIS Chapter 8</p>	<p>The EIS presents predicted drawdown in the Condamine Alluvium. The results indicate that under the cumulative modelling scenario, maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) show maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most of the Surat Cumulative Management Area (CMA). The OGIA model also estimates that the net flux from the Condamine as a function of extraction from the Walloon Coal Measures is approximately 1.1 GL per year over the next 100 years. This is a small volume in comparison with existing extraction from the Condamine Alluvium for agricultural, industrial, stock and domestic and urban supplies, which is estimated by the OGIA to be 55 GL per year.</p> <p>Potential impacts on the Condamine Alluvium are discussed in EIS Chapter 14, Groundwater, Section 14.4 and SREIS Chapter 8, Groundwater.</p> <p>Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders within the immediately affected areas (IAA). The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation. <p>The Queensland Government's Coal Seam Gas Water Management Policy (2012) promotes 'virtual injection' (substitution of groundwater allocations from the Condamine Alluvium). Under substitution arrangements, Arrow could supply suitable treated water to groundwater users from the Condamine Alluvium in the area of greatest predicted drawdown from coal seam gas activities. Substitution will have an effect of reducing the potential impacts of drawdown in the Condamine Alluvium (as groundwater users will be using treated coal seam gas water instead of extracting, which will have an effect of recharging the Condamine Alluvium through surface infiltration).</p> <p>The numerical groundwater model for the SREIS includes a mitigation scenario showing the predicted response in the Condamine Alluvium through the implementation of the substitution strategy. The results from this modelling scenario are contained in SREIS Chapter 8, Groundwater.</p>
R11033	S010, S015, S022, S075, S077, S082, S087, S106, S108, S120, S123, S143, S162	<p>General concern regarding predicted drawdown impacts. The trigger threshold concept merely indicated that there is a drawdown rate that is beyond the sustainable limit of the aquifer, but does not address the issues of mitigation or make good</p>	-	<p>Bore trigger threshold values are used to determine the point at which investigation is required to determine whether monitoring or intervention may be required to maintain groundwater supply or groundwater quality in line with current uses. The threshold values do not represent drawdown values that impact on the sustainable use of an aquifer, and instead provide an early</p>

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R11033	S010, S015, S022, S075, S077, S082, S087, S106, S108, S120, S123, S143, S162	measures. Predicted drawdowns are greater than the 2 m trigger thresholds for alluvial aquifers and above the 5 m threshold for the Great Artesian Basin. Provide more information regarding the drawdown and water pressure in aquifers, as well as long term recovery following increased water extraction, including how to minimise or manage exceedance of trigger thresholds. The extraction of this water should be treated the same way as other ground water users. Arrow needs to consider Queensland Water Commission Surat Underground Water Impact Report recommendations.		warning system that triggers investigation by responsible tenure holders. Drawdowns of 2 m for unconsolidated aquifers and 5 m for consolidated aquifers may have no effect on the capacity of the bore. These bore-specific characteristics drive the requirement for individual bores with the potential to be impacted to be investigated as part of a bore assessment. Since finalisation of the EIS, the final Underground Water Impact Report (UWIR) was released and approved by EHP, and Arrow is already obligated to meet the requirements set out in the UWIR.
R11034	S134	Arrow to recognise that operations may be reviewed in view of the adaptive management framework. Arrow to provide assurance that if groundwater supplies become critically low/contaminated, production will cease until conditions improve.	SREIS Chapter 8	Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders should a bore be impacted. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include: <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation. Arrow will accordingly be required to make-good any impaired capacity of third party bores both in terms of quantity and quality. The Queensland Government Underground Water Impact Report (UWIR) model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). The model has been updated with Arrow production data, the results of the update are presented in the SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR. As coal seam gas developments progress the UWIR model will be updated with new geological and hydrogeological information allowing greater accuracy in the prediction of impacts, consideration of risks and appropriate avoidance, mitigation and management actions to be implemented. Greater accuracy will facilitate timely responsiveness to predicted impacts. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations in this regard.
R11035	S106	Regulations are likely to be prescribed once seasonal water table variations are known that	–	Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders should a bore be impacted. The make good

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R11035	S106	would result in trigger levels for make good actions being reduced from 2 m and 5 m towards triggering a make good action once a 0.5 m drawdown is foreseen at least three years. Note: A 2 m drop equates to near a 10% drop in available water from the 30 m deep wells in the Condamine Alluvium which would potentially result in pump cavitation, hence the need for seasonal variations to be determined.		measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation. It is acknowledged that regulations may change over the life of the project and/or as more information on the hydrogeology of the Surat Basin becomes available.
R11036	S033	Concerned that drilling lubricant will contaminate drinking water used by humans and impact negatively on a potential Endangered Species Rehabilitation Breeding Program.	–	Arrow prefers to use very basic water-based drilling mud on its rigs (to lubricate the drill bit and assist the recovery of cuttings from the drill hole). The water based drilling mud mixture consists predominantly of fresh water combined with two to three per cent of salts, and can contain a small amount of bentonite clay to prevent loss of fluid through the bore hole. Arrow has also committed to the selection of drilling fluids to minimise potential groundwater impacts and to not use oil-based drilling fluids (Commitment C139). Oil based lubricants used on above ground components of the drill rig are generally the same as those used on agricultural machinery that is common within the project development area. The storage and handling of lubricants of this type will be in accordance with international, Australian and industry standards and codes of practice for the handling of all hazardous materials (Commitment C035).
R11037	S150	The precautionary principle should be applied and that fracking should not be permitted within the project due to serious and unquantified risk to groundwater. Arrow must demonstrate how it will prevent adverse impacts caused by direct disturbance to, or extraction from, groundwater flow systems by: • Only permitting well stimulation or hydraulic fracturing (fracking) in coal measures where it can be guaranteed interconnectivity between aquifers and aquitards resulting from the fractures in the coal seams and their surrounds will not occur. • Not permitting the use of radioactive tracer beads or chemicals for fracking where they may pose significant hazards to humans or other organisms, including the potential for bioaccumulation.	–	Arrow will enforce a no hydraulic fracturing (fracking) policy in the project development area (Commitment C079). Consequently, no impact (direct or cumulative) from fracking chemicals or direct disturbance to groundwater flow regimes from fracking is expected. Further to this, Arrow does not propose to use radioactive tracer beads in its hydraulic fracturing operations in other areas where the company operates.
R11038	S024, S026, S033,	Has a risk assessment been conducted to	–	Well integrity is of great importance to Arrow, not only for the purposes of

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R11038	S024, S026, S033, S038, S081	determine the potential impacts of incomplete and incorrect installation of wells on groundwater values? How can Arrow be sure that once the steel and cement wells age, they will not leak into the intake beds of the Great Artesian Basin and other aquifers?		<p>protection of the environmental values of the groundwater resources but also to ensure the effective recovery of the gas resource. For these reasons Arrow has committed to implement a well integrity management system during commissioning and operation of production wells (Commitment C143). Such a system will include components addressing well construction, assessment of the effectiveness of well completion, and post construction monitoring and response to identified issues of well integrity.</p> <p>Arrow has also committed to 'Decommission or repair all production wells and monitoring bores, either at the end of their operating life span or in the event of a failed integrity test in accordance with the minimum construction requirements for water bores in Australia (LWBC & NMBSC, 2003) and the P&G Act and regulations to that act. Arrow has committed to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150).</p> <p>The residual risk assessment relating to groundwater has been developed on the assumption that industry standard well construction and control measures have been implemented.</p>
R11039	S005, S010, S014, S017, S019, S022, S024, S025, S026, S027, S033, S034, S036, S043, S044, S049, S052, S054, S056, S061, S068, S069, S071, S079, S080, S081, S082, S083, S086, S088, S093, S106, S110, S116, S130, S134, S143, S146, S150, S155, S161, S162	<p>The risk based assessment process has not assigned correct sensitivity value to the Condamine Alluvium. EIS must acknowledge Condamine Alluvium as an important domestic and drinking water supply. The statement in EIS Section 4.1.3 is incorrect. The water from the Condamine Alluvium is used for domestic uses, not only potential.</p> <p>In Section 14.3.5 Arrow states that shallow groundwater systems, namely the Condamine Alluvium are prone to modification due to the infiltration of pollutants, and to the extent that these supplies are not potable. The Condamine alluvium supplies the water for the townships of Millmerran, Dalby, Pittsworth, Brookstead and Macalister, for all of their domestic and industrial needs. The industries serviced by these centres also rely on the Walloon coal measures and the Hutton and Precipice Sandstone aquifers.</p> <p>Many towns and hundreds of rural residents use the waters from the Condamine Alluvium for potable purposes. If the proponent's statement is</p>	-	<p>The sensitivity ranking applied to the Condamine Alluvium presented in the EIS considers all of the environmental values of the groundwater resource including a number of intrinsic characteristics in addition to water quality and water use. The description of the 'potential' use of the water for domestic purposes provides a broad coverage that recognises that the water resource is suitable for use as domestic water (even where it is not subject to such use). The importance of the Condamine Alluvium is not underestimated in the EIS or the SREIS. The supplies to the towns noted in submissions are made suitable for domestic use through additional treatment. The adjustment of the suggested components of the sensitivity ranking does not change the overall sensitivity ranking.</p>

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R11039	S005, S010, S014, S017, S019, S022, S024, S025, S026, S027, S033, S034,	not true, the value and the assessment of this resource needs to be readdressed. The supplementary report to the EIS should accurately describe the environmental value of the Condamine aquifer.		
R11040	S024, S026, S079, S081, S130, S143	The results of the regular water testing done by a local government agency show that the water is potable within the Australian Government drinking standards and not contaminated as stated in Section 14.3.5 of the EIS. Western Downs Regional Council requests Arrow provide evidence that the Condamine Alluvium has been modified by pollutants or reassign the environmental values of shallow groundwater systems in the project area.	EIS Chapter 14, Section 14.3.5	The sensitivity ranking applied to the Condamine Alluvium presented in the EIS considers a number of intrinsic characteristics in addition to water quality and water use. EIS Chapter 14, Groundwater, Section 14.3.5 discusses the potential for this groundwater system to be modified by surface activities in comparison with deeper aquifers. The importance of the Condamine Alluvium is not underestimated in the EIS or the SREIS. The sensitivity ranking acknowledges the Condamine Alluvium is a relatively shallow, unconfined alluvial aquifer that is susceptible to impact from surface based sources of pollutants such as those from agricultural, industrial and domestic land uses. The supplies to the towns noted in related submissions are made suitable for domestic use through additional treatment. Further, the adjustment of the suggested components of the sensitivity ranking does not change the overall sensitivity ranking.
R11041	S079	Arrow state that the Condamine Alluvium is up to 150 m thick and has limited potable use of the water. However the Queensland Water Commission states that this alluvium is mainly 30 m to 60 m and up to 130 m at maximum thickness and is utilised for domestic purposes.	SREIS Chapter 8	The sequence of alluvial sediments is up to 150 m thick according to the Upper Condamine Groundwater Model Calibration Report (Barnett and Muller, 2008). Actual interpreted thicknesses may vary depending on the information source and the age of the document. The Underground Water Impact Report (UWIR) prepared by the Office of Groundwater Impact Assessment (OGIA) adopted an average thickness of between 30 m and 60 m, with a maximum thickness of 130 m. This information was also used in the groundwater model prepared for the SREIS, with more detailed information on the inferred changes in the thickness of the the Condamine Alluvium as presented in SREIS Chapter 8, Groundwater, and shows that the Condamine Alluvium can reach approximately 150 m in thickness in limited areas near Dalby.
R11042	S089, S106	Terms of Reference, Section 4.5.1.2 is not satisfied as little or no data is provided on seasonal changes that have been exhibited historically.	-	Historical data for groundwater level fluctuation was used for calibration of the groundwater model presented in the EIS. Seasonal change in groundwater levels due to recharge is not generally expected in the confined aquifers of the Great Artesian Basin due to their recharge processes which are less reliant on direct rainfall recharge. Seasonal fluctuations in groundwater elevation in the Condamine Alluvium aquifer may be expected, however due to the significant historical development of the resource for agriculture and industry, which is also seasonally linked, it is difficult to distinguish between natural and pumping-

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R11042	S089, S106			induced fluctuations. Contamination is dealt with in the impact assessment, and groundwater quality has been assessed in the baseline investigations with respect to standard guidelines and criteria.
R11043	S005, S139, S148, S154, S157	EIS Section 4.1.3 fails to draw adequate attention to the significant dependence of significant business enterprises upon groundwater from the Walloon Coal Measures and the devastating affect lost groundwater supplies would have. The EIS states that groundwater quality in the coal seam gas groundwater system is suitable for stock watering only. Groundwater from this system is commonly used for domestic and irrigation purposes. The description of potential uses of groundwater extracted from the Walloon Coal measures does not identify intensive livestock operations as a regular user. Irrigators are concerned about the potential impacts of coal seam gas activities on their groundwater supplies, particularly the extraction of groundwater from the Walloon Coal Measures located beneath the central alluvium.	EIS Chapter 4, Section 4.1.3 and 4.3.2 Chapter 14, Sections 14.3.4, 14.3.5 and Figures 14.4 and 14.8	The EIS Chapter 4, Environmental, Social and Economic Context (specifically Section 4.1.3) addresses the classification and most predominant uses of the groundwater in the Walloon Coal Measures with a water quality range and a high level description of 'suitable for stock watering' that does not discount other uses or isolated areas of higher quality water. EIS Chapter 4, Environmental, Social and Economic Context, Section 4.3.2 acknowledges a wide range of agricultural activity in the region. EIS Chapter 14, Groundwater, specifically Figure 14.4, acknowledges the 166 registered bores accessing the Walloon Coal Measures. Section 14.3.4 and specifically Figure 14.8 address the range of registered use of the groundwater resources. Section 14.3.5 discusses the quality of the coal seam gas water in greater detail and acknowledges the variability in water quality and variety of potential uses. The importance of the Walloon Coal Measures water resource is not underestimated or undervalued in the EIS or SREIS. The potential impact on the resource is acknowledged and has been addressed through the proposed mitigations. The Queensland Government Coal Seam Gas Water Management Policy (2012) promotes substitution. Under the substitution arrangements Arrow could supply suitable treated water to users groundwater resources in the Immediately Affected Area.
R11044	S130	Condamine Alluvium should be identified as being part of the Great Artesian Basin.	–	The aquifers that make up the Great Artesian Basin (GAB) are defined in the Water Resources (Great Artesian Basin) Plan 2006. Although the Condamine Alluvium is located within the same geographical area as the GAB, the Condamine Alluvium is not defined as part of the GAB. Inclusion in the GAB may be determined in terms of hydrogeological system linkage rather than geographic location.
R11045	S139	The submission notes that to date, the regulator has refused to condition groundwater impacts in environmental authorities issued for coal seam gas activities, however, the EP Act does give the regulator powers to condition the environmental value of water, including values as defined in the EPP (Water), such as groundwater used for agricultural or drinking water purposes. The groundwater contained within the Condamine Alluvium is renowned for its ability to support both	–	Noted. Arrow expects that its operations will be regulated by EHP through the issuance of an environmental authority that will contain conditions that are applicable to all aspects of their operations, including those aspects associated with groundwater extraction. How the groundwater resource allocation is regulated, and how regulatory provisions are applied, is the jurisdiction of the Queensland Government.

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R11045	S139	these groundwater uses.		
R11046	S106	Table 8, column 2 of the EIS Executive Summary is incorrect as it should be definite flow between the Condamine Alluvium and the Walloon Coal Measure and not possible as stated in the Executive Summary. It is also incorrect to suggest the Condamine Alluvium may be described as resilient post commencement of coal seam gas extraction.	SREIS Appendix 4	Knowledge of the hydrogeological structures of the Surat Basin is based on a relatively small number of data points. The connectivity between the aquifers has to be assumed on the basis of the data available. The Queensland Government Office of Groundwater Impact Assessment (OGIA) model, which has been used as a base for assessment of groundwater impacts in the SREIS, makes an approximation of flux from the Condamine Alluvium into the Walloon Coal Measures. The OGIA model is a dynamic model that can be calibrated and updated as more geological and hydrogeological information becomes available through drilling and monitoring (SREIS Appendix 4, Supplementary Groundwater Report). Over time it is anticipated that the flux between aquifers will be better defined. As the model is calibrated with real time data, the prediction of impacts and hence the ability to make timely interventions will continue to improve.
R11047	S004, S006, S010, S015, S104	Existing groundwater entitlement holders are incensed that groundwater extraction associated with coal seam gas activities is outside the governance of the Water Act, and therefore does not require an entitlement. Similarly, that groundwater extraction from the Great Artesian Basin associated with coal seam gas activities is allowed even when the Great Artesian Basin resource operations plan shows that the resource is fully allocated. There are groundwater use issues that put coal seam gas industry at odds with existing groundwater users, including unlimited rights to take or interfere with groundwater and it is excluded from the Great Artesian Basin Plan 2006.	–	While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These requirements include a responsibility to make good any impairment of private bore groundwater supplies. Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The Long-term Affected Area for an aquifer is defined as the area within which water level impacts are expected to exceed the bore trigger threshold at any time in the future. The Queensland regulatory framework requires that, for a bore tapping an aquifer in the Immediately Affected Area for the aquifer (as defined in the UWIR), a tenure holder undertake a bore assessment to evaluate whether the bore is likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of

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R11047	S004, S006, S010, S015, S104			<p>extraction of water during production of coal seam gas. The tenure holder must then enter into a 'make good' agreement with the bore owner. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.</p> <p>The Queensland Government Coal Seam Gas Water Management Policy (2012) promotes substitution. There is currently no regulatory framework to facilitate substitution and therefore Arrow has developed a commercial framework to support the supply of coal seam gas water to groundwater users who hold allocations. Under the proposed framework, end users would receive and utilise water supplied by Arrow in lieu of utilising their groundwater allocations. Arrow will deliver agreed volumes of coal seam gas water treated to an agreed quality. Under water supply agreements with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval.</p>
R11048	S139	<p>Current entitlement holders have had to deal with reductions in entitlements of 30% to 50%, and the upcoming Murray Darling Basin Area Water Plan will likely result in further reductions.</p>	-	<p>Noted. Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders should a bore be impacted. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation.
R11049	S015, S032, S034, S043, S052, S056, S061, S068, S069, S080, S082, S086, S093, S155, S165	<p>Water is the main issue for all of us on the land, as we rely on it not just for our livelihood but our survival or domestic needs. Water quantity as well as quality needs to be addressed as the extraction of coal seam gas water will have an adverse effect on both.</p> <p>The EIS does not sufficiently address groundwater quality or security of water for future irrigation use (i.e., Condamine Alluvium aquifer and Great Artesian Basin). Concerned the quality of water in the Condamine Alluvium would no longer be suitable for irrigation purposes.</p> <p>Should the project proceed, 100% assurance needs to be provided that the domestic and drinking water supply and quality will not be affected by the development.</p>	-	<p>While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These requirements include a responsibility to make good any impairment of private bore groundwater supplies.</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11049	S015, S032, S034, S043, S052, S056, S061, S068, S069, S080, S082, S086, S093, S155, S165			<p>term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold within three years. The Long-term Affected Area for an aquifer is defined as the area within which water level impacts are expected to exceed the bore trigger threshold at any time in the future.</p> <p>The Queensland regulatory framework requires that, for a bore tapping an aquifer in the Immediately Affected Area for the aquifer (as defined in the UWIR), a tenure holder undertake a bore assessment to evaluate whether the bore is likely to experience an impaired capacity i.e. no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. The tenure holder must then enter into a 'make good' agreement with the bore owner. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is obligated to enter into these agreements. The Department of Environment and Heritage Protection (EHP) will be responsible for ensuring petroleum tenure holders comply with their obligations. The Queensland Government Coal Seam Gas Water Management Policy (2012) promotes substitution. There is currently no regulatory framework to facilitate substitution and therefore Arrow has developed a commercial framework to support the supply of coal seam gas water to groundwater users who hold allocations. Under the proposed framework, end users would receive and utilise water supplied by Arrow in lieu of utilising their groundwater allocations. Arrow will deliver agreed volumes of coal seam gas water treated to an agreed quality. Under water supply agreements with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval.</p>
R11050	S079, S099, S118	<p>Impact assessment should assess impacts to land owners that are using the Condamine Alluvium as a domestic water supply. As the Condamine Alluvium is such a precious and limited resource, how is it that Arrow can extract unmetered and unlimited amounts, when we as farmers can't seek new water entitlements and at present continue to have our allocations reduced? It is still the same over-allocated body of water, is it not?</p>	SREIS Chapter 8	<p>While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These requirements include a responsibility to make good any impairment of private bore groundwater supplies. Arrow will be drawing water from the Walloon Coal Measures, below the Condamine Alluvium. The connectivity between these aquifers is assumed on the basis of the data available. The Queensland Government Office of Groundwater Impact Assessment (OGIA) model used as a base for assessment of groundwater impacts in the SREIS makes an approximation of flux from the Condamine Alluvium into the Walloon Coal Measures under various extractive scenarios. As such the impacts to users of the Condamine Alluvium water resources are considered; see SREIS Chapter 8, Groundwater.</p>

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R11050	S079, S099, S118			Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).
R11051	S072, S157	If water availability is affected by the project, Australia could lose the use of some highly productive food production areas. Current groundwater entitlements associated with farming operations underpin their expansion plans and ability to continue the provision of extensive food products to Queensland.	–	Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders within the immediately affected areas (IAA). The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include: <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).
R11052	S086, S157, S160	Any deterioration in water quality or supply would have a deleterious impact on intensive livestock operational efficiency and possibly disease status (e.g. piggeries and poultry operations). Arrow must investigate other intensive livestock operations in the project area to determine whether they will be affected by groundwater drawdown.	EIS Chapter 14, Groundwater	Potential impacts on the groundwater aquifers within the project development area are discussed in EIS Chapter 14, Groundwater, Section 14.4 and SREIS Chapter 8, Groundwater. Under the Water Act, Arrow will be required to implement 'make good' provisions for bore holders should a bore be impacted. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include: <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation. EIS Chapter 12, Geology, Landform and Soils, Table 12.6 acknowledges the potential to cause soil contamination through overflow from brine dams. The appropriate avoidance, mitigation and management measures are summarised for this potential impact, and the residual impact is assessed following implementation of these measures.
R11053	S153	Concerned about the validation of the cumulative groundwater model and how the detail of the monitoring bore network can be applied to the submitter's situation.	SREIS Chapter 8	Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional

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R11053	S153			<p>groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA.</p> <p>The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP).</p> <p>The UWIR model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). The model has been updated with Arrow production data, the results of the update are presented in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR. Monitoring requirements are defined in the UWIR. As coal seam gas developments progress, the UWIR model will be able to be updated with new geological and hydrogeological information allowing greater accuracy in the prediction of impacts, consideration of risks and appropriate avoidance, mitigation and management actions to be implemented. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations. The cumulative impacts will be confirmed and calibrated regularly as monitoring data and field development information is used to rerun the model.</p>
R11054	S161	<p>EIS does not acknowledge that the impacts of short term (35 years) coal seam gas extraction have long-term (100 plus years) implications for the composition and movement of groundwater reserves.</p>	<p>EIS Chapter 14, Section 14.2.3 and Table 14.4</p> <p>SREIS Chapter 8</p>	<p>The groundwater impact assessment prepared for the EIS assessed the potential for the occurrence of longer term impacts. The assigned impact magnitude rankings as described in EIS Chapter 14, Groundwater, Section 14.2.3, Table 14.4, acknowledge the possibility of long term impacts if mitigations are not implemented.</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA) and shows the time period of potential impacts. The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP).</p> <p>The UWIR model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). The model has been updated with Arrow production data, the results of the update are presented in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11055	S118, S123, S134, S139, S145, S148, S154, S157, S159	<p>General concern that the potential impacts to groundwater quality and quantity lack local and specific detail, particularly within the Toowoomba Regional Council area, the Fitzroy Basin and within each development area.</p> <p>Imprecise locations of future sitings of wells, and locally unique aquifers. This needs further investigation at an individual bore level.</p> <p>The averaging of coal seam water extraction rates over large areas (for Arrow and other coal seam gas proponents), based on evenly spaced wells etc. is an over simplification, and does not take location specific conditions into consideration.</p>	<p>EIS Chapter 14 SREIS Chapter 8</p>	<p>The numerical groundwater model prepared for the EIS is a regional model, designed and structured to predict groundwater drawdown across the entire study area (as outlined in EIS Chapter 14, Groundwater). Model refinement is an ongoing process as more data is collected, collated and used a model inputs.</p> <p>The model is based on conceptual field development scenarios for Arrow and the other coal seam gas proponents, which includes average well spacing across the groundwater model extent. The regional model is not constructed to predict responses at a local level, and therefore the application of even well spacing across a model extent of that size is suitable and appropriate for the purposes of the EIS. Adjustment of well spacing distances will not alter to overall outcome of the numerical model.</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities occurring within, and planned to occur within the Surat CMA.</p> <p>The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP).</p> <p>The UWIR model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing).</p> <p>The model has been updated with Arrow production data, the results of the update are presented in the SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR. As the model is updated with increasing amounts of information from data gathered from wells drilled in specific locations, the model will be able to better predict localised impacts, thus allowing mitigations to be implemented in a timely manner.</p>
R11056	S002, S003, S004, S006, S008, S009, S015, S018, S019, S020, S030, S034, S037, S039, S050, S053, S055, S058, S059, S065, S067, S069, S070, S075, S076, S077, S085, S088, S089, S095,	<p>Concern that the EIS does not accurately assess the potential severity of permanent or long term impacts to groundwater resources (loss of capacity and quality) as a result of the project. Specifically impacts to the Condamine Alluvium, Great Artesian Basin and other aquifers used for irrigation. No confidence that Arrow will protect groundwater resources. The Queensland Government must adhere to the precautionary principle and reject this proposal until the industry can be proven safe to</p>	<p>EIS Chapter 14, Section 14.2.3 and Table 14.4 SREIS Chapter 8</p>	<p>The groundwater impact assessment prepared for the EIS assessed the potential for the occurrence of longer term impacts. The assigned impact magnitude rankings as described in EIS Chapter 14, Groundwater, Section 14.2.3, Table 14.4 acknowledge the possibility of long term impacts prior to mitigations being implemented. The model also acknowledges the fact that groundwater systems inherently recover through natural recharge processes over time. Arrow acknowledges that early intervention is required to enhance and accelerate recovery and acknowledges its requirements to implement make good provisions under the Queensland Government Coal Seam Gas Water Management Policy (2012) (for groundwater entitlement holders within</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11056	S002, S003, S004, S006, S008, S009, S015, S018, S019, S020, S030, S034, S037, S039, S050, S053, S055, S058, S059, S065, S067, S069, S070, S075, S076, S077, S085, S088, S089, S095, S096, S097, S098, S112, S114, S116, S139, S140, S141, S144, S152, S155, S161, S167	groundwater resources. Concern that Arrow does not have enough understanding of coal seam gas activities and potentially permanent impacts (having only 10 years experience). The project should not proceed while ambiguity exists in association with permanent impacts.		the immediately affected area). The numerical model prepared for the SREIS, based on the Queensland Government Office of Groundwater Impact Assessment (OGIA) model and updated with Arrow production data, presents a mitigation scenario which predicts the response of groundwater levels in the Condamine Alluvium as a result of the substitution strategy. Results from this modelling scenario are presented in SREIS Chapter 8, Groundwater. Arrow will be subject to compliance conditions applied through a new environmental authority or an amendment to their existing environmental authority. Arrow anticipates that under the environmental authority it will be required to protect or enhance groundwater values. These conditions, in conjunction with the legislative requirements of the UWIR require Arrow to regularly and routinely monitor groundwater resources and provide results to the OGIA. The OGIA model has been endorsed by EHP. Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR.
R11057	S106	Any impact on the very high quality waters of the Precipice Sandstone should be avoided. Accordingly the works proposed for the Dalby development region should not proceed as planned. Limited extraction to enable existing domestic contracts to be met would still need to be closely monitored.	-	Noted. Groundwater extraction associated with Arrow's domestic coal seam gas supply in the Dalby Development region is already conditioned under an environmental authority. Groundwater extraction associated with the Surat Gas Project will be subject to compliance conditions applied through a new environmental authority or an amendment to Arrow's existing environmental authority. It is anticipated that under the environmental authority Arrow will be required to protect or enhance groundwater values. These conditions, in conjunction with the legislative requirements of the UWIR, require Arrow to regularly and routinely monitor groundwater resources and provide results to the Queensland Government Office of Groundwater Impact Assessment (OGIA). The OGIA model has been endorsed by EHP. Arrow is already regulated by the responsible tenure holder obligations assigned to them in the UWIR.
R11058	S091, S134	Concerns about the effect of saline coal seam gas water being stored in dams and the impacts on the surrounding land and underground water aquifers. More information should be provided on the locations that are not suitable for holding brine e.g., due to water table levels and soil types.	EIS Chapter 14 SREIS Chapter 3	In accordance with the revised project description (SREIS Chapter 3, Project Description) there will be two brine storage dams located adjacent to each of the two water treatment facilities. These dams will be located on Arrow owned or leased properties. Brine storage dams will be designed, constructed and managed in accordance with the relevant industry standards. Hazard category of dams will be determined in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (DERM, 2011f). The detailed design for water treatment facilities and associated infrastructure will involve subsurface investigations to characterise the soil and groundwater conditions beneath and surrounding dams. This will ensure that appropriate site specific design controls can be applied to the brine dams. Leak detection monitoring wells will be installed around the brine dams as per Commitment C504.

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Issue No.	Submission No.	Issue	Reference	Responses
R11059	S032, S079, S086, S095, S130, S161, S162	<p>Concerns that the drilling of thousands of wells through the overlying Condamine Alluvium will cause impacts (such as contamination to Dalby's main drinking water supply) to the groundwater system due to:</p> <ul style="list-style-type: none"> • Leakage of water into the Condamine Alluvium over time from imperfect, incomplete or incorrect well construction. Details of the anticipated amount of contamination per well due to imperfect, incomplete or incorrect well installation should be provided. In EIS Section 14.4.5 incomplete or incorrect installation should be rectified under a best management practice at the time of installation. This should also be conditioned as part of the approval to negate interconnectivity and contamination of aquifers. • Failure of wells (a failure rate of up to 5% is common in the drilling world). A drill log signed by a contractor to protect the separate aquifers is inadequate. • Delay in well construction. Based on experience, every bore has delays (due to the weather, weekends, sickness, etc.) during construction that leads to collapsing and problems with how well sealed they are. • Lack of care and accountability by drillers. Drillers by and large are not that worried and the ones known can not be trusted to make every bore of thousands planned, sealed perfectly (a hard task under any circumstances). As a percentage of the wells won't seal, the co-mingling that results will be disastrous. • Interconnectivity of aquifers caused by deterioration of old wells. Section 14.6.6 did not address this topic. A well which will rust out over years will cause quality and quantity issues of water in the underlying aquifers, and needs to be addressed and conditioned. <p>Arrow must provide a comprehensive risk assessment to determine the impacts of cross-contamination of aquifers through incorrect well installation and interconnection of aquifers, and provide measures to nullify this risk.</p>	-	<p>Well integrity is of great importance to Arrow, not only for the purposes of protection of the environmental values of groundwater resources but also to ensure the effective recovery of the gas resource. For these reasons Arrow has committed to implement a well integrity management system during commissioning and operation of production wells (Commitment C143). Such a system will include components addressing well construction, assessment of the effectiveness of well completion, and post construction monitoring and response to identified issues of well integrity.</p> <p>Arrow has also committed to decommission or repair all production wells and monitoring bores, either at the end of their operating life span or in the event of a failed integrity test in accordance with the minimum construction requirements for water bores in Australia (LWBC & NMBSC, 2003) and the P&G Act and regulations to that act.</p> <p>Arrow has committed to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150).</p> <p>The residual risk assessment relating to groundwater has been developed on the assumption that industry standard well construction and control measures have been implemented.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11060	S001, S002, S003, S009, S015, S020, S027, S030, S034, S037, S039, S050, S051, S055, S058, S059, S065, S069, S070, S071, S075, S076, S077, S079, S085, S086, S088, S095, S096, S097, S106, S108, S110, S112, S113, S114, S116, S139, S140, S146, S150, S152, S162, S167	<p>Concerns that due to interconnectivity between the Condamine Alluvium, the Condamine Alluvium could be rapidly depleted even where the Westbourne Formation in places provides a significant aquitard to the downward vertical movement of water (see EIS Figure 14.4).</p> <p>The impacts relating to the unknowns between Condamine Alluvium and Walloon Coal Measures have not been addressed. Further modelling and studies must be undertaken to quantify the extent of interconnection and the effect of dewatering of the Walloon Coal Measures on the Condamine Alluvium. Underground geology is very complicated and interconnectivity between aquifers is poorly understood. There should be a clear description of location, extent of inter-aquifer flows and possible outcomes for the aquifers.</p> <p>Should the Walloon Coal Measures continue to be dewatered of the Condamine Alluvium inflow, a huge empty reservoir beneath the Condamine Alluvium would result, which would take decades to replenish before the Condamine Alluvium began to hold water at an acceptable standing water level. The quality of that water would depend upon the sequencing of recharge events with the quality being worst if recharge resulted initially from rainfall feeding the Walloon Coal Measures.</p> <p>No reference is made to where the Condamine Alluvium is saline or how this may relate to inflow occurring at those sites from the Walloon Coal Measures. It is potentially only at these sites where some very low level of Walloon Coal Measures dewatering may be acceptable.</p> <p>This will affect irrigation farmers, food and fibre production, landholder bores, and small towns and rural households who rely on this underground water.</p>	<p>SREIS Chapter 8</p>	<p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p> <p>The groundwater extraction associated with coal seam gas resource development requires that pressures are lowered in the target formations, but the formation is not drained. Post-production, aquifers can recover unassisted through natural recharge processes. The recharge mechanisms associated with the Walloon Coal Measures, which is a confined aquifer forming part of the Great Artesian Basin, are very different to those associated with the Condamine Alluvium, which is an unconfined aquifer predominately recharged from river leakage and direct surface infiltration.</p> <p>The EIS presented predicted drawdown in the Condamine Alluvium as a result of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicated that under the cumulative modelling scenario (incorporating all coal seam gas projects underway or proposed in the Surat Basin), maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) showed maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most of the Surat Cumulative Management Area (CMA). These predicted drawdown levels are considered manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures.</p> <p>Additional information on the degree of connectivity between the Condamine Alluvium and the Walloon Coal Measures is presented in SREIS Chapter 8, Groundwater. Additional investigations are also underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS Chapter 8, Groundwater.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>Direct groundwater drawdown in the Walloon Coal Measures and subsequent indirect drawdown in the overlying and underlying aquifers will be managed through make good obligations where required. Make good obligations</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11060	S001, S002, S003, S009, S015, S020, S027, S030, S034, S037, S039, S050, S051, S055, S058, S059, S065, S069, S070, S071, S075, S076, S077, S079, S085, S086, S088, S095, S096, S097,			include undertaking a detailed assessment of each potentially affected bore to determine whether the bore may experience an impaired capacity. Where required, make good measures will be implemented. These can be fulfilled through a number of means, including: <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore.
R11061	S106	South west of Cecil Plains the Gubberamunda Sandstone is in contact with the Springbok Formation or in direct contact with the Walloon Coal Measures. Any dewatering of the Walloon Coal Measures in this area would unacceptably halve the recharge in this section of the recharge zone of the important Great Artesian Basin Gubberamunda aquifer. In consideration of the Condamine Alluvium as well, any works proposed for this southern half of the proposed Millmerran/Kogan development region should not proceed as planned. Some limited extraction from existing works to enable existing domestic contracts to be met would still need to be closely monitored.	EIS Chapter 14 SREIS Chapter 8 Appendix 4, Appendix D	It is noted that recharge to aquifers in the Surat Basin occurs mainly in areas where formations outcrop. EIS Appendix G, Groundwater Impact Assessment, Figure 3.2 shows that the Kumbarilla Beds (of which the Gubberamunda Sandstone is a unit) outcrops extensively in the vicinity of Cecil Plains where recharge can occur. Reduced pressure in the Walloon Coal Measures does not impact this, although it is recognised that inter-aquifer fluxes will occur. In some cases reduced aquifer pressure leads to increasing recharge rates, due to the increased hydraulic gradient between aquifers and recharge sources. The EIS presented predicted drawdown in the Condamine Alluvium as a result of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicated that under the cumulative modelling scenario (incorporating all coal seam gas projects underway or proposed in the Surat Basin), maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) showed maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most of the Surat Cumulative Management Area (CMA). These predicted drawdown levels are considered manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures. Additional investigations are underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS Chapter 8, Groundwater. A revised numerical groundwater model has been prepared for the SREIS that is a repeat of the OGIA Surat CMA groundwater model but incorporating Arrow's latest Surat Gas Project development case. Predicted net flux estimates from the Condamine Alluvium (based on the calibrated model and Arrow's Surat Gas Project only) peak between 1.25 to 2.8 ML/d (refer SREIS Appendix 4, Supplementary Groundwater Assessment, appendix D) and total 63 GL in the next 100 years. The modelling also presents the maximum drawdown in the Condamine

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Issue No.	Submission No.	Issue	Reference	Responses
R11061	S106			<p>Alluvium under the cumulative coal seam gas industry scenario without substitution, and the results are presented in SREIS Appendix 4, Supplementary Groundwater Assessment.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p>
R11062	S010	<p>EIS Chapter 14, Table 14.8 which summarises the modelled groundwater drawdown has the greatest drawdown on the western edge of the Condamine Alluvium where the greatest separation exists between the Condamine Alluvium and the Walloon Coal Measures (as per Figure 14.4). Where there is no separation between the Condamine Alluvium and the Walloon Coal Measures in the central alluvium, the drawdown is minimal. This does not seem possible and needs more explanation.</p>	<p>EIS Chapter 14 SREIS Chapter 8</p>	<p>The majority of coal seam gas extraction from the Walloon Coal Measures occurs to the west of the Condamine Alluvium. The effects of depressurisation in the Walloon Coal Measures under the cumulative modelling scenario presented in the EIS propagate to overlying formations with time, resulting in a pressure loss in these formations as well. These formations include the Springbok Sandstone (refer to figure 4.24 in Appendix B of the EIS Appendix G, Groundwater Impact Assessment). The western edge of the Condamine Alluvium, where the maximum drawdown of 2.5 m occurs under the cumulative modelling scenario (refer to Figure 4.32 in Appendix B of the EIS Appendix G, Groundwater Impact Assessment) can be seen to overly the location in the Springbok Sandstone where a drawdown of over 40 m occurs.</p> <p>The timing of the maximum drawdown varies as it propagates through formations overlying the Walloon Coal Measures. For the Arrow only case presented in the EIS, the maximum drawdown for the Walloon Coal Measures occurs at around 2024, the Gubberamunda at 2031, and the Condamine Alluvium at 2059. These drawdowns presented in the EIS are unmitigated and conservative.</p> <p>Since the release of the EIS, a revised groundwater model has been prepared for the SREIS that is a repeat of the Office of Groundwater Impact Assessment Surat Cumulative Management Area groundwater model (but incorporating Arrow's latest Surat Gas Project development case). The results of this modelling are presented in SREIS Chapter 8, Groundwater. Consistent with the model prepared for the EIS, the SREIS revised model shows that the greatest drawdown in the Condamine Alluvium are also predicted to occur along its western extent (see SREIS Chapter 8, Groundwater).</p>
R11063	S106	<p>There is strong direct connection between the Walloon Coal Measure and the Condamine Alluvium for approximately 15 km perpendicular to the river and for many kilometres along the river. As a result, the remainder of the Condamine Alluvium which stretches further west would drain within six years towards the direct connection with the Walloon Coal Measures. This would occur with increasing downward vertical loss of water to the</p>	<p>SREIS Chapter 8 Appendix 4, Appendix D</p>	<p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The groundwater extraction associated with coal seam gas resource development requires that pressures are lowered in the target formations, but the formation is not drained.</p> <p>The EIS presented predicted drawdown in the Condamine Alluvium as a</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11063	S106	Walloon Coal Measures as the Westbourne Formation thinned, to a line whereby water from the Condamine Alluvium would flow directly unimpeded down into the Walloon Coal Measures should it be dewatered thereby depleting the Condamine Alluvium.		<p>result of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicated that under the cumulative modelling scenario (incorporating all coal seam gas projects underway or proposed in the Surat Basin), maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) showed maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most if the Surat Cumulative Management Area (CMA). These predicted drawdown levels are considered manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures. Additional investigations are underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS, Chapter 8, Groundwater.</p> <p>A revised numerical groundwater model has been prepared for the SREIS that is a repeat of the OGIA Surat CMA groundwater model but incorporating Arrow's latest Surat Gas Project development case. Predicted net flux estimates from the Condamine Alluvium (based on the calibrated model and Arrow's Surat Gas Project only) peak between 1.25 to 2.8 ML/d (refer SREIS Appendix 4, Supplementary Groundwater Assessment, appendix D) and total 63 GL in the next 100 years.</p> <p>The modelling also presents the maximum drawdown in the Condamine Alluvium under the cumulative coal seam gas industry scenario without substitution, and the results are presented in SREIS Appendix 4, Supplementary Groundwater Assessment.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p>
R11064	S143	Concern over uncertainties with connectivity between recharge springs and regional groundwater systems. Potential impacts to groundwater dependent ecosystems (and their cultural values to landholders and traditional owners) need to be addressed.	<p>EIS Chapter 14, Section 14.3.3, Figure 14.6 and Table 14.6 Chapter 23</p> <p>SREIS Chapter 8</p>	<p>The location of known springs (both recharge and discharge springs) within the Great Artesian Basin were presented in EIS Chapter 14, Groundwater, Figure 14.6. As per Section 14.3.3 recharge springs develop where the rate of water infiltration to groundwater (from direct rainfall and surface runoff) exceeds the throughflow in the shallow or perched groundwater system. These features may be ephemeral and supported by a local perched groundwater system, not necessarily connected to the underlying watertable. Where this occurs the springs are not considered to be susceptible to groundwater drawdown in GAB aquifers.</p> <p>The cultural and spiritual values associated with groundwater systems within the project development area are identified in EIS Chapter 14, Groundwater, Table 14.6. Areas of known cultural significance to Indigenous peoples are also discussed in EIS Chapter 23, Indigenous Cultural Heritage.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11064	S143			<p>Since the release of the EIS, numerous spring surveys and studies have been completed as detailed in SREIS Chapter 8, Groundwater, to inform the Surat Cumulative Management Area (CMA) Underground Water Impact Report (UWIR). During these investigations, additional springs were identified within the Surat CMA compared with those presented in the EIS, e.g., spring complex 584, located to the west of the project development area. Surveys and studies have improved understanding of the source aquifers supplying groundwater to discharge springs and other types of groundwater dependent ecosystems, including groundwater-fed watercourses and groundwater dependent vegetation.</p> <p>This additional information has enabled the identification (in the UWIR) of the springs potentially affected by coal seam activities in the Surat CMA. The UWIR also includes assignment of responsibility to tenure holders to collect additional information required under the Spring Impact Management Strategy, including ongoing monitoring, to enable selection of appropriate mitigation measures if required.</p> <p>Under the Water Act, a potentially affected spring means a spring overlying an aquifer (affected by the exercise of underground water rights) where the water level in the aquifer is predicted in a UWIR to decline by more than the spring trigger threshold at the location of the spring at any time. The spring trigger threshold is 0.2 m.</p> <p>The predicted drawdowns used to identify these springs are based on the maximum level of drawdown predicted by the OGIA Surat CMA groundwater model and therefore accounts for uncertainty.</p> <p>In addition, further areas of research are also identified by the Queensland Government Office of Groundwater Impact Assessment (OGIA) and the coal seam gas industry in relation to springs and other types of groundwater dependent ecosystems. Arrow is involved in these collaborative studies.</p> <p>Through the implementation of the Spring Impact Management Strategy, spiritual and cultural values associated with groundwater dependent ecosystems within the Surat CMA will be protected.</p>
R11065	S106	<p>It is imperative to ensure any dewatering of the Walloon Coal Measures or equivalent formations is only undertaken where there is proven to be very limited impact on any confined overlying or underlying sandstone strata, with areas abandoned should good quality water be dewatered from the Walloon Coal Measure signifying an area of strong connection with the higher quality overlying and underlying sandstone aquifers.</p>	<p>SREIS Chapter 8</p>	<p>Predictive groundwater modelling was conducted as part of the groundwater assessment for the EIS. The model predicted the levels of groundwater drawdown in the aquifers above and below the Walloon Coal Measures. These predictions incorporated the level of inter-connection between different aquifers represented in the model. The input parameters used to represent the interconnectivity in the model were set conservatively to address uncertainty of the actual connectivity. Arrow is presently undertaking studies into connectivity between the Condamine Alluvium and Walloon Coal Measures. These studies will include analysis of groundwater geochemistry to identify any evidence of mixing of different quality groundwater. Monitoring of groundwater levels in aquifers above and below the Walloon Coal Measures in the vicinity of production tests (i.e., appraisal pilot wells) is also used to quantify the degree of connectivity between the Walloon Coal Measures and</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11065	S106			<p>other formations.</p> <p>Since the release of the EIS, additional independent numerical modelling has been undertaken by the Queensland Water Commission (QWC) (now the Office for Groundwater Impact Assessment). This additional modelling, discussed in SREIS Chapter 8, Groundwater, is based on a more detailed understanding of geological data collected by other coal seam gas proponents (from outside the Surat Gas Project development area where they conduct their operations) and more up to date water production forecasts (supplied by the other coal seam gas proponents to the QWC). These models form the basis for the numerical model prepared by the Queensland Government Office of Groundwater Impact Assessment (OGIA) and used to inform the Underground Water impact Report (UWIR). Arrow and other coal seam gas proponents are already regulated by the requirements in the UWIR, which was approved by EHP in December 2012.</p> <p>A comparison between the model prepared for the EIS and the OGIA show that the drawdowns predicted by the EIS model were conservative.</p> <p>The UWIR identifies areas of aquifers where drawdown in excess of the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within the next three years (this area is identified as the Immediately Affected Area (IAA)) may occur as a result of coal seam gas extraction. The report also identifies the tenure holder responsible for establishing make good agreements with bore owners within these areas. It is important to note that the IAA defined for the Walloon Coal Measures in the UWIR contains 85 registered bores. The IAAs defined for overlying and underlying aquifers were minimal in extent, do not contain water bores that access water from those aquifers, and are therefore not expected to be affected by groundwater drawdown.</p> <p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g. the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p>
R11066	S106	Concerns the works for Goondiwindi development region should not proceed as large lenses occur in the overlying Westbourne Formation, the overlying and underlying aquitards are broken or thin thereby providing connection between the Walloon Coal Measures and sandstone aquifers.	SREIS Chapter 3, Figure 3.1	<p>The EIS model accounted for areas of connection between the Walloon Coal Measures and overlying and underlying aquifers.</p> <p>Since the release of the EIS, ongoing exploration and improved understanding of coal seam gas reserves has resulted in tenements within Arrow's project development area being relinquished, primarily in the former Goondiwindi development region and in the area of the Jimbour plain, as</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11066	S106			shown in SREIS Chapter 3, Project Description, Figure 3.1.
R11067	S075, S077, S089	The traumatic effects of short term (35 years) coal seam gas extraction has long term (10 plus years) implications for composition and movement of the above and below groundwater reserves and the EIS does not acknowledge this.	EIS Chapter 14, sections 14.4.1 and 14.4.2	EIS Chapter 14, Groundwater, Sections 14.4.1 and 14.4.2, acknowledge that the recovery of groundwater systems can take decades after the impacting activity occurs. Model predictions presented in the EIS extend to 2071, reflecting the timeframes required to allow assessment of impacts to groundwater systems.
R11068	S015	The EIS states two of these groundwater systems show only moderate recovery rates following extraction while one shows slow recovery rates. Surely this could directly impact on water resources within the coal measures and thus have indirect impacts on other water resources.	EIS Chapter 14	<p>Numerical groundwater modelling undertaken for the EIS predicted the groundwater level response in aquifers as a result of coal seam gas extraction (EIS Chapter 14, Groundwater). Predictions included the amount of groundwater drawdown over time, and the results reflect the understanding that the groundwater systems within the Surat Basin form part of a hydrogeological feature that responds to, and recovers from disturbance over long periods of time (years to decades). Aquifers can recover after disturbance through natural recharge processes.</p> <p>Since the release of the EIS, the Office of Groundwater Impact Assessment (OGIA) has developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The final Underground Water Impact report (UWIR) has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP). The UWIR identifies areas of aquifers where drawdown in excess of the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within the next three years (this area is identified as the Immediately Affected Area (IAA)) may occur as a result of coal seam gas extraction. The report also identifies the tenure holder responsible for establishing make good arrangements with bore owners within these areas. It is important to note that the IAA defined for the Walloon Coal measures contains 85 registered bores. The IAAs defined for overlying and underlying aquifers were minimal in extent. These defined IAAs do not contain water bores that access water from those aquifers and are therefore not expected to be affected by groundwater drawdown.</p> <p>Under the Water Act, and where identified as the responsible tenure holder by the OGIA, Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. The make good measures to be implemented will be negotiated between Arrow and the bore owner on a case-by-case basis and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore).

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Issue No.	Submission No.	Issue	Reference	Responses
R11069	S075, S077, S095	Concern that the interconnection between aquifers will result in dewatering of the overlying aquifers. Recharge is known to be very slow in the Walloon Coal Measures. There is clearly connection to our Condamine Alluvium and all hydrologists agree (even Arrow's) that the coal bed once dewatered will not stay empty. Given time - possibly as little as 30 to 50 years the coal will refill - seriously depleting both the Condamine Alluvium and the Great Artesian Basin. Recharge into the overlying aquifers is also likely to be extremely slow, taking far longer than the life of the project.	SREIS Chapter 8	There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The EIS presents predicted drawdown in the Condamine Alluvium as a result of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicated that under the cumulative modelling scenario, maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) show maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m across the remaining extent of the Condamine Alluvium. These predicted drawdown levels are manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures. The predicted drawdowns in the Condamine Alluvium based on the SREIS groundwater model are presented in SREIS Chapter 8, Groundwater. Additional investigations are underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS, Chapter 8, Groundwater.
R11070	S106	Concerns that the project will impact the natural groundwater recharge and flow (due to recharge of water to the Walloon Coal Measures from other aquifers). Specifically: <ul style="list-style-type: none"> • The south-westerly flow of water in the Surat East zone (shown in Appendix G, Figure 4.1 Great Artesian Basin Hydrology) just west of the proposed development area would end. • The flow from the eastern recharge zone. The impact to the flow would cancel any recharge benefits for at least the next 95 years. • Loss of water from the sandstone aquifers like the Gubberamunda s/s and Hutton s/s. • South west of Cecil Plains the Gubberamunda s/s is in contact with the Springbok Formation or in direct contact with the Walloon Coal Measure. Any dewatering of the Walloon Coal Measure in this area would unacceptably halve the recharge in this section of the recharge zone of the important Great Artesian Basin Gubberamunda aquifer. 	EIS Appendix G, figures 3.2 and 4.1	There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process. In response to the specific issues raised: <ul style="list-style-type: none"> • The groundwater flow directions presented in EIS Appendix G, Groundwater Impact Assessment, Figure 4.1, are regional flow directions across the entire Great Artesian Basin. While coal seam gas production associated with the project will result in changes to groundwater flow patterns on a more local scale, the overall process of groundwater recharge in the eastern portion of the Great Artesian Basin and regional flow towards the southwestern discharge zone will remain. • As pressure recovery occurs post-production, groundwater flow direction will

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Issue No.	Submission No.	Issue	Reference	Responses
R11070	S106	The impacts to groundwater will put existing agricultural operations across the Darling Downs and Maranoa districts (that forever rely on the contributions from recharge beds in the higher country towards the Great Dividing Range) at risk. There will be impacts to those relying on supplies from Gubberamunda s/s and Hutton s/s aquifers for decades in this century and the next, not only those few in the proposed development area but also to the many relying on the continuous horizontal westerly movement of water in these s/s aquifers beyond Surat towards St George.		return to pre-development conditions. During this time, recharge to the Surat Basin will continue, and the increased hydraulic gradients are likely to increase overall net recharge to the Great Artesian Basin. • It is noted that recharge to aquifers in the Surat Basin occurs mainly in areas where formations outcrop. EIS Appendix G, Groundwater Impact Assessment, Figure 3.2, shows that the Kumberilla Beds (of which the Gubberamunda Sandstone is a unit) outcrops extensively in the vicinity of Cecil Plains where recharge can occur. Reduced pressure in the Walloon Coal Measures does not impact this, although it is recognised that inter-aquifer fluxes will occur. In some cases reduced aquifer pressure leads to increasing recharge rates, due to the increased hydraulic gradient between aquifers and recharge sources. While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These underground water obligations include a responsibility to undertake baseline assessments (to identify the presence of existing groundwater bores), prepare (and comply with) underground water impact reports (including predictions of areas in each aquifer when drawdown impacts are likely to occur), undertake groundwater modelling (to verify groundwater modelling), and make good any impairment of private bore groundwater supplies. It should be noted that the UWIR for the Surat CMA is prepared by the OGIA.
R11071	S139, S148, S154, S157	The interactions between geological formations (boundary conditions) and recharge/discharge mechanisms are not considered to be representative of actual conditions. The classification of all surface drainage lines as 'drain cells' is considered to be a major failing of the model, in that streams do not act as drains, and that the model is based on a loss of 149.5 ML/d to the streams, which does not occur in the actual system.	–	The use of drain boundary conditions in the EIS groundwater model is consistent with the nature and the objectives of the model. The loss from the system occurs because the water levels, especially in the Condamine Alluvium, are higher than observed (because no groundwater extraction is simulated by the model in this unit), and rather than water flowing from the watercourse to the groundwater (a losing watercourse), the relationship has been reversed to a gaining system for the purposes of modelling. This does not affect the ability of the model to predict how impacts migrate from the Walloon Coal Measures to the Condamine Alluvium.
R11072	S150	The description of the water resources in the project development area fails to recognise the complexity and interconnectedness of those water resources and their catchments.	EIS Chapter 14, Section 14.3.5 SREIS Chapter 8	EIS Chapter 14, Groundwater, Section 14.3.5 describes each groundwater system present within the project development area and explains the level of connection with other aquifers and surface water features. SREIS Chapter 8, Groundwater, presents additional detail on surface water and groundwater connectivity.
R11073	S157	EIS Chapter 14 omits reference to the Commonwealth Water Act.	SREIS Chapter 8	Noted. This omission is rectified in SREIS Chapter 8.

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Issue No.	Submission No.	Issue	Reference	Responses
R11074	S157	<p>Section 255AA of the Water Act 2000 states 'mitigation of unintended diversions – Prior to licences being granted for subsidence mining operations on floodplains that have underlying groundwater systems forming part of the Murray-Darling system inflows, an independent expert study must be undertaken to determine the impacts of the proposed mining operations on the connectivity of groundwater systems, surface water and groundwater flows and water quality.' The Moran Report (2008) was written to satisfy the terms of s255AA. In the event that it did not satisfy this requirement, then no licenses should be issued because the precondition to the issue of the licences required that a study considering the impacts of the intended activity on the Murray Darling Basin be completed. This has not been satisfied.</p> <p>It is the submitter's interpretation that the requirements of S255AA in the Water Act 2000 could not be met by a single study, as it is required to assess cumulative impacts over time. Given that the Arrow operations were not contained in the Moran report, it is deemed an illegitimate study for the purposes of satisfying section 255AA.</p>	<p>SREIS Chapter 8</p>	<p>The Moran report (2008) documents the findings of a study with the objective of collating and documenting existing Queensland State Government information and subsequently proposing the basis for more detailed assessment of the potential impacts of coal seam gas extraction on groundwater systems. The preparation of the EIS and the associated numerical modelling post-date this publication and are based on more recent coal seam gas and groundwater extraction rates.</p> <p>The Moran Report has an implicit purpose for informing policy development. The objectives of the Moran Report were to:</p> <ol style="list-style-type: none"> 1. Provide background information on potential groundwater impacts resulting from the expansion of the CSG industry; 2. Provide a broad assessment of the water supply options resulting from the expansion of the CSG industry; and 3. Propose an approach for on-going monitoring of groundwater impacts during development of the CSG industry. <p>All of these objectives have been considered in the EIS.</p> <p>The Moran report was prepared in 2008, without a calibrated numerical groundwater model, and used many assumptions that are no longer relevant to the current situation.</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP).</p> <p>The UWIR model is a dynamic model that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). For the purposes of the SREIS, the OGIA model has been updated with Arrow's current production data. The results of the update are presented in SREIS Chapter 8, Groundwater. Revised recovery rates are discussed in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow will continue to work with the OGIA to manage cumulative impacts within the Surat CMA.</p>
R11075	S027, S051	<p>Concern that impacts will not be observed for many years due to the time lag between extraction and drawdown.</p>	<p>EIS Chapter 14 SREIS Chapter 8</p>	<p>Numerical groundwater modelling undertaken for the EIS predicted the groundwater level response in aquifers as a result of coal seam gas extraction (EIS Chapter 14, Groundwater). Predictions included the amount of groundwater drawdown over time, and the results reflect the understanding that the groundwater systems within the Surat Basin form part of a</p>

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R11075	S027, S051			<p>hydrogeological feature that responds to, and recovers from disturbance over long periods of time (years to decades). Aquifers can recover after disturbance through natural recharge processes.</p> <p>Arrow is seeking to proactively mitigate the potential impacts to the Condamine Alluvium through substitution or 'virtual injection' and for deeper aquifers will negotiate 'make good' measures with bore owners who may experience impaired capacity (SREIS Chapter 8, Groundwater).</p> <p>The predicted response of groundwater systems to coal seam gas extraction will be regularly compared with observed responses over time, as required by the Underground Water Impact Report (UWIR) administered by the Office of Groundwater Impact Assessment (OGIA) and enforced by EHP. The model identifies third party groundwater users potentially impacted within the next three years, and the UWIR identifies the tenure holder responsible for entering into a make good agreement with each bore owner. The UWIR also identifies groundwater dependent springs with the potential to be impacted, and the associated responsible tenure holder obligated to manage or monitor that spring as part of the Spring Impact Management Strategy. These management controls will be in place for as long as the impacts exceed the trigger threshold defined under the Water Act 2000, and therefore acknowledge the extended timeframes over which groundwater systems respond to disturbance.</p>
R11076	S010, S014, S044, S104, S139, S141, S144, S154	<p>Arrow is excluded from the Great Artesian Basin Plan, which puts the coal seam gas industry at odds with existing groundwater users.</p> <p>The assessment and approvals process for coal seam gas companies extracting water is not consistent with that of landholders and irrigators in relation to water rights. Specific questions raised (and causing concern and frustration) include: Why do irrigators have strict conditions on water usage from the Great Artesian Basin, while coal seam gas companies do not? The process of drawdown for coal seam gas is no different to drawdown for irrigation purposes, what is different however is the fact that landholders' water entitlements, as per the Water Act, are in the interests of sustainable management and the Petroleum and Gas Act (P&G Act) extraction rights are not.</p> <p>The P&G Act gives unlimited rights to take or interfere with groundwater which puts the coal seam gas industry at odds with existing groundwater users. Is this an acceptable in a region where there is such a heavy reliance on</p>	-	<p>While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These underground water obligations include a responsibility to undertake baseline assessments (to identify the presence of existing groundwater bores), prepare (and comply with) underground water impact reports (including predictions of areas in each aquifer when drawdown impacts are likely to occur), undertake groundwater modelling (to verify groundwater modelling), and make good any impairment of private bore groundwater supplies. It should be noted that the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) is prepared by the Office of Groundwater Impact Assessment (OGIA) and was released after submission of the EIS.</p> <p>The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction associated with production of coal seam gas within the Surat CMA. Arrow's coal seam gas water extraction from the Walloon Coal Measures (which forms part of the Great Artesian Basin) is regulated under the P&G Act and the Water Act.</p> <p>Arrow's compliance with its underground water obligations are defined in the Water Act and regulated by EHP.</p> <p>While the Condamine Alluvium is not defined as part of the Great Artesian Basin, as per the Water Resources (Great Artesian Basin) Plan 2006,</p>

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R11076	S010, S014, S044, S104, S139, S141, S144, S154	groundwater, where existing users have either forgone increases or given up existing allocations in the interests of sustainability? It is totally unacceptable to continue with the current practice of the regulator refusing to condition groundwater impacts by hiding behind the P&G Act while the Environmental Protection Act gives the power to place conditions in environmental authorities regarding the environmental values of water.		protection of water resources associated with the Condamine Alluvium are still captured under the requirements of the Water Act, and the UWIR for the Surat CMA. Arrow will be subject to compliance conditions applied through a new environmental authority or an amendment to their existing environmental authority issued under the Environmental Protection Act 1994. Arrow anticipates that under the environmental authority it will be required to protect or enhance groundwater values and that this will be regulated and enforced by EHP.
R11077	S106	The water resource is not well protected through policy controls and won't be until there is strong meshing between the Petroleum and Gas Act (P&G Act) and the Water Act and the regulations introduced to limit extraction, or trigger make good actions, when undesirable drawdown in overlying and underlying aquifers is greater than 0.5 m extending more than 2 km from production well sites and is foreseen at least three years.	–	While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These underground water obligations requirements include a responsibility to undertake baseline assessments (to identify the presence of existing groundwater bores), prepare (and comply with) underground water impact reports (including predictions of areas in each aquifer when drawdown impacts are likely to occur), undertake groundwater modelling (to verify groundwater modelling), and make good any impairment of private bore groundwater supplies. It should be noted that the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) is prepared by the Office of Groundwater Impact Assessment (OGIA) and was released after submission of the EIS. The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The Long-term Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold at any time in the future. Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The final UWIR has been approved by the

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Issue No.	Submission No.	Issue	Reference	Responses
R11077	S106			chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.
R11078	S157	DERM (now EHP) have largely failed to impose conditions that address groundwater impacts. They leave this to the make good provisions under the Water Act, and apparently does so on the grounds that the Petroleum & Gas Act (P&G Act) permits a tenure holder to take and to interfere with groundwater. However, the P&G Act is not explicitly excluded from the Environmental Protection Act (Section 23(2)), and therefore DERM's position is unsustainable. The proper interaction between these two acts is such that the P&G Act is subject to the requirements of the Environmental Protection Act. Whereas Section 185 of the P&G Act permits the taking and use of groundwater, this is not unconstrained by the requirements of the Environmental Protection Act to properly consider the environmental values. DERM is charged with evaluating the environmental impacts of taking the groundwater, interactions associated with that groundwater and the potential for contamination. There are also aspects of the make good measures (designed to address groundwater impacts) that do not address some water impacts, specifically those that occur independently of the trigger thresholds. That area is also clearly within the jurisdiction of DERM. These broad obligations are not adequacy described/addressed in the EIS. The inference in Section 2.3 of the EIS that the P&G Act is in some way irrelevant to the jurisdiction of DERM and/or that the take of groundwater is governed solely by underground water obligations under the P&G Act and Water Act is rejected.	-	Arrow will be subject to compliance conditions applied through a new environmental authority or an amendment to their existing environmental authority issued under the Environmental Protection Act 1994. Arrow anticipates that under the environmental authority it will be required to protect or enhance groundwater values and that this will be regulated and enforced by EHP.
R11079	S001, S015, S079, S146	The potential impacts from interconnectivity are: groundwater contamination (decreased quality of fresh water), drawdown/dewatering (loss of quantity), depressuring, gas migration and fugitive methane emissions. The area is heavily reliant on groundwater.	EIS Chapter 14, Section 14.4.4 SREIS Chapter 8 and Appendix 4	Coal seam gas and water extraction from the Walloon Coal Measures has a direct impact on groundwater values associated with that geological unit. The potential for subsequent indirect impacts on aquifers above and below the coal measures are identified in EIS Chapter 14, Groundwater, Section 14.4.4. There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA).

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Issue No.	Submission No.	Issue	Reference	Responses
R11079	S001, S015, S079, S146	The EIS states there is possible groundwater flows to and from other systems. Surely that means that contamination of one system could possibly contaminate other systems and this could be detrimental to our great groundwater systems.		<p>When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p> <p>There is anecdotal evidence that migration of gas to the surface can be a naturally occurring process that has occurred within the Surat Basin prior to the commencement of coal seam gas production activities. It is identified however, that coal seam gas extraction activities can cause pressure reductions allowing gas desorption and migration to the surface. Gas flow is proportional to the cone of depression created around a production well, the gas content of the coal within the cone of depression and the coal permeability. Proximity of groundwater bores completed in the coal seams to production wells will determine the extent to which the bore might be exposed to the cone of depression and therefore exposed to the potential for fugitive gas flows. The cone of depression around a production well will promote gas flow to the production well drawing it away from the peripheries of the cone of depression.</p> <p>Wells that draw water from the Walloon Coal Measures are predominantly exposed to this risk, as this is the aquifer from which Arrow will produce coal seam gas water. These wells are also more likely to experience drawdown as a result of coal seam gas extraction, and therefore gas migration issues will be detected and managed through the make good process.</p> <p>Potential impacts on other aquifers would be indirect; arising through connectivity between groundwater aquifers and the propagation of pressure reductions away from the Walloon Coal Measures to overlying and underlying units. This risk is partly managed through bore integrity requirements which are designed to limit the potential for gas migration. It is also managed through operation of the production wells which aims to achieve only a sufficient reduction in reservoir pressure to promote gas flow.</p> <p>Notwithstanding this, a number of gas migration investigations are currently proposed by Arrow and other parties. Work underway by Arrow will better quantify the nature of the interface between the Condamine Alluvium and Walloon Coal Measures, and whether legacy coal and mineral exploration bores are conduits for fugitive gas emissions.</p>
R11080	S075, S077, S089	There are a number of unregistered bores which may be affected. Those property holders would not be entitled to the make good provisions contained in the Water Act.	-	<p>The Queensland Government Underground Water Impact Report (UWIR) indicates the following with respect to unregistered bores: 'A bore does not need to be recorded on the DNRM's Groundwater Database in order for the make good obligations under the Water Act 2000 to apply.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11080	S075, S077, S089			<p>There are some stock watering bores that are not registered on the Groundwater Database for a number of reasons. The owners of such bores should contact their regional DNRM office if they believe the bore is not recorded on the Groundwater Database. This will ensure that the extent of impacts on water supplies is properly represented in future revisions of the UWIR. Registration will also ensure that if a bore is affected at a future date, that there is timely engagement with the relevant tenure holder about make good actions.'</p>
R11081	S108	<p>How will mitigation measures operate, particularly if the drawdown in aquifers continues after the trigger threshold is reached, given that recharge of the aquifers is quite a slow process, sometimes taking years for aquifers to reach a new equilibrium?</p>	<p>EIS Chapter 14</p>	<p>Numerical groundwater modelling undertaken for the EIS predicted the groundwater level response in aquifers as a result of coal seam gas extraction (EIS Chapter 14, Groundwater). Predictions included the amount of groundwater drawdown over time, and the results reflect the understanding that the groundwater systems within the Surat Basin form part of a hydrogeological feature that responds to, and recovers from disturbance over long periods of time (years to decades). Aquifers can recover after disturbance through their recharge processes.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>Direct groundwater drawdown in the Walloon Coal Measures and subsequent indirect drawdown in the overlying and underling aquifers will be managed through make good obligations where required. Make good obligations include undertaking a detailed assessment of each potentially affected bore to determine whether the bore may experience an impaired capacity. Where required, make good measures will be implemented. These can be fulfilled through a number of means, including:</p> <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore. <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR defines Immediately Affected Areas and Long-term Affected Areas, as well as the responsible tenure holder obligated to manage the potential impacts to third party bore owners and groundwater dependent ecosystems. The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA.</p> <p>Arrow is required to undertake bore assessments in the Immediately Affected</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11081	S108			Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The UWIR and the Water Act 2000 do not specify end time frames for make good responsibilities; these would need to be incorporated into make good agreements. EHP will be responsible for regulating compliance by petroleum tenure holders with their underground water obligations.
R11082	S118	Concerned there is a longer recovery phase beyond 2071 as it is stated within the context of a predictive scenario, that groundwater drawdown over a 30 year project life span and 20 years of recovery after cessation of gas extraction activities.	SREIS Chapter 8	<p>The numerical model prepared for the EIS predicted groundwater drawdown in aquifers within the model extent until 2071. This time frame represented 20 years post-production and was within the predictive uncertainty limits of the model.</p> <p>Since the release of the EIS, the Queensland Government Office of Groundwater Impact Assessment (OGIA) prepared a groundwater model as part of the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA). This model included coal seam gas water production and geological data that was not available to Arrow at the time of the EIS. The model predictions included an extended recovery period of 3000 years. This UWIR was approved by EHP to take effect on 1 December 2012.</p> <p>For the purposes of the SREIS, this OGIA Surat CMA groundwater model has been updated with Arrow's current development plan. The results of the update are presented in SREIS Chapter 8, Groundwater. Revised recovery rates over the extended time period are discussed in SREIS Chapter 8, Groundwater.</p> <p>Under the Water Act, and where identified as the responsible tenure holder by the OGIA, Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. It is acknowledged that impacts are likely to persist over time, as predicted by groundwater models. The make good measures to be put in place accounts for this, in that the obligation persists, and therefore the make good measures should continue to be effective over the longer term.</p>
R11083	S010, S022, S023, S035, S048, S078, S146, S157	Arrow has not provided confidence to the community that aquifer contamination will not occur. Similarly, if aquifer contamination does occur, the mitigation measures that will be applied are not clear or guaranteed. Specific concerns include: <ul style="list-style-type: none"> • What guarantees can be given that the towns of Millmerran and Cecil Plains water supplies will not be contaminated? 	EIS Chapter 14 SREIS Chapter 8	These risks were considered in the preparation of the EIS and SREIS; see EIS Chapter 14, Groundwater and SREIS Chapter 8, Groundwater. It is acknowledged that wells drilled through various formations could facilitate migration of water between aquifers if improperly constructed. Well integrity is of great importance to Arrow, not only for the purposes of protection of the environmental values of the groundwater resources but also to ensure the effective recovery of the gas resource. Arrow has committed to implement a well integrity management system during commissioning and operation of production wells (Commitment C143). Further, Arrow has committed to

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Issue No.	Submission No.	Issue	Reference	Responses
R11083	S010, S022, S023, S035, S048, S078, S146, S157	<ul style="list-style-type: none"> • Is there a guarantee that groundwater will not be contaminated with chemicals that are used by coal seam gas activities? • Contamination of aquifers is an unsolvable problem. • Arrow should provide detail of how it has considered the impacts on groundwater quality from its proposed dewatering activities. • If an aquifer is contaminated through coal seam gas activities, is it too late to remediate it? Are there technologies available to repair aquifer contamination? • Water contamination in relation to organic farming practices has not been adequately addressed. • Impacts on groundwater (specifically the Artesian Basin) from pollution or any other malfunction relating to coal seam gas extraction. 		<p>construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150). This code of practice was finalised at approximately the same time as the EIS was finalised for publication, and was therefore not discussed in the EIS.</p> <p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p> <p>The degree of interconnectivity between aquifers can also be influenced by historical groundwater extraction activities, as detailed in SREIS Chapter 8, Groundwater.</p> <p>Interconnectivity parameters have been built into the Queensland Government Office of Groundwater Impact Assessment (OGIA) model. For the purposes of the SREIS, the OGIA model has been updated with Arrow's current production data. The results of the update are presented in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow will continue to work with the OGIA to manage cumulative impacts within the Surat Cumulative Management Area (CMA).</p> <p>While Arrow is authorised under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and Petroleum Act 1923 to take or interfere with groundwater in the process of exploration for, and production of coal seam gas, the Water Act 2000 requires Arrow to manage any impacts caused as a result of these activities on groundwater values. These underground water obligations include a responsibility to make good any impairment of private bore groundwater supplies. Make good requirements are applicable to quality as well as quantity impairment.</p>
R11084	S031, S051	Believe that mitigation measures are inadequate. Arrow has not provided appropriate mitigation strategies to address drawdown of the magnitude estimated in the EIS. Not satisfied with the management strategy that commits to mitigate the impacts of groundwater depressurisation where	EIS Chapter 14 SREIS Chapter 8	EIS Chapter 14, Groundwater, identified application of the substitution strategy as a measure for offsetting groundwater drawdown, with other impacts to be managed through fulfilment of make good obligations. The EIS also detailed Arrow's mitigation measures associated with potential impacts on shallow groundwater resources from dams, including appropriate dam construction, design and monitoring requirements (described in

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Issue No.	Submission No.	Issue	Reference	Responses
R11084	S031, S051	possible'.		<p>Commitment C141) and the installation of groundwater monitoring bores as a leak detection measure (described in Commitment C504). Since the release of the EIS Arrow has revised its Coal Seam Gas Water and Salt Management Strategy (presented in SREIS Attachment 5). This document identifies options for the management of coal seam gas water, including 'virtual injection' into the Condamine Alluvium. The ability of this process to offset potential flux from the Condamine Alluvium to underlying aquifers as a result of depressurisation of the Walloon Coal Measures was simulated by the groundwater model prepared for the SREIS. The results of this modelling scenario are presented in SREIS Chapter 8, Groundwater, and show that it is effective in offsetting Arrow's proportion of the flux from the Condamine Alluvium.</p> <p>Direct groundwater drawdown in the Walloon Coal Measures and subsequent indirect drawdown in the overlying and underlying aquifers will be managed through make good obligations where required. Make good obligations can be fulfilled through means other than supply of coal seam gas water, for example:</p> <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore.
R11085	S117	<p>While the government has taken steps to introduce groundwater monitoring trigger threshold for make good obligations and a requirement for make good agreements between bore owners and petroleum tenure holders, many landholders and scientists fear that irreversible damage may occur that no amount of 'adaptive management' can rectify. There is no confidence on the effect Arrow will have on water contamination and water levels. There is a lack of real data used and it is therefore unacceptable to use as the basis of the EIS.</p>	SREIS Chapter 8	<p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP).</p> <p>The UWIR model is a dynamic model, built on real geological and hydrogeological data (including details from approximately 22,000 bores such as existing water extraction, existing water levels, and known stratigraphic units) that may be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing). Hydraulic parameters used in the model were also obtained from the Queensland petroleum and Gas Exploration Database, including more than 13,000 data points collected during drill stem tests. More than 1,000 pump test records were obtained from the Department of Natural Resources and Mines groundwater database. For</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11085	S117			<p>the purposes of the SREIS, the OGIA model has been updated with Arrow's current production data. The results of the update are presented in SREIS Chapter 8, Groundwater. The model has been endorsed by EHP and Arrow will continue to work with the OGIA to manage cumulative impacts within the Surat CMA.</p> <p>Responsible tenure holders are required to provide OGIA with monitoring data and updates to production plans on an annual basis. If this information indicates previous modelling predictions are likely to have materially changed, OGIA will re-run the groundwater flow model developed as part of the UWIR. Through this process, predictions about future groundwater levels and the defined Immediately Affected Areas (IAAs) and Long-term Affected Areas (LAAs) will be updated.</p> <p>The UWIR will be revised by OGIA every three years. The OGIA will maintain a database to store data collected under monitoring plans carried out in accordance with monitoring programs in approved UWIRs.</p>
R11087	S106, S150	<p>Arrow must demonstrate how it will prevent adverse impacts caused by direct disturbance to, or extraction from, groundwater flow systems by not causing interconnectivity between groundwater flow systems.</p> <p>Pressure should be maintained to minimize the risks of contamination associated with depressurisation.</p>	-	<p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas production wells are drilled, direct disturbance to aquifers will occur as part of the drilling process, whereby vertical or deviated wells will be drilled through geological formations to access the Walloon Coal Measures.</p> <p>Well integrity is of great importance to Arrow, not only for the purposes of protection of the environmental values of the groundwater resources but also to ensure the effective recovery of the gas resource. For these reasons Arrow has committed to implement a well integrity management system during commissioning and operation of production wells (Commitment C143). Such a system will include components addressing well construction, assessment of the effectiveness of well completion, and post construction monitoring and response to identified issues of well integrity.</p> <p>Arrow has committed to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150). This code of practice was finalised at approximately the same time as the EIS was finalised for publication, and was therefore not discussed in the EIS.</p> <p>The code of practice requires that wells are constructed so that aquifers are isolated from one another, and that the well cannot act as a preferential pathway for groundwater movement between aquifers. Mandatory construction requirements, in conjunction with Arrow's well integrity program and regular well workover schedules will minimise the potential for groundwater movement between aquifers via coal seam gas wells.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11087	S106, S150			<p>Arrow has committed to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150). The residual risk assessment relating to groundwater has been developed on the assumption that industry standard well construction and control measures have been implemented.</p>
R11088	S118	<p>Request precise impacts defined for specific properties before proposed drilling begins within the study area, inclusive of bore assessments on an individual basis to establish base lines for bores on specific properties – a requirement for the Make-Good Obligations.</p>	–	<p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The UWIR defines Immediately Affected Areas (IAA) and Long-term Affected Areas (LAA) based on the predicted groundwater drawdown in aquifers identified in the regional model. An IAA for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The LAA for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold at any time in the future. Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.</p> <p>Based on the UWIR, the bores within the IAA and a prediction of the impacts in these bores have been identified. Responsible tenure holders are preparing make good agreements to address the potential impacts on those bores as a result of coal seam gas production.</p> <p>Arrow must also prepare a baseline assessment plan for each tenure in which it undertakes production or production testing. The plan must include a timetable showing when a baseline assessment of every water bore in that tenure will be undertaken. This includes the mandatory (Water Act)</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11088	S118			<p>requirement to undertake baseline assessments of all water bores within 2 km of the production well (that also access the same aquifer as the production well) before production or production testing starts. Through the completion of baseline assessments a record of bore construction, groundwater level and groundwater quality will be obtained at a point in time, before any impacts from coal seam gas water extraction have occurred. Any future changes to those parameters can then be compared to that point in time. Notwithstanding this, any potentially impacted bore is likely to be identified as being within an IAA in a UWIR well before it experiences an impaired capacity.</p> <p>Under the Water Act, and where identified as the responsible tenure holder by the OGIA, Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities, through the completion of a bore assessment. It is acknowledged that impacts are likely to persist over time, as predicted by groundwater models. The make good measures to be put in place accounts for this, in that the obligation persists, and therefore the make good measures should continue to be effective over the longer term.</p> <p>The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore).
R11089	S079, S146, S161	<p>Concern over long-term impacts to aquifers and how mitigation measures will continue in the long-term when operations cease (or if Arrow is no longer in business). Arrow should provide evidence on how it will mitigate long-term drawdown impacts or contamination to all aquifers in the Surat Gas project area, specifically the Condamine Alluvium which will be too depleted and/or may be contaminated.</p>	<p>EIS Chapter 14 SREIS Chapter 8 Attachment 5</p>	<p>Numerical groundwater modelling undertaken for the EIS predicted the groundwater level response in aquifers as a result of coal seam gas extraction (EIS Chapter 14, Groundwater). Predictions included the amount of groundwater drawdown over time, and the results reflected the understanding that the groundwater systems within the Surat Basin form part of a hydrogeological feature that respond to, and recover from disturbance over long periods of time (years to decades). Aquifers can recover after disturbance through natural recharge processes.</p> <p>EIS Chapter 14, Groundwater, identified application of the substitution strategy as a measure for offsetting groundwater drawdown, with other impacts to be managed through fulfilment of make good obligations.</p> <p>The EIS also detailed Arrow's mitigation measures associated with potential impacts on shallow groundwater resources from dams, including appropriate dam design requirements (described in Commitment C141) and the installation of groundwater monitoring bores as a leak detection measure (described in Commitment C504).</p> <p>Since the release of the EIS, the Underground Water Impact Report (UWIR)</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11089	S079, S146, S161			<p>for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA. The OGIA developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities planned and occurring within the Surat CMA. The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The Long-term Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold at any time in the future. Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The final UWIR has been approved by the chief executive of the Department of Environment and Heritage Protection (EHP), and Arrow is obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations.</p> <p>Bore trigger threshold values are used to determine the point at which detailed investigation of a bore, referred to as a bore assessment, must be undertaken. The threshold values do not represent drawdown values that impact on the sustainable use of an aquifer, and instead provide an early warning system that triggers investigation by responsible tenure holders. Drawdowns of 2 m for unconsolidated aquifers and 5 m for consolidated aquifers may have no effect on the capacity of the bore. A bore assessment evaluates construction and completion of the bore, and its authorised use, to determine the likelihood that the bore will no longer be able to supply an adequate quantity or quality of water due to drawdown as a result of coal seam gas water extraction. The outcomes of the bore assessment are documented in a make good agreement between the tenure holder and bore owner. The make good agreement may also contain make good measures, if required, to maintain (or compensate for) groundwater supply.</p> <p>Under the Water Act, and where identified as the responsible tenure holder by the OGIA, Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. It is acknowledged that impacts are likely to persist over time, as predicted by groundwater models. The make good measures to be put in place accounts for this, in that the obligation persists, and therefore the make good measures</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11089	S079, S146, S161			<p>should continue to be effective over the longer term. Direct groundwater drawdown in the Walloon Coal Measures and subsequent indirect drawdown in the overlying and underlying aquifers will be managed through make good obligations where required. Make good obligations can be fulfilled through means other than supply of coal seam gas water, for example:</p> <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore. <p>Since the release of the EIS Arrow has revised its Coal Seam Gas Water and Salt Management Strategy (presented in SREIS Attachment 5). This document identifies options for the management of coal seam gas water, including 'virtual injection' into the Condamine Alluvium. The ability of this process to offset potential flux from the Condamine Alluvium to underlying aquifers as a result of depressurisation of the Walloon Coal Measures was simulated by the groundwater model prepared for the SREIS. The results of this modelling scenario are presented in SREIS Chapter 8, Groundwater, and show that it is effective in offsetting Arrow's proportion of the flux from the Condamine Alluvium. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p>
R11090	S014, S044, S106, S108	<p>With no ability or guarantee in providing treated coal seam gas water for water allocations after the production of coal seam gas stops until such times as aquifers near fully recover, the concept of suggesting that substitution will be considered by the company means little to the numerous landholders and irrigators who will be impacted both during the 30 year life of the project and for the subsequent 20, 30, 40 years until the adjoining aquifers attempt to recover from maximum drawdowns ranging from 60 m (Kumbarilla Beds) to 75 m (Hutton and Precipice). Stakeholder requests that Arrow state where 'make good' water will be sourced from when project is completed. Given that the project only generates water for an estimated 30 years and the coal seam gas water will be used for make-good measures,</p>	<p>SREIS Chapter 8 Attachment 5</p>	<p>Since the release of the EIS Arrow has revised its Coal Seam Gas Water and Salt Management Strategy (presented in SREIS Attachment 5). This document identifies options for the management of coal seam gas water, including 'virtual injection' into the Condamine Alluvium. The ability of this process to offset potential flux from the Condamine Alluvium to underlying aquifers as a result of depressurisation of the Walloon Coal Measures was simulated by the groundwater model prepared for the SREIS. The results of this modelling scenario are presented in SREIS Chapter 8, Groundwater, and show that it is effective in offsetting Arrow's proportion of the flux from the Condamine Alluvium. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565). Direct groundwater drawdown in the Walloon Coal Measures and subsequent indirect drawdown in the overlying and underlying aquifers will be managed through make good obligations where required. Make good obligations can be</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11090	S014, S044, S106, S108	this is not an ongoing water supply. This does not fulfil the make good requirement as the sourced aquifers would take, many years after production ceases to even then only partially recover (groundwater impacts are likely to extend beyond the life of the project).		<p>fulfilled through means other than supply of coal seam gas water, for example:</p> <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore. <p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission (QWC), now identified as the Office of Groundwater Impact Assessment (OGIA). The UWIR defines Immediately Affected Areas and Long-term Affected Areas based on the predicted groundwater drawdown in aquifers identified in the regional model. An Immediately Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within three years. The Long-term Affected Area for an aquifer is defined as the area within which groundwater drawdown is predicted to exceed the bore trigger threshold at any time in the future. The UWIR forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA.</p> <p>Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The UWIR and the Water Act 2000 do not specify end time frames for make good responsibilities; these would need to be incorporated into make good agreements. EHP will be responsible for regulating compliance by petroleum tenure holders with their underground water obligations.</p>
R11091	S161	It is estimated that for the coal measures and the significantly affected aquifers there will be a 50 per cent recovery from maximum impact, 30 to 80 years after maximum impact. How do you value a water supply for eighty years' time for an environmental bond?	–	<p>Under the Water Act, and where identified as the responsible tenure holder by the Office for Groundwater Impact Assessment (OGIA), Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities.</p> <p>The make good measures to be implemented will be negotiated between Arrow and the bore owner on a case-by-case basis and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer.

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Issue No.	Submission No.	Issue	Reference	Responses
R11091	S161			<ul style="list-style-type: none"> • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore). <p>The UWIR and the Water Act 2000 do not specify end time frames for make good responsibilities; these would need to be incorporated into make good agreements. The Department of Environment and Heritage Protection will be responsible for ensuring petroleum tenure holders comply with their obligations.</p>
R11092	S166	<p>The make good level of a drop of 2 m in the bores is unsuitable as a drop of one meter will have most domestic bores dry and we have nothing for drinking or domestic use.</p>	-	<p>Bore trigger threshold values are used to determine the point at which detailed investigation of a bore, referred to as a bore assessment, must be undertaken. The threshold values do not represent drawdown values that impact on the sustainable use of an aquifer, and instead provide an early warning system that triggers investigation by responsible tenure holders. Drawdowns of 2 m for unconsolidated aquifers and 5 m for consolidated aquifers may have no effect on the capacity of the bore. A bore assessment evaluates construction and completion of the bore, and its authorised use, to determine the likelihood that the bore will no longer be able to supply an adequate quantity or quality of water due to drawdown as a result of coal seam gas water extraction. The outcomes of the bore assessment are documented in a make good agreement between the tenure holder and bore owner. The make good agreement may also contain make good measures, if required, to maintain (or compensate for) groundwater supply. Since finalisation of the EIS, the final Underground Water Impact Report (UWIR) was released and approved by EHP, and Arrow is already obligated to meet the requirements set out in the UWIR. Under the Water Act, and where identified as the responsible tenure holder by the Office for Groundwater Impact Assessment (OGIA), Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore). <p>The Department of Environment and Heritage Protection (EHP) will be responsible for ensuring petroleum tenure holders comply with their obligations, including completion of bore assessment and fulfilment of make good agreements. Even though it is considered unlikely that a 1 m drawdown will result in most domestic bores becoming 'dry', the regulatory framework does allow EHP to consider complaints lodged by third-party bore owners who believe that their bore is, or will be likely to experience an impaired</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11092	S166			capacity (whether they are in an Immediately Affected Area or not). For valid complaints, EHP may direct tenure holders to undertake a bore assessment and enter into a make good agreement with the bore owner.
R11093	S015	The EIS speaks of intention and expectation (with respect to coal seam water beneficial use and injection of treated coal seam water into aquifers to offset the impact of drawdown), but the water may not be of expected quality and more importantly, it could lead to the demise of Australia's great underground water system.	EIS Attachment 9 SREIS Attachment 5	<p>There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p> <p>Since finalisation of the EIS, the final Underground Water Impact Report (UWIR) was released and approved by EHP, and Arrow is already obligated to meet the requirements set out in the UWIR.</p> <p>A revised numerical groundwater model has been prepared for the SREIS that is a repeat of the OGIA Surat CMA groundwater model but incorporating Arrow's latest Surat Gas Project development case. SREIS Appendix 4, Supplementary Groundwater Assessment, presents the revised predicted drawdowns and net flux estimates in response to Arrow's coal seam gas extraction and also in response to cumulative coal seam gas extraction within the Surat CMA.</p> <p>Management options for coal seam gas water were presented in the EIS Attachment 9, Coal Seam Gas Water Management Strategy. This strategy outlined the full range of management options likely to be utilised by Arrow during the project.</p> <p>Arrow's revised Coal Seam Gas Water and Salt Management Strategy is presented in SREIS, Attachment 5, and it aligns with the priorities described by the Queensland Government in the Coal Seam Gas Water Management Policy (2012), which was released following the submission of the EIS.</p> <p>The coal seam gas water and brine/salt management options chosen during the project will be detailed in the Coal Seam Gas Water Management Plan for the Environmental Authority application or amendment application process. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies. The management options for coal seam gas water and/or brine/salt will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves. It should be noted that Arrow will have the capacity to treat and balance water to qualities suitable for the variety of options that may be pursued.</p>
R11094	S031, S079	Submitter indicates that Arrow is unable to mitigate	–	Under the Water Act, and where identified as the responsible tenure holder by

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Issue No.	Submission No.	Issue	Reference	Responses
R11094	S031, S079	<p>any impacts that the project may cause in relation to direct, indirect and cumulative impacts on the water supplies from the Hutton Sandstone. Submission questions relating to the 'make good' agreements including:</p> <ul style="list-style-type: none"> • What will the Government do in situations where the coal seam gas company has caused permanent or irreversible damage to land or water that just cannot be rectified or the 'make good' condition just cannot be achieved? • Who reviews the 'make good' agreements or rectification for each site? • Do coal seam gas companies have to notify the Government of each 'make good' agreement, process or procedure they do? • Who oversees the 'make good' conditions if the result of the make good is not acceptable to the landowner or stakeholder? • Who determines if the 'make good' is acceptable? 		<p>the Office for Groundwater Impact Assessment (OGIA), Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. This includes those drawing water from the Hutton Sandstone, which is identified as part of the deep groundwater system in the EIS and SREIS groundwater models. The make good measures to be implemented will be negotiated between Arrow and the bore owner on a case-by-case basis and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore). <p>The Department of Environment and Heritage Protection will be responsible for ensuring petroleum tenure holders comply with their obligations, including completion of bore assessment and fulfilment of make good agreements. There is a framework in place for administering all aspects of the make good provisions, including dispute resolution and variation of the agreement (by either party). Make good agreements do not cover land issues.</p>
R11095	S106	<p>No allowance has been made within the modelling for what is likely to be the most common method of making good and that is the proponent constructing wells to deeper aquifers for the ongoing provisioning of water after coal seam gas production ceases and providing additional lump sum compensation funds to provide for the ongoing maintenance of the deeper wells and pumps and pumping costs.</p>	-	<p>The make good measures to be implemented will be negotiated between Arrow and the bore owner on a case-by-case basis and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water (substitution). • Monetary compensation (considerate of the use of the bore). <p>The application of the full hierarchy of options will limit any subsequent impacts, and the application of some options (such as substitution) will serve to mitigate impact to the aquifers and allow them to recover faster. Current modelling of groundwater impacts in the Surat Cumulative Management Area by the Office of Groundwater Impact Assessment (OGIA) does not incorporate changes in the system due to the installation of deeper bores as part of make good measures. However, future Underground Water Impact Reports (UWIR) may document the transfer of allocations to other aquifers as part of the update provided in groundwater use within the Surat CMA.</p>
R11096	S108	<p>If there is depressurisation of aquifers that are already over allocated, then the make good arrangements should be explicitly conditioned so that the likelihood of an appropriate make good arrangement can be assessed and shown to be</p>	<p>SREIS Chapter 8</p>	<p>Under the Water Act, and where identified as the responsible tenure holder by the Office for Groundwater Impact Assessment (OGIA), Arrow will be required to implement 'make good' measures where third-party bores are found to be impaired by coal seam gas activities. Under the Water Act 2000 (Qld) and the Underground Water Obligations</p>

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R11096	S108	realistic.		<p>determined by the Office of Groundwater Impact Assessment (OGIA), a tenure holder is required to undertake bore assessments evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. Bore assessments consider aquifer characteristics and their vulnerability to potential drawdown at each bore. Therefore make good measures will be determined on a case-by-case basis and will consider the site specific data collected from that bore assessment.</p> <p>If an impact is identified, the tenure holder must negotiate make good agreements with bore owners. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations. It is assumed that there will be a framework in place for administering all aspects of the make good provisions. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water (substitution). • Monetary compensation (considerate of the use of the bore).
R11097	S108	Trucking water in as a make good measure will not cover the needs to agricultural enterprises that rely on groundwater from these aquifers,	–	<p>Water will not be trucked in as a permanent make good measure for a bore that supplies a large quantity of groundwater. This is not practical or sustainable. Make good measures will however be determined on a case-by-case basis and in some instances alternative water supplies (i.e., substitution) may be the measure selected.</p> <p>Make good measures are:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water (substitution). • Monetary compensation (considerate of the use of the bore). <p>Where substitution of a water supply is adopted as the appropriate make good provision, the mode of substitution will need to be agreed between Arrow and the bore holder. Distribution of water to users for substitution of their existing groundwater allocations will require the development of water supply agreements between Arrow and third party users. Agreements will specify timing, quality and volume of the supply of coal seam gas water. Arrow is required to ensure that coal seam gas water provided under individual agreements meets the requirements specified in each agreement. Quality will be dictated by the end use of the water. It is envisaged that there</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11097	S108			will be a network of water pipelines to supply end users holding supply agreements with Arrow.
R11098	S112, S123, S160	The impacts of the coal seam gas industry on farm and domestic aquifers could take a long time to become evident. If any damage is done, it would be very difficult to repair, and talk of 'making good' seems fanciful. The EIS does not appear to cover any strategies in place to make good for purpose if the water quality is affected by coal seam gas operations, i.e., if groundwater of a poorer quality migrates to an aquifer of better quality. Arrow must comply with make good obligations prior to undertaking large scale coal seam gas extraction in the area.	–	<p>Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission, now identified as the Office of Groundwater Impact Assessment. The UWIR now forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA.</p> <p>The UWIR identifies areas of aquifers where drawdown in excess of the bore trigger threshold (2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer) within the next three years (this area is identified as the Immediately Affected Area (IAA)) may occur as a result of coal seam gas extraction. The report also identifies the tenure holder responsible for establishing make good arrangements agreements with bore owners within these areas.</p> <p>Under the Water Act 2000 (Qld) and the Underground Water Obligations determined by OGIA, Arrow is required to undertake bore assessments in the Immediately Affected Area to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. A range of make good measures are presented in the EIS. Arrow will enter into individual agreements with each potentially affected bore owner, as defined in the UWIR, and the most suitable option will be agreed between the parties, i.e., it may be more suitable in one instance to deepen the bore, whereas in another instance, a more suitable option could be to lower the pumping infrastructure. The make good agreement must then be implemented to ensure management and continuity of groundwater supply prior to impacts occurring. Arrow is legislatively obligated to adhere to these requirements and has commenced this process for bores identified in the current UWIR.</p> <p>There is a framework in place for administering all aspects of make good provisions including dispute resolution and variation to the make good agreement by either party.</p> <p>There are inherent levels of connectivity between formations in the project development area and broader Surat CMA. When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater from the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11099	S095	<p>Arrow has been operating illegally for six years at least (with no aquifer impact study) as the company that Arrow said they had environmental insurance from (needed under the act) said that they had denied Arrow insurance. For many years Arrow has had no insurance, making any 'make-good' not possible, leaving farmers to carry the risk. It is understood that Arrow now has insurance because the 'Water and Other Act' clears them of responsibility if the aquifers are damaged. Farmers sought protection and convinced the previous premier and she said 'the farmers have legitimate concerns.' She then passed the 'Water and Other Act' which protects the mining companies instead. How good is their insurance if they're not liable? Landholders have no protection or compensation likely and are fearful of the future.</p>	-	<p>Arrow's operations to date have been undertaken in accordance with environmental authority / authorities issued by DERM [EHP]. The regulatory provisions affecting Arrow's operations have been dynamic and rapidly developing in response to the increased understanding of the coal seam gas industry for the period of Arrow's current and historical operations. Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released by the Queensland Water Commission, now identified as the Office of Groundwater Impact Assessment. The UWIR now forms part of the regulatory framework for managing the cumulative impacts associated with groundwater extraction within the Surat CMA.</p> <p>The administering authority requires financial assurance to be lodged as a condition of an environmental authority (chapter 5A activities) under the Environmental Protection Act 1994. The environmental authority will be held by one corporate entity that is responsible for compliance with the conditions of that environmental authority (EA).</p> <p>Financial assurance is a security held to meet any costs or expenses (or likely costs or expenses) incurred by the administering authority in taking action to prevent or minimise environmental harm or rehabilitate or restore the environment in relation to the activity (e.g., petroleum activities) for which financial assurance has been given.</p> <p>Arrow must comply with the conditions of the EA for the project. These conditions will enforce protection of environmental values, and incorporate communication procedures and feedback mechanisms for inspection, monitoring and reporting.</p>
R11100	S024, S026, S072, S075, S077, S081, S106, S108, S110, S117, S145, S146	<p>More information and evidence of research, should be provided on substitution of water allocations. Specifically:</p> <ul style="list-style-type: none"> • How does groundwater allocation substitution and surface water allocation substitution mitigate groundwater impacts? • Arrow to provide detailed evidence on how it has determined that a one-for-one mega-litre substitution of groundwater and surface water entitlement for treated coal seam water will mitigate long-term effects. • The degree to which this water applied through irrigation is able to replenish aquifers deep underground is unknown. • It is misleading that Arrow predicts that the actual direct and indirect impacts on groundwater users will be 'low' and that by substituting existing water allocations they will 'facilitate natural recharge of those aquifers and offset depressurisation impacts 	<p>SREIS Chapter 3 Chapter 8 Attachment 5</p>	<p>SREIS Chapter 3, Project Description, Chapter 8, Groundwater and Attachment 5, Coal Seam Gas Water and Salt Management Strategy contain revised information regarding Arrow's coal seam gas water and salt management strategy, including the application of the substitution strategy. Since the release of the EIS, Arrow's coal seam gas water management strategy has been revised, with the option of substitution of surface water allocations no longer proposed.</p> <p>The numerical groundwater model prepared for the SREIS, based on the EHP approved model presented by the Office of Groundwater Impact Assessment, includes a mitigation scenario that predicts the response of the Condamine Alluvium to substitution of existing groundwater allocations from the Condamine Alluvium. Results are presented in SREIS Chapter 8, Groundwater.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>The Queensland Government's Coal Seam Gas Water Management Policy (2012) promotes 'virtual injection'. There is currently no regulatory framework</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11100	S024, S026, S072, S075, S077, S081, S106, S108, S110, S117, S145, S146	<p>in the aquifers.'</p> <ul style="list-style-type: none"> • Substitution will only fractionally, temporarily offset depressurisation because of the strong connections between these dynamic aquifer systems and the Walloon Coal Measures, and any natural recharge to those aquifers would subsequently be extracted from the adjoining Walloon Coal Measures. • How will the substitution of river licences work? How will this substituted water be provided? Will it be directly piped to the receiving licence holder or will it be discharged to a river/creek system? • Concern that Arrow will force the community to accept treated coal seam gas water and limit rights to water in relation to water licences. The Executive Summary says that 'Arrow's preferred management measure will be to substitute existing water allocations such that licence holders must accept treated or untreated coal seam gas water that satisfies their end use in lieu of taking water under their current licences'. • Does Arrow understand the views of the community on accepting substitution? No serious effort by Arrow to ascertain whether any allocation holders would be willing to sign up for the substitution of existing water allocations for coal seam gas water. 		<p>to facilitate substitution and therefore Arrow has developed a commercial framework to support the supply of coal seam gas water to groundwater users who hold existing groundwater allocations from the Condamine Alluvium. Distribution of water to users for substitution of their existing groundwater allocations from the Condamine Alluvium will require the development of water supply agreements between Arrow and third party users. Agreements will specify timing, quality and volume of the supply of coal seam gas water. Arrow will ensure that coal seam gas water provided under individual agreements meets the requirements specified in relevant guidelines, which will be determined by the end use of the water and recognised standards for that use. These agreements are voluntary.</p>
R11101	S146	<p>One of the difficulties for Basin Sustainability Alliance in considering the merits of substituting existing water allocations, is that Arrow Energy provides no evidence that substituting allocations will mitigate long term impacts of coal seam gas development on aquifers in the Surat Basin Project Area. Arrow Energy implies that a one-for-one megalitre licence offset/substitution will mitigate damage, however, dewatering the Walloon Coal Measures will cause a change in pressure differential insuring an ongoing draw of water from non-target aquifers long after dewatering ceases. After which time, treated coal seam gas water will not be available for mitigation as dewatering will not be occurring.</p>	<p>SREIS Chapter 3, Chapter 8 and Attachment 5</p>	<p>SREIS Chapter 3, Project Description, Chapter 8, Groundwater and Attachment 5, Coal Seam Gas Water and Salt Management Strategy outline revised information regarding Arrow's coal seam gas water and salt management strategy.</p> <p>The numerical groundwater model prepared for the SREIS is based on the EHP approved model prepared by the Office of Groundwater Impact Assessment (OGIA). The SREIS model includes a mitigation scenario that predicts the response of the Condamine Alluvium to substitution of groundwater allocations. Results are presented in SREIS Chapter 8, Groundwater.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>Where other drawdown impacts are experienced, and third-party bores experiences an impaired capacity as a result of coal seam gas activities, they will be managed through make good obligations. Make good obligations can</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11101	S146			<p>be fulfilled through a number of means, including:</p> <ul style="list-style-type: none"> • Bore enhancement by deepening the bore or improving its pumping capacity. • Construction of a new bore. • Providing a supply of an equivalent amount of water of suitable quality by piping it from an alternative source. • Monetary or non-monetary compensation payable to the bore owner for impact on the bore. <p>Make good obligations will remain in place for the duration of impaired capacity in the third-party bore.</p>
R11102	S089, S123	<p>Concern that the use of treated coal seam gas water for other uses, (e.g., irrigation, agriculture and aquaculture) is unproven or unknown. Specific concerns include:</p> <ul style="list-style-type: none"> • The effects of treated water on the productivity of the various soil types is unknown. • The effects of treated water on the health of the catchment is unknown. • The degree to which this water applied through irrigation is able to replenish damaged aquifers deep underground is unknown. • The effects of mining on the connectivity of underground aquifers are unknown. • Information on the viability of brackish and saline water produced from coal seam gas for aquaculture is requested. 	SREIS Chapter 8	<p>In response to the specific concerns raised:</p> <ul style="list-style-type: none"> • Responses to issues raised that are associated with the use of treated coal seam gas water within the catchment or for agricultural purposes are addressed in the Coal Seam Gas Water and Salt Management section of SREIS Chapter 19. • The quality of the coal seam gas water provided by Arrow will be in accordance with the water quality requirements of the beneficial end use (e.g., irrigation or stock watering). • The numerical groundwater model prepared for the SREIS includes a mitigation scenario that predicts the response of the Condamine Alluvium to substitution of existing groundwater allocations from the Condamine Alluvium. Results are presented in SREIS Chapter 8, Groundwater. • The potential for coal seam gas activities to impact on aquifer connectivity is managed through Arrow's commitment to construct, decommission or repair all coal seam gas production wells in accordance with the code of practice for constructing and abandoning coal seam gas wells in Queensland (DEEDI, 2011b), or relevant code at the time of construction, which details mandatory requirements for well installations, monitoring, management and eventual decommissioning. Should production wells be converted into monitoring bores, do so in accordance with relevant regulations (Commitment C150). The code of practice requires that wells are constructed so that aquifers are isolated from one another, and that the well cannot act as a preferential pathway for groundwater movement between aquifers. Mandatory construction requirements, in conjunction with Arrow's well integrity program and regular well workover schedules will minimise the potential for groundwater movement between aquifers via coal seam gas wells. • The management options for coal seam gas water and brine/salt will be continually reviewed as field development planning evolves and opportunities for additional beneficial uses present themselves, including aquaculture.
R11103	S079, S089, S134, S145	The reinjection and reallocation of coal seam gas water must be demonstrated to be an adequate	EIS Attachment 5	As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted

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R11103	S079, S089, S134, S145	<p>measure to mitigate impacts to existing bore holders. Arrow must also demonstrate that this is a viable 'make good' measure. It is not known if reinjection will be successful and what the full impacts will be. More detail required regarding the benefits of water injection into aquifers. What are the effects of reinjection of water? It is unknown how this will change the composition of the injected aquifers and what the impact of this is. Make good measure strategies of reinjection and reallocation should not be considered until they have been scientifically researched and tested to verify their viability. If this is not possible, Arrow should not be permitted to take or interfere with groundwater used for irrigation or potable household purposes.</p>	<p>SREIS Chapter 3, Section 3.7.3 Chapter 8 and Attachment 5</p>	<p>environmental authority amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the results from the trial will be used to prepare an application for an environmental authority (EA) or EA amendment.</p> <p>SREIS Chapter 3, Project Description, Chapter 8, Groundwater and Attachment 5, Coal Seam Gas Water and Salt Management Strategy outline revised information regarding Arrow's coal seam gas water and salt management strategy. Based on this revised strategy injection of treated coal seam gas water into suitable aquifers where these are depleted is no longer considered to be feasible as the: appropriate regulatory framework is not in place, and project timeframes do not accommodate the time required to conduct trials and gain approvals. If in future, Arrow considers injection an appropriate management option, an aquifer injection trial would be conducted to determine the extent and feasibility of injection over the project development area. If carried forward, this option will be assessed (including groundwater quality requirements and the volumes able to be injected) under a separate approval process.</p> <p>The numerical groundwater model prepared for the SREIS includes a mitigation scenario that predicts the response of the Condamine Alluvium to substitution ('virtual injection') of existing groundwater allocations from the Condamine Alluvium. The results are presented in Chapter 8, Groundwater. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the Underground Water Impact Report) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. Under the Water Act 2000 (Qld), Arrow will be required to implement these make good measures depending on the specific situation and may include:</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore). <p>The final UWIR has been approved by the Chief Executive of the Department</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11103	S079, S089, S134, S145			<p>of Environment and Heritage Protection (EHP), and Arrow is now obligated to enter into these agreements. EHP will be responsible for ensuring petroleum tenure holders comply with their obligations. It is assumed that there will be a framework in place for administering all aspects of make good provisions. Substitution of groundwater allocations and injection of groundwater are unlikely to be used in make good agreements to maintain water supply to third-party bores impaired by coal seam gas water activities. There are a number of options available and the most appropriate option will be adopted based on site specific conditions identified when the make good agreement is put in place between Arrow and the bore owner.</p>
R11104	S010, S011, S018, S019, S020, S024, S025, S026, S027, S030, S032, S037, S038, S039, S051, S053, S055, S059, S064, S065, S070, S076, S081, S085, S088, S095, S096, S097, S098, S106, S114, S139, S140, S148, S149, S152, S154, S157, S167	<p>Concern regarding the groundwater model and the gaps in knowledge or data. Little confidence in the groundwater model. Specifically:</p> <ul style="list-style-type: none"> • The conceptual modelling of groundwater impacts should be based on something more certain than estimates and approximates presented in the EIS. Terms like 'estimate', 'approximately' and 'likely' are routinely used and lack credibility. • The model lacks credibility because of the lack of real data around many of the inputs needed to calibrate such a model and therefore there is little confidence in this model. • There are insufficient current monitoring bores to validate the model. Landholders can have little confidence in the Queensland Water Commission modelled draw down impacts, until the modelled predictions are replicated by actual drawdown levels. • Groundwater Modelling Report provides little detail of the data used to conduct the modelling. • There is an unknown lag time between extraction and effect, and this area should be left alone until the industry has had several years to physically validate modelling. • What is the spatial distribution of the data points (permeability, specific storage, groundwater level, top of formation) over the modelled area? Has this information been provided? • The numerical model prepared by Schlumberger Water Services and presented in the groundwater impact assessment component of the EIS has significant deficiencies and is not capable of predicting the impacts that will occur from the dewatering of the Walloon Coal Measures in 	<p>EIS Chapter 14, sections 14.4.1 and 14.4.2, figures 14.9 - 14.3 and Table 14.1 Appendix G, Appendix B</p>	<p>In response to the specific issues raised:</p> <ul style="list-style-type: none"> • The objective of the groundwater model prepared for the EIS was to predict the degree of groundwater drawdown in aquifers (centimetres, meters or tens of metres), when the drawdown may occur, and over what time frame (years, decades or centuries). The model was structured to generate drawdown predictions over a regional model extent, and therefore not designed to make detailed predictions on a local scale. • The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time. Where assumptions, estimates or approximations were required, the most conservative option was adopted to ensure impacts were not under-represented. Confidence can be placed in the assessment of potential impacts based on the model results. • Groundwater model verification requires ongoing and regular comparison of observed responses (once production commences) in monitoring bores compared with modelled responses. Since the release of the EIS, the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) was released. It contains details of the Water Monitoring Strategy (WMS), specifically the details of the monitoring network and the tenure holders responsible for the construction, maintenance and installation of monitoring equipment, together with the monitoring and reporting requirements. Responsible tenure holders must provide monitoring data and field development updates to OGIA on a regular basis, as defined in the UWIR, where it will be used to update the UWIR every three years and redefine impact predictions if required. • Section 2 of the EIS Appendix G, Groundwater Impact Assessment, appendix B, contains additional details of the data inputs to the model. EIS Chapter 14, Groundwater, Table 14.1, provides a summary of the data points used in the development of the EIS groundwater model. • EIS Chapter 14, Groundwater, figures 14.9 to 14.13, show the predicted peak groundwater drawdown for key aquifer units within the project development area. The estimated time of peak drawdown provides an indication of the lag time between commencement of coal seam gas water extraction and peak drawdown. EIS Chapter 14, Groundwater, sections 14.4.1 and 14.4.2, summarise the predicted groundwater drawdown profiles

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Issue No.	Submission No.	Issue	Reference	Responses
R11104	S010, S011, S018, S019, S020, S024, S025, S026, S027, S030, S032, S037, S038, S039, S051, S053, S055, S059, S064, S065, S070, S076, S081, S085, S088, S095, S096, S097, S098, S106, S114, S139, S140, S148, S149, S152, S154, S157, S167	<p>nearby aquifers.</p> <ul style="list-style-type: none"> Data inputs into the numerical model only include coal seam gas extractions and not other historical extractions from private bores (including those used for irrigation, industrial and urban purposes). These extractions form a large part of the water balance, recharge and outflow and cannot be ignored as model inputs. 		<p>over time for each key aquifer.</p> <ul style="list-style-type: none"> The spatial distribution of data points across the model extent are provided in the following sections of the Schlumberger Water Services Report contained in EIS Appendix G, Groundwater Impact Assessment, appendix B: <ul style="list-style-type: none"> Section 2.5 describes the information sources used to define the hydraulic parameters used in the model. Figures 2.22-2.31 present the pre-1995 groundwater level data point locations. Figure 2.32 presents the 1995 – 2009 Arrow groundwater level data point locations. Figures 2.3 to 2.17 present the top of formation, extent and thickness data points. The numerical groundwater model prepared for the EIS was a regional model, and was suitable for the purposes of impact assessment. The model was peer reviewed by Dr Lloyd Townley, and following the release of the EIS, additional groundwater modeling was conducted by OGIA, with the results presented in the UWIR for the Surat CMA. The results of the OGIA model verify that the groundwater drawdown impacts predicted by the Arrow EIS groundwater model were conservative, and did not under-represent the potential impacts. At the time the groundwater model was prepared for the EIS, there was uncertainty associated with quantification of non-coal seam gas extraction rates within the groundwater model extent. Reliance on this data was considered to pose a potential source of error in the predictions produced by the model. As such, it was recognised and publically acknowledged by Arrow that this data would not be included in the model until uncertainties could be addressed. Since the release of the EIS, OGIA has prepared a regional groundwater model, with the results used to develop the Surat CMA UWIR. This model forms the framework of the groundwater model prepared for the SREIS, and includes groundwater extraction data from non-coal seam gas activities, as described in Chapter 8, Groundwater.
R11105	S024, S026, S081, S146	<p>It is recognised that the data contained within the DERM (now EHP) & Qld water entitlements registration databases is incomplete. Has Arrow provided enough data (in relation to groundwater level, water quality and stratigraphy), for the reader to determine the sufficiency of the data in allowing an assessment of the baseline hydrogeological characteristics of aquifers in the project description area?</p>	–	<p>The numerical groundwater model prepared for the EIS was a regional model, and was suitable for the purposes of impact assessment. The model was peer reviewed by Dr Lloyd Townley, and following the release of the EIS, additional groundwater modelling was conducted by the Office of Groundwater Impact Assessment (OGIA), with the results presented in the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA). The results of the OGIA model verify that the groundwater drawdown impacts predicted by the Arrow EIS groundwater model were conservative, and did not under-represent the potential impacts.</p>
R11106	S024, S026, S079, S081, S106, S139,	<p>Questions regarding the model inputs and scenarios.</p>	<p>SREIS Chapter 8 and Appendix 4,</p>	<p>In response to the specific issues raised:</p> <ul style="list-style-type: none"> The numerical groundwater model prepared for the SREIS includes a

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Issue No.	Submission No.	Issue	Reference	Responses
R11106	S024, S026, S079, S081, S106, S139, S148, S154, S157	<ul style="list-style-type: none"> • Why hasn't the modelling accounted for the scenario that substitution of allocation will not occur? This after all is a potential management scenario. • Arrow must be directed to undertake the groundwater impact modelling exercise, assuming that there will be no substitution of allocations to create a 20 year recovery. • Groundwater extraction from bores other than petroleum/gas wells is not included in the model. This is considered to be an inadequate data set, resulting in inaccurate predictions. Arrow's groundwater modelling must be rerun, including annual extraction by non-petroleum and gas groundwater users. • Requesting further modelling for all confined aquifers in the study area on a steady state basis and what drawdown may have resulted by 2024, or at peak drawdown and 2041 when coal seam gas production ceases and 2061 when residual drawdown in Walloon Coal Measure is less than 10 m. • Unacceptable impacts would result along the eastern boundary and in the surrounding areas for more than 50 years. It is recommended that the modelling be rerun to see where unacceptable impacts would remain after 100 years. 	Appendix E	<p>mitigation scenario that predicts the response of the Condamine Alluvium to substitution of groundwater allocations, as well as unmitigated cumulative development. Results are presented in SREIS Chapter 8, Groundwater.</p> <ul style="list-style-type: none"> • At the time the groundwater model was prepared for the EIS, there was considerable uncertainty associated with quantification of non-coal seam gas extraction rates in within the groundwater model extent. Reliance on this data was considered to pose a potential source of error in the predictions produced by the model. As such, it was recognised and publically acknowledged by Arrow that this data would not be included in the model until uncertainties could be addressed. Since the release of the EIS, the Office of Groundwater Impact Assessment has prepared a regional groundwater model, with the results used to develop the Surat Cumulative Management Area (CMA) Underground Water Impact Report (UWIR). This model forms the framework of the groundwater model prepared for the SREIS, and includes groundwater extraction data from non-coal seam gas activities, as described in SREIS Chapter 8, Groundwater. • Significant additional modelling has been undertaken, including for all Surat CMA confined aquifers, as well as underlying Bowen Basin formations. The modelling simulates a period of 3000 years from commencement of coal seam gas operations. Hydrographs are provided for all main aquifer formations in the SREIS Appendix 4, Supplementary Groundwater Assessment, appendix E.
R11107	S018, S019, S020, S030, S032, S037, S039, S053, S059, S064, S065, S070, S076, S085, S088, S095, S096, S097, S098, S114, S139, S140, S152, S154, S167	<p>A program should be instigated to obtain the data required to ascertain:</p> <ul style="list-style-type: none"> • The permeability of the various strata that lies between the alluvium and the coal seams. • Water levels in the Walloon coal measures. • Volumes that will be pumped etc. • From this, develop a groundwater flow model which could then be used to simulate the long-term changes and impact that the mining of coal seam gas would have on the alluvial groundwater. 	SREIS Chapter 8 and Appendix 4	<p>The groundwater model prepared for the EIS makes conservative assumptions related to the level of connectivity between the Walloon Coal Measures and the Condamine Alluvium.</p> <p>A revised numerical groundwater model has been prepared for the SREIS that is based on the framework of the OGIA Surat Cumulative Management Area (CMA) groundwater model. Within this framework is a detailed model of the Condamine Alluvium prepared by Khlohn Crippen Berger (KCB, 2011) and additional information in relation to the interface between the Condamine Alluvium and the Walloon Coal Measures is incorporated into this model. The Underground Water Impact Report (UWIR) model is a dynamic model that will be calibrated as additional data becomes available (in terms of geological data gained through drilling and hydrogeological data gained through extraction and hydraulic testing).</p> <p>Details of Arrow's study into the level of Condamine Alluvium and Walloon Coal Measures connectivity is provided in SREIS Chapter 8, Groundwater. While this study is underway, no results are available at this time. This study</p>

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R11107	S018, S019, S020, S030, S032, S037, S039, S053, S059, S064, S065, S070, S076, S085, S088,			is being conducted by Arrow in collaboration with the Office of Groundwater Impact Assessment (OGIA). OGIA have identified a direction for further research in the UWIR in relation to the connectivity between the Condamine Alluvium and the Walloon Coal Measures. The results of the study will be used in future refinements of the OGIA model presented in updates to the UWIR.
R11108	S089	Concerned with quantities of required water and unknown replenishing rates of aquifers. Agricultural producers will also be dealing with lower levels of rainfall (as stated in the EIS) which will compound the water scarcity.	<p>EIS Chapter 14, Section 14.3.2 and Appendix G, Appendix B, Section 3.5.2</p> <p>SREIS Appendix 4, Appendix E, Section 2.5.7</p>	<p>The information presented in EIS Chapter 14, Groundwater, Section 14.3.2 provides a summary of desktop information available in relation to the range of recharge rates across the study area.</p> <p>Recharge rates specifically applied to the groundwater model are presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.5.2, where recharge is discussed, and the model applies a range of recharge values based on (Kellet et al, 2003).</p> <p>The model used for the SREIS uses presents revised recharge rates and distribution across the study area. Refer SREIS Appendix 4, Supplementary Groundwater Assessment, appendix E, Section 2.5.7.</p> <p>Petroleum tenure holders are afforded underground water rights by the Petroleum and Gas (Production and Safety) Act 2003. Under Section 185 of the Petroleum and Gas (Production and Safety) Act 2003, "the petroleum tenure holder may take or interfere with groundwater to the extent that it is necessary and unavoidable during the course of an activity authorised under the petroleum tenure, including coal seam gas extraction". The aforementioned underground water rights also attract underground water obligations with which petroleum tenure holders must comply. These obligations are described in chapter 3 of the Water Act which provides a framework for identification of existing groundwater users within and in the vicinity of petroleum tenure, prediction of impacts on aquifers in these areas, establishment of a monitoring network to verify predicted impacts, and a process whereby petroleum tenure holders enter agreements into 'make good' agreements with bore owners (including the provision of make good measures where the predicted impacts are likely to result in an impaired capacity of existing water bores).</p>
R11109	S106	Request information specifying the year in which drawdown will be less than 1 m on average and from what inputs were the maps in Figure 11 of the Executive Summary generated. What peak (maximum) drawdown was predicted in 2059? Reference is made to full recovery not occurring til after 2071? When would full recovery occur?	<p>EIS Appendix G</p> <p>SREIS Chapter 8</p>	<p>The Executive Summary of the EIS presents a brief summary of the major findings presented in the main body of the EIS. For specific information regarding the inputs for Figure 11, or specific drawdown predicted for particular years, EIS Appendix G, Groundwater Impact Assessment, provides further detail and discussion.</p> <p>Additional model outputs presented in the EIS Appendix G, Groundwater Impact Assessment show that groundwater levels do not recover to initial levels by 2071, which is the maximum temporal extent of the model.</p> <p>For the purposes of the SREIS, the Queensland Government Office of Groundwater Impact Assessment (OGIA) model has been updated with Arrow's current development plan. The results of the update are presented in</p>

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R11109	S106			SREIS Chapter 8, Groundwater. Revised recovery rates are also discussed in SREIS Chapter 8, Groundwater.
R11110	S106	<p>The groundwater predictive model can be updated with data being produced by existing producers. No comments are provided on the interaction of the aquifers in the northeast corner of the Tipton West area. There should be significant data available from Arrow's Kogan, Daandine, Stratheden and Tipton West areas where 292 production or pilot wells have been drilled, however it appears as if Arrow only has 7 cores or stratigraphic records from these sites (EIS Appendix G, Table 2.5, Summary of Arrow Testing of the Walloon Subgroup). Provision/inclusion of key data which would have been available appears not to have been included hence not satisfying the baseline data required under Terms of Reference Section 4.5.1.2.</p> <p>Furthermore, concern that Terms of Reference 4.5.1.2 has not been satisfied, as there is limited evidence of appropriate modelling provided, potentially projecting lessened impacts caused by the project. Further to this, no mention of the impacts and how they relate to the risk of production from this key prime agricultural area in efficient close proximity to the population base of southeast Queensland is referred to.</p>	<p>EIS Chapter 13 and Appendix G, Appendix B, Section 2.5 and Table 2.5</p>	<p>The groundwater model prepared for the EIS is based on Arrow's development plan at that time, and relevant available data from existing fields and monitoring wells. EIS Appendix G, Groundwater Impact Assessment, appendix B, Table 2.5 presents Arrow production, core and drill stem test results from the Walloon Coal Measures available at the time the EIS was prepared, and includes data collected from numerous samples collected for each test type. The permeability and equivalent hydraulic conductivity measurements presented in the table reflect more than seven data sets. The available Arrow data was supplemented with information from other literature sources and similar projects in the area, as detailed in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 2.5.</p> <p>The objective of the groundwater model prepared for the EIS was to predict the degree of groundwater drawdown in aquifers (centimetres, meters or tens of metres), when the drawdown may occur, and over what time frame (years, decades or centuries). The model was structured to generate drawdown predictions over a regional model extent, and therefore not designed to make detailed predictions on a local scale.</p> <p>The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time. Where assumptions, estimations or approximations were required, the most conservative option was adopted to ensure impacts were not underrepresented. Confidence can be placed in the assessment of potential impacts based on the model results. Potential impacts associated with agricultural values present within the project development area are discussed in the EIS, Chapter 13, Agriculture.</p>
R11111	S106	<p>Suggests all wells that would be impacts both east, west, north and south of the project development area should be shown, as many more wells will be severely impacted upon. There are many more wells in the Hutton Formation that will be severely impacted than EIS Figure 4.3a suggests.</p> <p>Additionally, maps for different levels of drawdown (0.5, 1, 2, 5, 10, 15, 20 up to 70m) in key aquifers should be produced that show the number of years that certain levels of drawdown will occur for over the next 100 years. That way an estimate may be made of the associated costs of the detrimental drawdown right across the Darling Downs and Maranoa districts.</p>	<p>EIS Chapter 14, figures 14.10 to 14.13</p>	<p>The groundwater drawdown contour maps presented in the EIS show the peak drawdown, and the year in which the maximum drawdown is likely to be reached. Following maximum drawdown, outputs are presented 20 years after coal seam gas production ceases, providing an indication of how drawdown reduces over time as the aquifers recover. The different drawdown levels are shown by the contour lines on EIS Chapter 14, Groundwater, figures 14.10 – 14.13, and also in EIS Appendix G, Groundwater Impact Assessment.</p> <p>Since the release of the EIS, results of groundwater predictions modelled by the Office of Groundwater Impact Assessment (OGIA) were presented and finalised in the Surat Cumulative Management Area (CMA) Underground Water Impact Report (UWIR). This model defined potentially affected third-party wells within the Immediately Affected Areas (IAA) and Long-term Affected Areas (LAA) that are required to undergo bore assessment by the responsible tenure holder identified in the UWIR. Of all the third-party bores known to access the Hutton Sandstone in the Surat CMA, no bores are</p>

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R11111	S106			located in the IAA, and 23 bores are located in the LAA defined for the Hutton Sandstone.
R11112	S106	Issues regarding EIS Chapter 14 and EIS Appendix G, Appendix B, Figure 2.21. Request that the extent and thickness of the Eurombah Formation beneath the Walloon Coal Measure is included. The 'northings' scale on the graph is incorrect and actually reflects 'eastings.'	EIS Chapter 14, Figure 14.3 and Appendix G, Appendix B, Figure 2.21 and Table 2.3	The cross section presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Figure 2.21, is a cross section positioned north-south through the project development area. As such, the use of northings to define the horizontal axis of the section is correct. As described in EIS Appendix G, Groundwater Impact Assessment, appendix B, Table 2.3, the Eurombah/Durabilla Formations are included as a formation within the Walloon Coal Measures for the purposes of modelling and conceptualisation of the stratigraphy. This is also reflected in EIS Chapter 14, Groundwater, Figure 14.3.
R11113	S106	A comparison needs to be made between plots generated from pre-1970 data and post-1970 data to ensure that those two data sets can be combined without error being generated. Additional data would be available for inclusion from the St George office. (Related to Chapter 14 / Vol 4., Appendix G – Appendix B, Figure 2.22-2.31).	EIS Appendix G, appendix B, figures 2.22 - 2.31	Figures 2.22 to 2.31 in EIS Appendix G, Groundwater Impact Assessment, appendix B, represent the groundwater level information available within the groundwater model extent for the time period prior to 1995. This time period was chosen because available groundwater level data showed that after 1995 the initiation of coal mining and coal seam gas projects in the Surat Basin area impacted on the baseline groundwater levels.
R11114	S106	There is inadequate inclusions of Santos wells with the figure showing what Santos' water production would be from within the Darling Downs and not their total, the figure (related to EIS Chapter 14 and Appendix G, Appendix B, Figure 2.36) should be inclusive of any proponents' works outside the area that have an impact on Arrow wells.	SREIS Chapter 8	Groundwater extraction data for the other coal seam gas proponents (Queensland Gas Company (QGC), Origin Energy and Santos) are based on publicly available information on extraction rates from tenures within the EIS model extent. The cumulative groundwater model predictions prepared for the SREIS (presented in SREIS Chapter 8, Groundwater) are based on more detailed production information provided to the Office of Groundwater Impact Assessment for the purposes of the regional groundwater model used to prepare the Surat Cumulative Management Area Underground Water Impact Report.
R11115	S106	The reference (related to EIS Chapter 14 and EIS Appendix G, Appendix B, figures 3.6 and 3.8) to 'drains' is an incorrect inclusion suggesting the model is not correct.	–	The use of drain boundary conditions in the EIS groundwater model is consistent with the nature and the objectives of the model. The loss from the system occurs because the water levels, especially in the Condamine Alluvium, are higher than observed (because no groundwater extraction is simulated by the model in this unit), and rather than water flowing from the watercourse to the groundwater (a losing watercourse), the relationship has been reversed to a gaining system for the purposes of modelling. This may have been the natural state of the interaction between the river and the groundwater system (i.e., gaining watercourse) before groundwater resources were developed in the area. This does not affect the ability of the model to predict how impacts migrate from the Walloon Coal Measures to the Condamine Alluvium.

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R11116	S106	The calculated head does not fit with the observed head which signifies the model is not correct. The gradients of the actual data points are very different indicating the model cannot be relied upon without being corrected. (Related to Chapter 14 / Vol4., Appendix G – Appendix B, Figure 3.10 and 3.11).	EIS Appendix G, appendix B, sections 3.8.3 and 3.8.4	The calibration and scatter plots are discussed in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.8.3. The calibration is considered satisfactory, and the Scaled Root Mean Square (SRMS) which is commonly used as a measure of calibration success, was 6.8%. This is within the range of values that would be considered acceptable (Middlemis, 2000). It is not possible to prepare a regional model that fits all data points, for a range of reasons. These include: <ul style="list-style-type: none"> • Some observed data points are likely to have erroneous values. • Some data points may have errors in the co-ordinates assigned. • The effects of local groundwater pumping influences groundwater levels in monitoring wells, and therefore are no longer regionally representative. • Model cells are 1 km square, and therefore cannot resolve all spatial effects associated with well locations. • Aquifers are modelled as homogeneous layers, but in reality aquifers are heterogeneous, and insufficient data is available to account for this. Additional discussion is provided in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.8.4.
R11117	S106	Figures 3.12 and 3.19 (EIS Chapter 14 and EIS Appendix G, Appendix B, figures 3.12 and 3.19) are extremely incorrect as only calibration for the Walloon Coal Measure has been included for the model resulting in the contours for the Simulated Head and the Interpolated Observed Head crossing at right angles, signifying incorrect modelling.	EIS Appendix G, appendix B, Section 3.8.3 and Figure 3.2	A steady state calibration that included groundwater level observations in all model layers was undertaken. The fact that groundwater level observations did not truly represent a steady state (because they were recorded during a time of depressurisation caused by groundwater extraction in some of the aquifers), the steady state calibration was not pursued further than necessary. This is in line with the goals set for the modelling exercise The statistical analysis of the steady state calibration is provided in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.8.3. The Scaled Root Mean Square (SRMS) which is commonly used as a measure of calibration success was 6.8%. For a model of this nature this is acceptable, given that a far more detailed model would be considered well calibrated with an SRMS of 5%, as presented in the Groundwater Flow Modelling Guideline, Middlemis, 2000. A time variant (historical) calibration was undertaken in the Juandah Coal Measures, Tangalooma Sandstone and Taroom Coal Measures, using very precise (in time and location) data collected in these formations by Arrow. These were complemented by precise records of groundwater abstraction from the Arrow coal seam gas bores located in the same formations. Together these two datasets provide a very useful calibration dataset that can be used with confidence to set the parameters of these three units in the model. An additional benefit of this dataset is that the depressurisation observed was likely due to the extraction from the coal seam gas wells only and the water levels were not perturbed by any other external (unrecorded) factors. The final calibration is presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Figure 3.20, and shows a very good match between observed

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R11117	S106			<p>and simulated groundwater levels at 9 of the 12 locations. By comparison, the time variant (historical) groundwater observations in the other hydrogeological units are less precise and are controlled by many external factors (groundwater recharge, irrigation, industrial and urban abstraction, groundwater-surface water interaction etc.), which are poorly recorded or observed. This dataset, in the absence of extensive auditing, is much less useful and could only be used with low confidence. For these reasons a time variant (historical) calibration was not undertaken on these units, but the following strategy was used to ensure that appropriate parameter values were used:</p> <ul style="list-style-type: none"> • Parameter values were set based on a literature review and existing models (CSIRO Condamine Alluvium model (Barnett and Muller, 2008)). • Parameter values were varied as part of a sensitivity analysis to see if they had a major control on predictions, and to provide a range of possible impacts.
R11118	S106, S141, S144	<p>Does the density of Arrow wells and non-Arrow well relate to fraccing and not fraccing, or will there be infill in the non-Arrow sites? If there is to be well infill by other proponents, how will that impact the current predicted impact if such is based on the current well density? A complete investigation of in-fill production wells needs to be undertaken to determine the potential impact across the region.</p>	–	<p>In accordance with Commitment C079, Arrow will enforce a no hydraulic fracturing (fraccing) policy in the project development area. The density and spacing of coal seam gas wells proposed to be drilled by Arrow is not a reflection of the no fraccing policy. The EIS conceptualised that vertical wells would be drilled with a separation distance between wells averaging a minimum of 800 m across the project development area. The EIS described that the grid of production wells may be drilled in sequence, or in stages to enable learning from the performance of early wells with a wide spacing, before adding remaining wells to complete the grid (this historically has been referred to as infilling). Therefore, the process of infilling will not result in wells being drilled closer together (than the minimum separation distance of 800 m), and does not influence the way in which coal seam gas is extracted from within the project development area. Wells installed by other proponents will not be drilled within Arrow tenure.</p>
R11119	S106	<p>Requests a map (related to EIS Chapter 14 and EIS Appendix G, Appendix B, Figure 4.3 and 4.4) with more appropriate scale is required to determine the actual proposed density of Arrow wells, as higher density is of greater concern to landholders using disc ploughing around the paddock and numerous points of weed source across the cropped area would be of great ongoing additional concern.</p>	<p>EIS Appendix G, appendix B, figures 4.3 and 4.4 SREIS Chapter 7</p>	<p>The location of wells shown on EIS Appendix G, Groundwater Impact Assessment, appendix B, figures 4.3 and 4.4, are simulated coal seam gas water extraction sites identified for the purposes of regional groundwater drawdown modelling. They do not represent planned coal seam gas well locations. In the absence of known infrastructure locations at the time of the EIS, the groundwater model was based on conceptual field development plan, which included a grid of wells across the project development area. The siting of wells will be undertaken in consultation with landholders, as described in SREIS Chapter 7, Agriculture, with the objective of minimising impacts on productive areas and providing the best opportunity for rehabilitation.</p>
R11120	S106	<p>A more detailed summary of the literature found in</p>	EIS	<p>The data presented in EIS Appendix G, Groundwater Impact Assessment,</p>

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R11120	S106	EIS Appendix G, Section 4.4 (Hydrogeological Parameters) is required. Submitter sceptical of some of these figures in particular those chosen for the Condamine River Alluvium, eg the resultant Kh.	Appendix G, Section 4.4 and appendix B, Section 2.5	Section 4.4, is a summary of information presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 2.5. This section provides a more detailed review of the information related to hydraulic parameters available from literature sources and related projects in the area.
R11121	S118	The findings of the EIS in respect to groundwater needs to be reviewed to safeguard water as a valuable resource for the future.	–	Noted. The attributes of groundwater systems in the project development area and their ecological, biological, consumptive, productive, cultural and spiritual values are acknowledged in the EIS.
R11122	S118	Any effective management of these impacts presupposes that the project will proceed to a high standard of implementation based on modelling inputs, inclusive of accuracy of historical information on bore rates of use and the results of further studies identified by Arrow as necessary in the EIS, before the project proceeds.	SREIS Chapter 8	The results of the groundwater impact assessment conducted for the EIS concluded that impacts are manageable. Subsequent groundwater assessments, such as the one that prepared by the Office of Groundwater Impact Assessment and presented in the Underground Water Impact Report, confirms the findings of the EIS, and reiterates that the predicted impacts to groundwater values presented in the EIS were conservative. Notwithstanding that, Arrow, in conjunction with other coal seam gas proponents and the OGIA, are progressing with a number of studies to gain more detailed understanding of certain aspects of the groundwater system within the Surat Cumulative Management Area. These projects are detailed in SREIS, Chapter 8, Groundwater.
R11123	S134	If groundwater usage has been underestimated, will the adaptive management framework provide for a review of operations?	–	Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) regular updates on changes to their plans for development, including predicted coal seam gas water extraction profiles. On an annual basis, OGIA will run the regional groundwater flow model using the updated estimates of planned production and assess if changes to planned production result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11124	S145	Given the data gaps in terms of groundwater drawdown impacts, a precautionary approach should be adopted.	–	Noted. The process of groundwater modelling adopted for the EIS, resulted in a conservative assessment of potential impacts.
R11125	S146	How is Arrow able to ground-truth hydrogeological characteristics of aquifers?	–	The geological structure of groundwater formations is determined by stratigraphic bores and the recovery of cores that enable the structure and composition of the formation to be determined. Groundwater monitoring bores and pump tests are used to determine the hydrologic properties of the formation including piezometric head and porosity of the formation, which is informed by the volumes and rate at which water is able to be pumped.

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R11125	S146			Aquifer geochemistry is determined through groundwater quality sampling and analysis.
R11126	S146	How will Arrow incorporate real time data into their modelling?	–	Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) the data collected during implementation of their Water Monitoring Strategy. The trends in the monitoring data will reflect the net effect of impacts from petroleum activities along with other factors such as agricultural use or seasonal conditions. Every year, OGIA will summarise and assess the predicted groundwater drawdown levels against the monitoring data provided. In addition, OGIA will obtain updated coal seam gas water production profiles from all proponents and run the regional groundwater flow model using the updated estimates and assess if changes to planned production within the Surat CMA result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11127	S139, S148, S154, S157	Inaccurate predictions made by the numerical model could result in the permission of adverse impacts, to the detriment of landholders, the environment and the state, despite 'make good' provisions.	–	The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time. Where assumptions, estimations or approximations were required, the most conservative option was adopted to ensure impacts were not underrepresented. Confidence can be placed in the assessment of potential impacts based on the model results. Since the release of the EIS, results of groundwater predictions modelled by OGIA were presented and finalised in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR). Every year, the Office of Groundwater Impact Assessment (OGIA) will summarise and assess the predicted groundwater drawdown levels against the monitoring data provided by coal seam gas proponents. In addition, OGIA will obtain updated coal seam gas water production profiles from all proponents and run the regional groundwater flow model using the updated estimates and assess if changes to planned production within the Surat CMA result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11128	S139, S148, S154, S157	The mass balance of the model is considered unacceptable. The Hutton Sandstone has the largest recharge, followed by the Juandah Coal	EIS Appendix G, appendix B, Section 2.52 and Figure 3.7	The amount of groundwater entering each formation is a function of their outcrop surface area. A complicating factor is that 1 mm per year was applied over the central and eastern portion of the model (EIS Appendix G,

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R11128	S139, S148, S154, S157	measures, which is not considered to be a true aquifer. Given that these units also display the largest losses via drains, the whole mass balance is not considered to be practical and is one of the biggest doubts associated with the model. The water balance and steady state calibration of the model are both considered to be wrong.		Groundwater Impact Assessment, appendix B, Figure 3.7) but no recharge was applied anywhere else (apart from the Main Range Volcanics). The units represented as outcropping in the areas of recharge are dominated by the Hutton Sandstone and the Juandah Coal Measures (units of considerable thickness). Therefore, based on the surface area of these units, and that the outcrop within the areas of recharge, they receive more recharge than the other units. According to the 2010 Water Entitlements Registration Database there are 141 extraction bores in the Surat Basin with a registered target aquifer defined as the Walloon Coal Measures and 769 with a registered target aquifer as the Hutton Sandstone. From this analysis alone it would be fair to class the Walloon Coal Measures (of which the Junadah Coal Measures is a major part) as an aquifer.
R11129	S139, S148, S154, S157	The calibration of the numerical model is considered to be non-existent, with only limited formations considered calibrated. The comparison of the simulated and observed groundwater levels is very poor. This leads to the interpretation that the model is deficient, cannot be considered calibrated and therefore cannot be used for predictions with any confidence. Due to the issues related to the model calibration, the predicted drawdowns for the Walloon Coal Measures may then be acceptable, but not for the surrounding aquifer units (because they were not accurately calibrated).	EIS Appendix G, Appendix B, Section 3.8.3 and Figure 3.20	A steady state calibration that included groundwater level observations in all model layers was undertaken. The fact that groundwater level observations did not truly represent a steady state (because they were recorded during a time of depressurisation caused by groundwater extraction in some of the aquifers), the steady state calibration was not pursued further than necessary. This is in line with the goals set for the modelling exercise The statistical analysis of the steady state calibration is provided in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.8.3. The Scaled Root Mean Square (SRMS) which is commonly used as a measure of calibration success was 6.8%. For a model of this nature this is acceptable, given that a far more detailed model would be considered well calibrated with an SRMS of 5%, as presented in the Groundwater Flow Modelling Guideline, Middlemis, 2000. A time variant (historical) calibration was undertaken in the Juandah Coal Measures, Tangalooma Sandstone and Taroom Coal Measures, using very precise (in time and location) data collected in these formations by Arrow. These were complemented by precise records of groundwater abstraction from the Arrow coal seam gas bores located in the same formations. Together these two datasets provide a very useful calibration dataset that can be used with confidence to set the parameters of these three units in the model. An additional benefit of this dataset is that the depressurisation observed was likely due to the extraction from the coal seam gas wells only and the water levels were not perturbed by any other external (unrecorded) factors. The final calibration is presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Figure 3.20, and shows a very good match between observed and simulated groundwater levels at 9 of the 12 locations. By comparison, the time variant (historical) groundwater observations in the other hydrogeological units are less precise and are controlled by many external factors (groundwater recharge, irrigation, industrial and urban abstraction, groundwater-surface water interaction etc.), which are poorly

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R11129	S139, S148, S154, S157			<p>recorded or observed. This dataset, in the absence of extensive auditing, is much less useful and could only be used with low confidence. For these reasons a time variant (historical) calibration was not undertaken on these units, but the following strategy was used to ensure that appropriate parameter values were used:</p> <ul style="list-style-type: none"> • Parameter values were set based on a literature review and existing models (CSIRO Condamine Alluvium model (Barnett and Muller, 2008)). • Parameter values were varied as part of a sensitivity analysis to see if they had a major control on predictions, and to provide a range of possible impacts.
R11130	S139, S148, S154, S157	The predictive aspect of the model used groundwater extraction as a function of impact, rather than drawdown, and it is averaged across large areas. Therefore the predicted impacts have no relationship to actual bores locations.	–	Details of the precise location of coal seam gas wells were unavailable to the study and these details did not yet exist. It would an insignificant impact on the model predictions, especially at the regional level over which they have been provided.
R11131	S106, S139, S148, S154, S157	<p>Groundwater drawdown predicted for the Condamine Alluvium is expected to be masked by:</p> <ul style="list-style-type: none"> • The even spread of extraction points. • The 10 m shale incorporated into the model between the Walloon Coal Measures and the overlying Springbok Sandstone. • The increased thickness of the Springbok Sandstone in the model. <p>Layer 8 should be deleted from Table 3.1 in EIS Appendix G, Appendix B. The groundwater drawdowns in the Condamine Alluvium are considered to be incorrect.</p>	<p>EIS Appendix G, Section 5.4 and appendix B, Table 3.1</p>	<p>Details of the precise location of coal seam gas wells were unavailable to the study and these details did not yet exist. It would have insignificant impact on the model predictions, especially at the regional level over which they have been provided.</p> <p>Layer 8 described in EIS Appendix G, Groundwater Impact Assessment, appendix B, Table 3.1, refers to the shale layer between the top of the Jundah Coal Measures (a unit within the Walloon Coal Measures) and the overlying Springbok Sandstone.</p> <p>Shale and silt in the coal measures is present in all Arrow boreholes above, below, and between the coal seams. With a numerical model of the size used for the Surat Gas Project EIS groundwater modelling, it was not possible to incorporate all of these geological features, although the shale and silt layers will limit the impacts. It was possible to incorporate a single additional layer, without impacting the model utility significantly. Of all these shale and silt layers, it was interpreted that the layer with the greatest potential to control the migration of impacts would be located at the top of the Juandah Coal Measures. The 10 m shale layer was therefore used to simulate this material. An additional benefit of this modelling approach was to allow for the significance of this layer (10 m shale at the top of the Juandah) to be tested. This was achieved in sensitivity run 5C, where the hydraulic parameters of the 10 m shale layer were changed to equal exactly those that had been used for the Springbok Sandstone (a layer with much higher hydraulic conductivity). The results showed that with or without this low hydraulic conductivity layer, the predicted impacts in the aquifers above (including the Condamine Alluvium) were very similar (EIS Appendix G, Groundwater Impact Assessment, Section 5.4). Therefore, at the scale of the model (453 km by 270 km laterally and up to 2 km deep) this representation of the Walloon Coal Measures has not impacted on the predictions made by the model.</p>

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R11131	S106, S139, S148, S154, S157			<p>Modelling conducted for and reported in the SREIS is based on the Underground Water Impact Report and accordingly utilises hydrogeological parameters that were developed by the Office of Groundwater Impact Assessment and endorsed by EHP.</p> <p>While a shale layer may be interpreted as limiting impacts, this must be considered in the context of the overall simplification of the geology in a numerical model. As 10% of the Walloon Coal Measures is coal and most of the remainder is low permeability siltstone and mudstone, the increase of this shale unit and simplification of layering within the Walloon Coal Measures allows impacts to propagate more rapidly and to a greater extent than would occur in reality. The averaging of parameters for this unit and representations of aquitards are therefore a reasonable and defensible modelling procedure to represent the overall system behaviour.</p>
R11132	S139, S148, S154, S157	<p>Drawdowns at peak production are not displayed accurately across the project development area, and the extraction sequence does not account for areas that may not be produced from in the future. The production sequence is too evenly spread. Based on the issues identified above, the potential impacts to the Condamine Alluvium to the east of the Condamine River are not considered to be adequately represented by the model.</p>	-	<p>The objective of the groundwater model prepared for the EIS was to predict the degree of groundwater drawdown in aquifers (centimetres, meters or tens of metres), when the drawdown may occur, and over what time frame (years, decades or centuries). The model was structured to generate drawdown predictions over a regional model extent, and therefore not designed to make detailed predictions on a local scale.</p> <p>Details of the precise location of coal seam gas wells were unavailable to the study and these details did not yet exist. This has insignificant impact on the model predictions, especially at the regional scale over which they have been provided.</p> <p>The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time. Where assumptions, estimations or approximations were required, the most conservative option was adopted to ensure impacts were not underrepresented. Confidence can be placed in the assessment of potential impacts based on the model results.</p>
R11133	S139, S148, S154, S157	<p>Lack of detail associated with production areas, groundwater monitoring programs and modelling inadequacies means that no confidence can be placed in the groundwater impact assessment.</p>	-	<p>The objective of the groundwater model prepared for the EIS was to predict the degree of groundwater drawdown in aquifers (centimetres, meters or tens of metres), when the drawdown may occur, and over what time frame (years, decades or centuries). The model was structured to generate drawdown predictions over a regional model extent, and therefore not designed to make detailed predictions on a local scale.</p> <p>The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time. Where assumptions, estimations or approximations were required, the most conservative option was adopted to ensure impacts were not underrepresented. Confidence can be placed in the assessment of potential impacts based on the model results.</p>
R11134	S157	The groundwater assessment prepared for the EIS	EIS	Additional detailed information used in the groundwater impact assessment is

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R11134	S157	<p>is defective because it fails to expose the foundation for the assumptions applied to the assessment, and sometimes fails to expose the assumptions themselves.</p> <p>It fails to produce or adopt a sufficiently detailed dataset and to expose the nature of the data excluded or modified and the reasons of these exclusions/modifications.</p> <p>It also fails to expose the nature of the processes that were adopted in relation to the dataset and also the reasons for the adoption of that form of modelling.</p> <p>Some data obtained from the registered and licensed bore databases were excluded from further assessment due to the interpretation that some information was anomalous. No information is provided on what constitutes 'anomalous' and what data was subsequently excluded.</p> <p>Does the groundwater model take recent flooding into account, in terms of including it in the model inputs. The technical report does not allow the reader to understand what data inputs are included.</p> <p>The lack of explanation around assumptions made and gaps in the data means that the groundwater assessment and model are flawed and that the outcomes drawn from the model in EIS Appendix G, Section 8.1.1 in the groundwater technical report are meaningless.</p> <p>Because there is a lack of data, the groundwater model cannot be assured of proper groundwater flow modelling, and therefore the risk modelling represents nothing more than 'guess work'.</p>	Appendix G, appendix B, Section 2	<p>presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, which is the numerical groundwater modelling report prepared by Schlumberger Water Services.</p> <p>Section 2 of the Schlumberger Water Services report contains details on the information sources used to conceptualise the hydrogeological system, including:</p> <ul style="list-style-type: none"> • Geology (stratigraphy). • Groundwater levels. • Hydraulic parameters. • Groundwater extraction rates. <p>In addition, Section 2 also describes the information used, methods and assumptions made during the development of the conceptual model structure. Where assumptions were made (to exclude or include data), the most conservative approach was adopted to ensure that the model predictions did not under represent potential impacts. Confidence can be placed in the assessment of potential impacts based on the model results.</p> <p>The groundwater model prepared for the EIS was based on geological and hydrogeological information available at the time.</p>
R11135	S157	<p>Models based on a lack of data may manifest in an error resulting in irretrievable environmental damage such as the death of rare lung fish due to methane bubbling up in the Condamine River.</p>	-	<p>The cause of the presence of gas in the Condamine River has not been determined at the time of submission of the SREIS. Investigations carried out at the time of writing suggested that based on the information obtained by the LNG (liquefied natural gas) enforcement unit (DNRM, 2012b), the cause of bubbles in the Condamine River was unlikely to be due to coal seam gas activities.</p> <p>Origin Energy has advised DNRM that the gas present may be naturally-occurring coal seam methane rising through the underlying geology in the area. Further investigations into the cause of gas in the Condamine River are continuing.</p> <p>Part 1 of the summary technical report of the Condamine River gas seep</p>

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R11135	S157			investigation (DNRM, 2012b) also concluded no apparent safety risk in the immediate are of the seeps, and no apparent evidence of environmental harm that can be attributed to the present gas seeps.
R11136	S157	The timeframes used for modelling are confusing. Timeframes vary from 30 to 40 years, with a 20 year recovery period. The reason for the adoption of these timeframes is not provided and the assumptions are also not exposed.	EIS Chapter 14, figures 14.9 - 14.13 and Chapter 28, figures 28.2 - 28.6	The timeframes adopted for groundwater modelling in the EIS differ due to the different coal seam gas production timeframes forecast by Arrow and the other coal seam gas proponents. At the time the EIS was prepared, available coal seam gas water production forecasts showed that the cessation of coal seam gas extraction varied between proponents. For model outputs (EIS Chapter 14, Groundwater, figures 14.9, 14.10, 14.11, 14.12 and 14.13) prepared for the Arrow-only modelling scenario (scenario 1) the model extends for 20 years following cessation of Arrow's coal seam gas extraction. For model outputs (EIS Chapter 28, Cumulative Impacts, figures 28.2, 28.3, 28.4, 28.5 and 28.6) prepared for the cumulative modelling scenario (scenario 3) the model extends for 10 years following cessation of coal seam gas extraction within the area. The figures represent peak groundwater drawdown contours for each aquifer within the four groundwater systems, together with predicted drawdown in 2061, which includes a ten year timeframe after the cessation of coal seam gas extraction across the region.
R11137	S157	While the assessment states that a MODFLOW type model was used, it does not go into sufficient detail regarding the data inputs and how it was treated during calibration and sensitivity runs. For example, the report fails to disclose the manner through which 'incremental changes to the relevant parameters' were made during the sensitivity analyses. The foundations of the modelling are not presented by Arrow.	EIS Appendix G, Appendix B	Additional detailed information used in the groundwater impact assessment is presented in EIS, Appendix G, Groundwater Impact Assessment, appendix B, which is the numerical groundwater modelling report prepared by Schlumberger Water Services.
R11138	S157	The submitter maintains that the moratorium must be placed on coal seam gas activities until such time as the Walloon Coal measures can be independently and properly assessed and a model derived for that actual area. The Queensland government should disregard the findings of the UWIR. Any stakeholder in the Walloon Coal measures might wish to take proper objection to such issues and may wish to commence proceedings to have the matter judicially reviewed.	–	Noted. Since the release of the EIS, the Office of Groundwater Impact Assessment groundwater model and associated Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area was finalised and endorsed by EHP. Arrow and other coal seam gas proponents are already regulated by the requirements in the UWIR and their obligations are enforced by EHP.
R11139	S106	Argues out-dated data from 1991 was used (in EIS Chapter 14, Section 14.3.2) suggesting recharge is	EIS Appendix G, appendix B,	The information presented in Section 14.3.2 of the EIS provides a summary of desktop information available in relation to the range of recharge rates across

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R11139	S106	5 to 10 mm per annum, where newly created data involving radioactive carbon and unsaturated moisture profiles dictates less than 2.5 mm per annum. Suggests models should be re-run with the 2.5 mm per annum figure as the input for the recharge parameter. Only then should sensitivities be run.	Section 3.5.2 and Figure 3.7 SREIS Appendix 4, appendix E, Section 2.5.7	the study area. Recharge rates specifically applied to the groundwater model are presented in EIS Appendix G, Groundwater Impact Assessment, appendix B, Section 3.5.2, where recharge is discussed, and the model applies a range of recharge values based on (Kellet et al, 2003). The model used for the SREIS uses presents revised recharge rates and distribution across the study area. Refer to SREIS Appendix 4, Supplementary Groundwater Assessment, appendix E, Section 2.5.7.
R11140	S134	Arrow to specify how they will monitor dams holding contaminated water for seepage, overtopping lining, erosion etc.	EIS Chapter 14	Arrow has committed to develop the construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and determine the hazard category of the dam in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Construct the dams under the supervision of a suitably qualified and experienced person in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141). EIS Chapter 14, Groundwater identifies Arrow's commitment that, Arrow will install groundwater monitoring bores near dams as a leak detection measure: <ul style="list-style-type: none"> • The number of monitoring bores and their location will take into account site-specific hydrogeology, preferential pathways and potential receptors of impacts. • Monitoring bores installed near dams will have groundwater levels and relevant water quality parameters monitored on a routine basis. • The number of monitoring bores or associated monitoring frequencies will be increased and further investigation will be triggered where impacts are identified (Commitment C504).
R11141	S134	Arrow to provide the public with regular updates reporting the groundwater levels and water quality of the Walloon Coal Measures.	–	Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) the results of their Water Monitoring Strategy (WMS). Information relevant to the UWIR for the Surat CMA will be available on the OGIA website, including access to: <ul style="list-style-type: none"> • Current output from the regional groundwater flow model. • Monitoring data collected from the monitoring network. • Information about technical studies carried out by OGIA or studies on which OGIA expects to rely for future assessments.
R11142	S134	How often will groundwater monitoring be carried out by Arrow, and will there be a third party involved in the data collection and analysis of	–	Arrow's groundwater monitoring obligations are defined in Appendix G of the Surat Cumulative Management Area, Underground Water Impact Report, Where Arrow is identified as the responsible tenure holder required to

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R11142	S134	results?		conduct monitoring at wells in the regional monitoring network, water pressure is required to be monitored at least fortnightly, and water quality, either fortnightly or annually, depending on the water quality suite required.
R11143	S145	Arrow should implement a robust monitoring program to assess baseline groundwater levels and to monitor changes to water levels in aquifers and inter-aquifer flow. Contingency actions should be implemented in a timely manner.	–	The Water Act requires petroleum tenure holders to carry out baseline assessments of water bores on a tenure before production commences on the tenure. These baseline assessments are carried out in accordance with a baseline assessment plan approved by EHP and in accordance with guidelines issued by EHP. Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) the results of their Water Monitoring Strategy. The trends in the monitoring data will reflect the net effect of impacts from petroleum activities along with other factors such as agricultural use or seasonal conditions. Every year, OGIA will summarise and assess the predicted groundwater drawdown levels against the monitoring data provided. In addition, OGIA will obtain updated coal seam gas water production profiles from all proponents and run the regional groundwater flow model using the updated estimates and assess if changes to planned production within the Surat CMA result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11144	S111	There is no independent research and the government will not fund independent monitoring for bores that may be affected by coal seam gas drilling.	–	The Water Act requires petroleum tenure holders to carry out baseline assessments of water bores on a tenure before production commences on the tenure. These baseline assessments are carried out in accordance with a baseline assessment plan approved by EHP and in accordance with guidelines issued by EHP.
R11145	S123	To help assess and gain a better understanding how future development may be affected and measure the success of mitigation measures used, any monitoring and management of existing water resources (as per monitoring program) for existing wells in Tipton is requested. In particular, how and what management techniques will be used for proposed wells in similar conditions.	–	Arrow's groundwater monitoring obligations are defined in Appendix G of the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR). Through the periodic reporting and review requirements defined in the Surat CMA UWIR, coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) the results of their Water Monitoring Strategy. Information relevant to the UWIR for the Surat CMA will be available on the OGIA website, including access to monitoring data collected from the monitoring network.
R11146	S025	Comment to EHP regarding conditioning of groundwater impacts. The submitter requests that no further production wells be approved until sufficient monitoring bores are in place to more	–	The Water Monitoring Strategy (WMS) defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR) is designed to establish background groundwater trends (both groundwater levels and quality) in advance of predicted impacts occurring from coal seam

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R11146	S025	accurately predict the short term and residual impact of Arrow's dewatering of the Walloon Coal Measure groundwater.		gas water extraction. As such, Appendix G in the UWIR identifies the responsible tenure holders associated with each well in the regional monitoring network and the year in which they are required to complete installation of monitoring works and commence recording monitoring data.
R11147	S008, S010, S110	<p>Comments to EHP regarding conditioning groundwater impacts.</p> <ul style="list-style-type: none"> • Concerned that the regulator to date has refused to condition groundwater impacts in Environmental Authorities issued for coal seam gas activities. • The regulator should condition coal seam gas companies and not hide behind the Petroleum & Gas (Production and Safety) 2004 Act. • There must be conditions in any approval of this EIS which gives absolute protection to the groundwater resource; it is not acceptable to approve an impact which is assessed by unknowns. • There is no confidence in the groundwater model. The government must condition Arrow to ensure protection of the groundwater resource. 	SREIS Chapter 2, Section 2.3.2	<p>Important points associated with conditioning for the project by the regulator, and management of groundwater impacts are provided below:</p> <ul style="list-style-type: none"> • The Environmental Authority application or amendment application process described in SREIS Chapter 2, Project Approvals, Section 2.3.2, will result in a set of conditions related to the protection of groundwater values. • As defined under the Petroleum & Gas (Production and Safety) 2004 Act, proponents are authorised to take or interfere with groundwater as a function of activities associated with exploration for, and production of petroleum and gas. However, under the Water Act 2000 (Qld), petroleum tenure holders are required to monitor and manage any associated impacts on groundwater resources as a result of these activities. • In response to expansion of coal seam gas activities in the Surat and southern Bowen Basins, the Surat Cumulative Management Area (CMA) was established on 18 March 2011. The Office of Groundwater Impact Assessment (OGIA) subsequently prepared a numerical model and the associated final Underground Water Impact Report (UWIR), which was approved by the Chief Executive of EHP. On approval, the report has become a statutory instrument under the Water Act 2000 (Qld). • Obligations for individual petroleum tenure holders for activities arising from the UWIR are now legally enforceable. EHP is responsible for ensuring petroleum tenure holders comply with their obligations. • Through the periodic reporting and review requirements defined in the Surat CMA UWIR, coal seam gas proponents are required to provide OGIA with the results of ongoing monitoring programs, together with regular updates on changes to their plans for development, including predicted coal seam gas water extraction profiles. On an annual basis, OGIA will run the regional groundwater flow model using the updated estimates of planned production and assess if changes to planned production result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11148	S002, S010, S018, S019, S020, S030, S032, S034, S037, S039, S053, S055, S059, S064, S065,	<p>Comments to EHP regarding conditioning groundwater impacts.</p> <ul style="list-style-type: none"> • The government should exclude approval or apply appropriate enforceable conditions, in areas where there is potential to impact on the Condamine 	SREIS Chapter 8	Concerns related to potential impacts on the Condamine Alluvium are noted. Comparison of predicted groundwater drawdown levels in the Condamine Alluvium presented in the EIS and those produced by the SREIS model show that the EIS was based on more conservative drawdowns and therefore did not under-represent the impacts.

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R11148	S002, S010, S018, S019, S020, S030, S032, S034, S037, S039, S053, S055, S059, S064, S065, S069, S070, S076, S085, S088, S095, S096, S097, S098, S114, S139, S140, S149, S152, S154, S167	<p>alluvium.</p> <ul style="list-style-type: none"> • The government should exclude approval prior to the QCA's modelled predictions being proven to be correct. • If the extraction is to occur through the Condamine Alluvium, the project must be conditioned so that if drawdowns exceed those modelled by the draft Underground Water Impact Report the scope of the project must be wound back or discontinued immediately until drawdown's fall back below those estimated by the QCA report. • No coal seam gas activities should be approved where the Condamine Alluvium can be affected before community agreement has been reached on the modelled impacts and mitigation measures. • A condition of approval should be that no development should proceed on lands overlaying the Condamine Alluvium until better data is obtained in relation to actual drawdowns. 		<p>The Office of Groundwater Impact Assessment model results show that third-party bores accessing the Condamine Alluvium are not expected to observe a groundwater drawdown in excess of the 2 m trigger threshold within the next three years.</p> <p>A revised numerical groundwater model has been prepared for the SREIS that is based on the framework of the OGIA Surat CMA groundwater model. Predicted net flux estimates from the Condamine Alluvium based on Arrow only impacts are presented in SREIS Chapter 8, Groundwater.</p> <p>The numerical groundwater model for the SREIS also includes a mitigation scenario showing the predicted response in the Condamine Alluvium through the implementation of the substitution strategy. The results from this modelling scenario are contained in SREIS Chapter 8, Groundwater.</p> <p>Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).</p> <p>Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide OGIA with the results of ongoing monitoring programs, together with regular updates on changes to their plans for development, including predicted coal seam gas water extraction profiles. On an annual basis, the Office of Groundwater Impact Assessment (OGIA) will run the regional groundwater flow model using the updated estimates of planned production and assess if changes to planned production result in material changes to predicted Immediately Affected Areas and Long-term Affected Areas. Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.</p>
R11149	S008	<p>The Environmental Protection Act does give the regulator powers to condition the environmental value of water; those values include 'agricultural use' and 'drinking water' and the Condamine alluvium are renowned for both of these values. This issue alone is enough to stop this industry before endangering their underground aquifers.</p>	-	<p>Noted. The attributes of groundwater systems in the project development area and their ecological, biological, consumptive, productive, cultural and spiritual values are acknowledged in the EIS and SREIS.</p>
R11150	S002, S018, S019, S020, S030, S032, S034, S037, S039, S053, S055, S059, S064, S065, S069, S070, S076, S085,	<p>Compliance with commitments and mitigation actions outlined in the EIS must be a condition of the project. Specifically EIS Chapter 14, sections 14.6.3 to 14.6.6 (to minimise impacts regarding risks associated by contamination - direct or indirect) should be conditioned in any approval by</p>	-	<p>The administering authority will consider the proposed mitigation and management measures (commitments) in setting conditions of approval for the project.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11150	S002, S018, S019,	the regulator.		
R11151	S023, S086	Landholders are also very concerned about the risks associated by contamination, either direct (from use of chemicals, brine dam spills, fracing, etc; and indirect from the movement of poorer quality water from one aquifer to another. In its EIS, Arrow lists a whole range of measures to minimise impacts, and while these measures appear supportable, compliance with them must be a condition of the project rather than a commitment by Arrow.	EIS Chapter 14, sections 14.6.3 to 14.6.6	There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The pressure gradients are not conducive to movement of poorer quality groundwater in the Walloon Coal Measures into surrounding aquifers with generally better water quality (e.g., the overlying Springbok Sandstone and the underlying Hutton Sandstone). The significance of potential impacts to groundwater quality presented in the EIS is based on this process. Mitigation measures associated with the potential for project activities to have a direct impact on groundwater quality are identified in EIS Chapter 14, Groundwater, sections 14.6.3, 14.6.4, 14.6.5, and 14.6.6. The administering authority will consider the proposed mitigation and management measures (commitments) in setting conditions of approval for the project. Arrow will be subject to compliance conditions applied through a new environmental authority or an amendment to its existing environmental authority issued under the Environmental Protection Act 1994. Arrow anticipates that under the environmental authority it will be required to protect or enhance groundwater values and that this will be regulated and enforced by EHP.
R11152	S106	A practical condition of any coal seam gas production needs to be stipulated so 97 to 99% of all feed water produced needs to be treated to a potable or less standard as required by an end user, or injected into the Walloon Coal Measures at a site where earlier gas production has ceased and where the original water at that site was of equal or poorer quality than that being injected, within 1 to 24 months before evaporation occurs.	-	The Walloon Coal Measures is not a suitable target aquifer for injection because gas production relies on the removal of water from the coal seams. Coal seam gas production associated with the Surat Gas Project will occur concurrently with gas production associated with the APLNG, GLNG and QCLNG projects over a period of approximately 30 years. During this time, the Walloon Coal Measures will be depressurised to allow coal seam gas to be released from the coal seams. To return coal seam gas water to the formation via injection will only result in the need to remove it again as part of the gas production process. The injection of coal seam gas water into geographically remote sections of an already depleted section of the Walloon Coal Measures, should these be available in time, may seem reasonable but because of lateral connectivity through the coal measures, reinjected water would eventually migrate back to extraction points. The Queensland Government's Coal Seam Gas Water Management Policy (2012) requires proponents to identify, as their first priority, a use for coal seam gas water that is beneficial to one or more of the following: the environment, existing or new water users, and existing or new water-dependent industries. The treatment and use of coal seam gas water for a

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R11152	S106			wide variety of purposes aligns with this policy objective. Because of the potential for repeated removal of the same water, reinjection into the Walloon Coal Measures does not represent the best option for the environment.
R11153	S108	The use of the term 'where possible' should not be a condition of any environmental authority associated with the project – used in the context that 'Arrow seeks ('where possible' to manage coal seam water in such a way as to mitigate the impacts of groundwater depressurisation'.	–	The administering authority will consider the proposed mitigation and management measures (commitments) in setting conditions of approval for the project.
R11154	S143	Believe the project is inconsistent with the recent policy and management context (specifically the Great Artesian Basin and Condamine Balonne Water Resource Plan, ongoing investment in Great Artesian Basin Sustainability Initiative (GABSI) by government, investment by landholders, salinity investment by Murray-Darling Basin and investments in the Reef Rescue Great Barrier Reef catchment water quality program).	SREIS Chapter 8 and Chapter 19	SREIS Chapter 8, Groundwater describes updates to legislation relevant to groundwater since the release of the EIS, including the Murray-Darling Basin Plan and the role of associated Queensland water resource plans. The Great Artesian Basin Sustainability Initiative (GABSI) is not a statutory instrument. It is an initiative under the federal government to accelerate repairs on uncontrolled artesian bores and replacement of open drains to reduce wasteful use of groundwater sourced from the Great Artesian Basin. Arrow's management of coal seam gas water is not related to this initiative. The Reef Rescue Great Barrier Reef catchment water quality program aims to improve the quality of water entering the Great Barrier Reef Lagoon. The potential for the project to impact on water quality entering the Great Barrier Reef Lagoon is considered in SREIS Chapter 19, Submission Responses, Table 19.12.
R11155	S153	The SREIS should reference current and future government policies and the Gasfields Land & Water Commission. It should also have regard to matters addressed in the current government's policies and the manner in which these are likely to be administered by the Gasfields Land & Water Commission.	SREIS Chapter 8 and Appendix 4	Noted. SREIS Chapter 8, Groundwater, contains a summary of new, updated or revised legislation, policy and guidance information available since the release of the EIS.
R11156	S146	Has the administering authority been able to verify the suitability of the data used by Arrow, for groundwater resources?	SREIS Chapter 8 and Appendix 4	Since the release of the EIS, the Office of Groundwater Impact Assessment (OGIA) released the final Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA), which was subsequently approved by EHP. The UWIR is based on a numerical model prepared by OGIA, and the framework of the model forms the basis for the numerical groundwater model presented in the SREIS. Groundwater drawdowns predicted by the SREIS model are compared with the EIS model outputs in SREIS Chapter 8, Groundwater and Appendix 4, Supplementary Groundwater Assessment to show that the EIS was a conservative assessment.

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Issue No.	Submission No.	Issue	Reference	Responses
R11157	S153	Under current regulatory framework it is not clear how to know which company is responsible for making good, when the activities of more than one company (in the submitter's case, Arrow and QGC/Origin), have a negative impact. How will this issue be resolved?	–	The Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) defines the tenure holders responsible for fulfilling make good obligations. Arrow is required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. This is required to manage predicted reduced groundwater supply from existing bores. The bores located within the Immediately Affected Areas are identified in Appendix E of the UWIR, along with the current responsible tenure holder.
R11158	S141, S144	When the roles and responsibilities of the Queensland Gasfield Commission and the Queensland Water Commission are clarified further assessment should be undertaken.	SREIS Chapter 8	Noted. SREIS Chapter 8, Groundwater contains a summary of new, updated or revised legislation, policy and guidance information available since the release of the EIS.
R11159	S157	The Underground Water Impact Report released by the Queensland Water Commission (after the release of the EIS) does not adequately address the issues raised in EIS, Chapter 14, Section 14.6.2. The issue and relationship is actually made more confused.	SREIS Chapter 8	Additional clarity on the role of the Office of Groundwater Impact Assessment (OGIA), formerly the Queensland Water Commission, and how the requirements detailed in the now finalised and EHP-approved Underground Water Impact Report for the Surat Cumulative Management Area is provided in Chapter 8, Groundwater.
R11160	S157	Chapter 9 in the UWIR makes reference to make good measures, which are linked to the predictive power of the model in that it determines 'immediately affected areas.' Other issues raised by the submitter are believed to show that the model has severe limitations – specifically that the modelled drawdown in the Walloon Coal Measures is based on over simplified hydrogeological assumptions. Therefore is it improper for the make good obligations to not extend over the Walloon Coal Measures.	–	The Office of Groundwater Impact Assessment (OGIA) model was approved by EHP in December 2012 and now forms the regulatory framework for the management of groundwater resources within the Surat Cumulative Management Area (CMA). The model is considered appropriate by EHP for the proposed of regional groundwater modelling within the Surat CMA. In accordance with the Water Act 2000 (Qld), and as described in the Surat CMA Underground Water Impact Report (UWIR), Arrow (when identified as the responsible petroleum tenure holder) is required to undertake bore assessments in the Immediately Affected Area (IAA) (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. There are bores within the IAA that access the Walloon Coal Measures. Therefore, responsible tenure holders assigned under the UWIR to the bores extracting groundwater from the Walloon Coal Measures within the IAA are required to comply with these make good obligations, where the bore is identified as likely to experience impaired capacity, following the bore

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Issue No.	Submission No.	Issue	Reference	Responses
R11160	S157			assessments.
R11161	S157	The current legislation requires baseline bore assessment to be done by the bore owner. Based on the inadequacies of the UWIR and associated model, it is improper for the landholder to be responsible for the expenses related to the bore baseline monitoring. Therefore coal seam gas companies seeking to engage in production from the Walloon Coal measures should be obliged to engage in the proper baseline monitoring of the bores, and this information should be made available in the EIS. In the event of the need for make good measures, questions will be asked about the adequacy of the baseline monitoring. If this were to be conducted by the proponents themselves, or in conjunction with the bore owners (as opposed to the bore owner themselves), these concerns may be mitigated.	–	<p>Section 7.3.6 of the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA) defines the objectives and process for baseline assessments.</p> <p>The Water Act 2000 (Qld) requires petroleum tenure holders to carry out baseline assessments of water bores on their tenure before production commences on that tenure.</p> <p>The Water Act 2000 (Qld) also requires the Water Monitoring Strategy in the UWIR to contain a program for baseline assessments for private bores within the Long-term Affected Areas (LAAs). The LAAs extend beyond petroleum tenure areas, and impacts are predicted to occur in these areas sometime in the future. Baseline assessments need to be timed carefully, to obtain the most up to date information immediately prior to impacts occurring. As such, the UWIR identifies bores within the LAA requiring baseline assessments, as those bores with a predicted 1 m drawdown in the next 3 years. Figure 7-4 in the UWIR defines these areas, and the responsible tenure holder.</p> <p>The UWIR defines the baseline assessment program as follows:</p> <ul style="list-style-type: none"> • The baseline assessment area for an aquifer is an area where a water pressure decline of more than 1 m is expected within three years as shown in Figure 7-4. • Responsible tenure holders must carry out baseline assessments for bores tapping an aquifer within the baseline assessment area for the aquifer. • If a baseline assessment has already been carried out in accordance with other obligations arising under the Water Act, no further assessment is required. • The assessments are to be carried out in accordance with the guidelines for baseline assessments issued by EHP. • The baseline assessment must be completed and the results reported to the OGIA within 12 months of the UWIR being approved. • Each time the UWIR is reviewed, new baseline assessment areas will be established until the baseline assessment areas for an aquifer coincide with the entire LAA for the aquifer. • Baseline assessments are carried out in accordance with a baseline assessment plan approved by EHP and in accordance with guidelines issued by EHP.
R11162	S004, S006, S008, S034, S069, S088	Queensland Water Commission Surat Underground Water Impact Report provides some comfort of likely water level drawdowns, it is based almost exclusively on modelling and accuracy must be proven over time by tracking actual drawdowns against the modelled predictions.	–	<p>It is normal for groundwater models to be calibrated to the available data, and then over time, to be 'validated' as new data become available. This allows for the model to be recalibrated if necessary, therefore improving predictions. Hence, the approach is considered adaptive.</p> <p>Through the periodic reporting and review requirements defined in the Surat Cumulative Management Area (CMA), Underground Water Impact Report</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R11162	S004, S006, S008, S034, S069, S088			(UWIR), coal seam gas proponents are required to provide the Office of Groundwater Impact Assessment (OGIA) regular updates on changes to their plans for development, including predicted coal seam gas water extraction profiles. On an annual basis, OGIA will run the regional groundwater flow model using the updated estimates of planned production and assess if changes to planned production result in material changes to predicted Immediately Affected Areas (IAA) and Long-term Affected Areas (LAA). Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11163	S010	Data used to inform the Queensland Water Commission model is either old or not yet known. It will be many years before the Queensland Water Commission has the real data from the as yet largely uninstalled monitoring systems and the actual water extractions to inform the model.	–	The Underground Water Impact Report (UWIR) released by the Office of Groundwater Impact Assessment (OGIA), formerly the Queensland Water Commission, specifies the timing of the installation of the additional monitoring network at various locations. In many areas monitoring is already underway, and additional monitoring points are being incorporated. Priority areas for monitoring installation have been specified in the UWIR based on modelling and the identification of Immediately Affected Areas (IAA). Petroleum tenure holders, such as Arrow, are obligated to comply with the monitoring requirements of the UWIR.
R11164	S010	Chapter 4.4.1 of the Queensland Water Commission report highlights the amount of unknowns regarding the relationship between the Walloon Coal Measures and the Condamine Alluvium. This highlights the need for the Condamine Alluvium to be excluded from any approvals.	SREIS Chapter 8	The EIS presents predicted drawdown in the Condamine Alluvium as a result of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicate that under the cumulative modelling scenario, maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) show maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most if the Surat Cumulative Management Area (CMA). These predicted drawdown levels are manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures. Additional information on the degree of connectivity between the Condamine Alluvium and the Walloon Coal Measures is presented in SREIS, Chapter 8, Groundwater. Additional investigations are also underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS, Chapter 8, Groundwater. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).

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Issue No.	Submission No.	Issue	Reference	Responses
R11165	S031	Unsatisfied that the EIS bases groundwater related mitigation measures on a draft document (Draft Queensland Water Commission Underground Water Impact Report). There are no mitigation measures presented by Arrow that would otherwise be contained in a finalised Underground Water Impact Report prepared by the Queensland Water Commission.	EIS Chapter 14 SREIS Chapter 8	EIS Chapter 14, Groundwater identified a range of mitigation measures and monitoring obligations required to address project-related impacts. At the time the EIS was prepared, the Queensland Government had established a cumulative management area (CMA) for the Surat and southern Bowen Basin areas, and the Queensland Water Commission (QWC) (now the Office of Groundwater Impact Assessment (OGIA)) was responsible for the preparation of underground water impacts reports (UWIR) associated with this CMA. The EIS acknowledged Arrow's obligations under this regulatory framework, however, the UWIR had not yet been released. The draft UWIR for the Surat CMA was released on 17 May 2012, and approved by EHP (after a period of consultation) on 1 December 2012. The Surat CMA UWIR contains detailed information on Arrow's obligations where they are identified as the responsible tenure holder. The SREIS Chapter 8, Groundwater, identifies new and revised commitments based on the information now available and Arrow's revised development plan.
R11166	S051	There is no comfort from having the Queensland Water Commission as they are only an advisory body.	–	The Office of Groundwater Impact Assessment (OGIA) was established in place of the former Queensland Water Commission, and the model presented in the Underground Water Impact Report (UWIR) was approved by EHP in December 2012 and now forms the regulatory framework for the management of groundwater resources within the Surat Cumulative Management Area (CMA). EHP is required to enforce the requirements set out in the UWIR, and coal seam gas proponents are already regulated under this process.
R11167	S108	The Queensland Water Commission is yet to complete the well installations needed to calibrate their model, and it appears that the Queensland Water Commission model did not account for Arrow extraction activities beneath the Condamine Alluvium. This has implication for landholders, but also the Murray Darling Basin Plan.	–	The Water Monitoring Strategy (WMS) defined in the Surat Cumulative Management Area (CMA) Underground Water Impact Report (UWIR) is designed to establish background groundwater trends (both groundwater levels and quality) in advance of predicted impacts occurring from coal seam gas water extraction. As such, Appendix G in the UWIR identifies the responsible tenure holders associated with each well in the regional monitoring network and the year in which they are required to complete installation of monitoring works and commence recording monitoring data. Arrow groundwater extraction for their coal seam gas developments were provided to the Queensland Water Commission, now the Office of Groundwater Impact Assessment (OGIA), for inclusion in the model. The OGIA model therefore accounts for coal seam gas extraction from the Walloon Coal Measures in areas beneath the Condamine Alluvium.
R11168	S157	Arrow refers to the then-to-be released Underground Water Impact Report prepared by the Queensland Water Commission, indicating that many of the requirements of the Queensland Water	–	The Office of Groundwater Impact Assessment (OGIA) model was approved by EHP in December 2012 and now forms the regulatory framework for the management of groundwater resources within the Surat Cumulative Management Area (CMA).

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R11168	S157	Commission will form the basis for Arrow's monitoring network etc. However, the concerns of groundwater impacts related to the project should not be downplayed by any decision maker on the assumption that such matters are in some way cured by the Underground Water Impact Report and Queensland Water Commission. The Underground Water Impact Report lists the limitation associated with the report, and is tainted by the lack of available data, and the inability of the reader to fully understand data provided by other proponents (i.e. have they provided field development information different to that presented in their respective EISs? How has data been sorted, assessed, verified? With insufficient data, the model may produce results that do not in any way reflect the true nature of the subject under analysis.		The groundwater model presented in the SREIS is based on the OGIA model and contains Arrow's current development plan, along with more detailed production forecasts for the other coal seam gas proponents than those presented in the EIS. Through the periodic reporting and review requirements defined in the Surat CMA Underground Water Impact Report (UWIR), coal seam gas proponents are required to provide OGIA regular updates on changes to their plans for development, including predicted coal seam gas water extraction profiles. On an annual basis, OGIA will run the regional groundwater flow model using the updated estimates of planned production and assess if changes to planned production result in material changes to predicted Immediately Affected Areas (IAA) and Long-term Affected Areas (LAA). Where there is material change, new predictions will be submitted to EHP, along with the summary of monitoring results. The management and monitoring requirements defined in the UWIR may also be revised accordingly to account for the revised model predictions.
R11169	S157	The Underground Water Impact Report and associated model produced by the Queensland Water Commission is inadequate. Specifically in relation to the Walloon Coal measures, page 48 of the Underground Water Impact Report states that the hydrogeology of the Walloon Coal Measures is particularly complex, but that the model cannot fully represent this complexity. Therefore the coal measures are assumed to be represented by 3 layers. It is inappropriate to simply "assume" that data in a complex system mirrors that of a more simple system. While a sub-model was created for the Condamine Alluvium, no sub-model was created for the Walloon Coal Measures, despite being noted as an idiosyncratic area. Subsequent calibration (as detailed on Section 6.2.2) is also assumed to be inadequate and inaccurate due to the issues identified above.	-	The Office of Groundwater Impact Assessment (OGIA), formerly the Queensland Water Commission, model was approved by EHP in December 2012, and now forms the regulatory framework for the management of groundwater resources within the Surat Cumulative Management Area. The groundwater model presented in the SREIS is based on the OGIA model and contains Arrow's current development plan, along with more detailed production forecasts for the other coal seam gas proponents, than those presented in the EIS.
R11170	S141, S144	Given the fact that the Queensland Water Commission impact report which was released since this EIS was developed, the assessments and assertions provided in this EIS need to be recaster and further consultation undertaken.	SREIS Chapter 8	Noted. The groundwater model prepared for the SREIS is based on the Office of Groundwater Impact Assessment (OGIA) model, as described in SREIS Chapter 8, Groundwater.

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R11171	S106	In Figure 14.4 the outcropping Walloon Coal Measure shown, suggests the third dot point, in Table 8 of the EIS Executive Summary, is incorrect and that this aquifer system is at least partly unconfined, and should not be considered confined until some distance west (where the Westbourne Formation can be considered a significant aquitard).	–	From a regional standpoint, the Walloon Coal Measures are confined beneath significant thicknesses of overlying formations. However, like all confined aquifers that outcrop or subcrop, a transition to unconfined conditions can occur locally. Overall, however, this formation is considered as a confined aquifer system.
R11172	S106	There is no figure provided to demonstrate the limited extent and thickness of the Eurombah Formation beneath the Walloon Coal Measure and unacceptable stress levels placed upon the Hutton s/s where average drawdown has been estimated at an unacceptable 20 m, with undesirable drawdown greater than 0.5 m extending more than 2 km from production wells up to 80 km.	EIS Chapter 14, Figure 14.3 and Appendix G, appendix B, figures 3.2 and 3.3 and Table 2.3 SREIS Chapter 8	As described in EIS Appendix G, Groundwater Impact Assessment, appendix B, Table 2.3, the Eurombah/Durabilla Formations are included as a formation within the Walloon Coal Measures for the purposes of modelling and conceptualisation of the stratigraphy. This is also reflected in EIS Chapter 14, Groundwater, Figure 14.3. The Eurombah/Durabilla Formations are also shown in figures 3.2 and 3.3 of the EIS, Appendix G, Groundwater Impact Assessment, Appendix B. Revised drawdown predictions for the Hutton Sandstone are presented in the SREIS groundwater model, and discussed in SREIS Chapter 8, Groundwater.
R11173	S024, S025, S026, S036, S054, S081, S083	What is the maximum thickness of shallow groundwater systems?	EIS Chapter 14, Figure 14.3	The EIS Chapter 14, Groundwater, Figure 14.3, provides approximate thickness of each groundwater system (including the shallow groundwater system). The shallow groundwater system has an approximate thickness of 150 m.
R11174	S005, S024, S025, S026, S036, S054, S081, S083	Concerned that the EIS does not clearly explain that not just the deep groundwater system forms part of the Great Artesian Basin. Requests that the EIS clearly states that the intermediate and coal seam gas groundwater systems are part of the Great Artesian Basin as defined in the Great Artesian Basin resource operations plan. Requests that a cross section should be produced to show this.	EIS Chapter 14, Section 14.3.2	The aquifers that make up the Great Artesian Basin are defined in the Water Resources (Great Artesian Basin) Plan 2006. Groundwater resources that form part of the Great Artesian Basin, and are present within the project development area (see EIS Chapter 14, Groundwater, Section 14.3.2), were included in the numerical groundwater model that was prepared for the EIS.
R11175	S106	Concerned the information contained in Table 8 of the EIS Executive Summary, specifically the third dot-point presented for the intermediate groundwater system is incorrect as it states there is no physical connection with surface feature, however, the Gubberamunda Sandstone outcrops along one-third of the cross-section shown in Figure 14.4.	SREIS Chapter 8	Noted. The Executive Summary presents a summary of the EIS Chapter 14, Groundwater, and the intent of that dot point was to reflect that there are no known areas of physical connection between this particular groundwater system and features with ecological value at the surface. Additional information on the degree of connectivity between groundwater systems and surface ecological features is presented in SREIS Chapter 8, Groundwater.
R11176	S106	Argues work should not be carried out beneath or	SREIS	The EIS presents predicted drawdown in the Condamine Alluvium as a result

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R11176	S106	in the vicinity of the Condamine Alluvium throughout the proposed Millmerran/Kogan and Dalby regions as thicknesses described are inaccurate and even 1 m of drawdown would be significant because of the reduced thickness of the strata.	Chapter 8	of coal seam gas extraction from the underlying Walloon Coal Measures. The results indicate that under the cumulative modelling scenario, maximum drawdown of 2.5 m would be limited to the western extent of the Condamine Alluvium. Outputs from the cumulative modelling scenario prepared by the Office of Groundwater Impact Assessment (OGIA) and presented in the Underground Water Impact Report (UWIR) show maximum drawdown of approximately 1.2 m along the western extent of the Condamine Alluvium, with an average drawdown of approximately 0.5 m for most if the Surat Cumulative Management Area (CMA). These predicted drawdown levels are manageable and are based on a conservative assessment of the level of connectivity between the Condamine Alluvium and the Walloon Coal Measures. Additional information on the degree of connectivity between the Condamine Alluvium and the Walloon Coal Measures is presented in SREIS, Chapter 8, Groundwater. Additional investigations are also underway in relation to the degree of interconnectivity between these two units, as detailed in SREIS, Chapter 8, Groundwater. Arrow is committed to offsetting its component of modelled likely flux impacts to the Condamine Alluvium in the area of greatest predicted drawdown as a result of coal seam gas water extraction from the Walloon Coal Measures (Commitment C565).
R11177	S106	The Terms of Reference, Section 4.2.1.2 is not met as Chapter 14, Section 14.3.2, Figure 14.4 cross-section is inaccurate and misleading, not showing Mooga s/s in the development area nor is the Walloon Coal Measure to be accessed east of the Condamine alluvium.	EIS Chapter 14, Figure 14.4 and Appendix G	EIS Chapter 14, Groundwater, Figure 14.4, does show that the Mooga Sandstone is present in the eastern area of the project development area. This cross section however, is a schematic conceptual representation of all the formations that occur within the project area, and their vertical juxtaposition within the sedimentary sequence. It is not intended to imply that these formations are always present. The lateral spatial extent of formations and aquifers is described in other sections of the EIS, including EIS Appendix G, Groundwater Impact Assessment.
R11178	S106	Concerned the Westbourne Formation only underlies 30% of the Condamine Alluvium and is very much thinner than suggested in Figure 8 of the EIS Executive Summary.	SREIS Chapter 8	A revised cross section reflecting additional information on the relationship between the Condamine Alluvium and underlying formations is presented in SREIS Chapter 8, Groundwater.
R11179	S079, S143	Insufficient detail provided on the thickness of shallow groundwater system (Condamine Alluvium). Arrow state that the Condamine Alluvium is up to 150 m thick and has limited potable use of the water. However the Queensland Water Commission states that this alluvium is mainly 30 m to 60 m and up to 130 m at maximum thickness and is utilised for domestic purposes.	SREIS Chapter 8	The sequence of alluvial sediments is up to 150 m thick according to the Upper Condamine Groundwater Model Calibration Report (Barnett and Muller, 2008). Actual interpreted thicknesses may vary depending on the information source and the age of the document. The Underground Water Impact Report (UWIR) prepared by the Office of Groundwater Impact Assessment (OGIA) adopted an average thickness of between 30 and 60 m, with a maximum thickness of 130 m. This information was also used in the groundwater model prepared for the SREIS, with more detailed information on the inferred changes in the

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R11179	S079, S143			thickness of the Condamine Alluvium as presented in SREIS Chapter 8, Groundwater. This figure shows that the Condamine Alluvium can reach approximately 150 m in thickness in limited areas near Dalby.
R11180	S143, S146	Chapter 4 fails to acknowledge that the groundwater resources described are all part of the Great Artesian Basin and are covered under the Great Artesian Basin Water Resources Plan and Resource Operations Plan. Potential impacts to the Great Artesian Basin should be addressed. The Water Resource section of Arrow's EIS needs to be reworded to recognise all the formations that form the Great Artesian Basin. Concerned that Arrow does not recognise the extent of the Great Artesian Basin water resource and therefore is unable to establish the risk from coal seam gas extraction to aquifers of the Great Artesian Basin.	EIS Chapter 14, Section 14.3.2 SREIS Chapter 8	The aquifers that make up the Great Artesian Basin are defined in the Water Resources (Great Artesian Basin) Plan 2006. Groundwater resources that form part of the Great Artesian Basin, and are present within the project development area (see EIS Chapter 14, Groundwater, Section 14.3.2), were included in the numerical groundwater model that was prepared for the EIS. Given the application of mitigation measures as presented in the EIS it was found that impacts to groundwater values were manageable. The SREIS presents a revised groundwater model, which is based on the Queensland Government Office of Groundwater Impact Assessment model, approved by EHP in December 2012. SREIS Chapter 8, Groundwater describes the results of this model.
R11181	S130	Condamine Alluvium should be identified as being part of the Great Artesian Basin.	–	The aquifers that make up the Great Artesian Basin (GAB) are defined in the Water Resources (Great Artesian Basin) Plan 2006. Although the Condamine Alluvium is located within the same geographical area as the parts of Great Artesian Basin, it is not defined as part of the Great Artesian Basin because it is an unconfined alluvial aquifer of limited lateral extent, as opposed to the regionally extensive, confined aquifer systems of the Great Artesian Basin.
R11182	S106	Requests a series of more than 15 detailed East-West cross-sections should be provided for all the proposed development areas south of Dalby prior to any production.	SREIS Appendix 4	Noted. Available cross sections developed since the preparation of the EIS are presented in SREIS Appendix 4, Supplementary Groundwater Assessment.
R11183	S106	To offer Figure 14.3 as something that satisfies the Terms of Reference, Section 4.5.1.2 "depth to and thickness of the aquifer" is not satisfactory. Cross sections need to be run along the northern, middle and southern thirds of the proposed development area similar to those produced for Figures 3.2 and 3.3 in EIS Appendix G, Appendix B so as the most relevant cross sections are provided.	EIS Appendix G, sections 3 and 4 and appendix B	Cross-sections are provided in the modelling report appended to EIS Appendix G, Groundwater Impact Assessment. In addition, descriptions of the formations including depth and thickness are provided in the text, for example, refer to EIS Appendix G, Groundwater Impact Assessment, Section 3 (Geology) and Section 4 (Hydrogeology). Figures showing geological top surfaces, extent and thickness of all key aquifer formations are also provided in the Schlumberger modelling report (EIS Appendix G, Groundwater Impact Assessment, appendix B).
R11184	S106	The stratigraphy log of the Westbourne Formation aquitard (Figure 8 and Figure 14.3) is shown to have an approximate average thickness of 150 m within the proposed project development area. This	EIS Chapter 14, Figure 14.3 and Appendix G SREIS	The stratigraphic column presented as EIS Chapter 14, Groundwater, Figure 14.3, is used to provide a schematic conceptualisation of all the formations that occur within the project area, and their vertical juxtaposition within the sedimentary sequence. It is not intended to imply that these formations are

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R11184	S106	would suggest it would be difficult for the waters of the Condamine Alluvium to drain into the Walloon Coal Measure. The reality is a different story. The figure of 150 m may be correct for the Westbourne Formation across the area encompassed by the geological model boundary (including the strata up to 400 km west of the proposed project development area, where the strata is more than 100 m thick across) however that strata is only present in approximately 50% of the project area and has an average thickness of less than 70 m.	Chapter 8	always present. The lateral spatial extent of formations and aquifers is described in other sections of the EIS, including EIS Appendix G, Groundwater Impact Assessment. A revised cross section reflecting additional information on the relationship between the Walloon Coal Measures and the Condamine Alluvium is presented in SREIS Chapter 8, Groundwater.
R11185	S113	A map should be provided outlining where aquifers are directly interconnected or where large pressure differences over a large area are currently providing for inter aquifer flow and extent thereof. Additionally, these areas must also be identified and charted once the Walloon coal measures have been de-pressurised as a result of gas mining occurring.	SREIS Chapter 8 and Appendix 4	There are inherent levels of connectivity between formations in the project development area and broader Surat Cumulative Management Area (CMA). When coal seam gas and water are extracted from the Walloon Coal Measures, a pressure gradient will be generated such that groundwater in overlying and underlying aquifers will migrate towards the Walloon Coal Measures at various rates. The thickness and extent of the geological formations included in groundwater models can be useful in helping to understand the distribution of formations and interpreting connectivity. While the groundwater model prepared for the SREIS covers a regional area (the Surat CMA), and therefore cannot represent local-scale variations in the degree of connectivity between geological formations, it does predict the flux between layers, as contained SREIS Appendix 4, Supplementary Groundwater Assessment. The issue of aquifer connectivity is recognised as important, and SREIS Chapter 8, Groundwater, contains information on additional investigations in relation to this topic.
R11186	S113	EIS Chapter 14, Figure 14.3 needs to be corrected. The depth range of the Walloon Coal measures does not account for many areas where the coal seams are only approximately 150 m deep. In these areas percolation of coal seam gas to the surface seems more likely from shallow coal seam than a deep seam. This process cannot be a naturally occurring event once the gas mining depressurises the aquifer.	EIS Chapter 14, Figure 14.3 and Appendix G SREIS Chapter 8	The stratigraphic column presented as EIS Chapter 14, Groundwater, Figure 14.3, is used to provide a schematic conceptualisation of all the formations that occur within the project area, and their vertical juxtaposition within the sedimentary sequence. It is not intended to imply that these formations are always present at the depths shown. The vertical extent of formations and aquifers is described in other sections of the EIS, including EIS Appendix G, Groundwater Impact Assessment. SREIS Chapter 8, Groundwater, presents additional information on the potential for gas migration to occur as a result of coal seam gas production, and areas of future research related to this topic.
R11187	S139, S148, S154, S157	The conceptual geological model (the representation of aquifers and aquitards, thicknesses and distribution) is inaccurate, showing	EIS Chapter 14, Figure 14.3 and Appendix G	The stratigraphic column presented as EIS Chapter 14, Groundwater, Figure 14.3, is used to provide a schematic conceptualisation of all the formations that occur within the project area, and their vertical juxtaposition within the

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R11187	S139, S148, S154, S157	formations in areas where they are known not to exist. For example, the Precipice Sandstone does not exist in the Millmerran Area.		sedimentary sequence. It is not intended to imply that these formations are always present. The lateral spatial extent of formations and aquifers is described in other sections of the EIS, including EIS Appendix G, Groundwater Impact Assessment.
R11188	S113	Told by Arrow that two licensed (150 m) bores near to Tipton gas field were in Walloon coal measures and likely to be severely impacted by coal seam gas production as a result of Queensland Water Commission's report. Will these bores become gas wells in the next five years?	–	<p>Any impaired capacity in these wells as a result of coal seam gas activities will be managed by the responsible tenure holder assigned to those wells, as defined in the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA).</p> <p>It is unlikely that these bores will be converted into coal seam gas production wells, as they are unlikely to meet the design and construction requirements. Within the Surat CMA, individual petroleum tenure holders are identified as the tenure holders responsible for specific activities, including make good obligations. Responsible tenure holders identified in the UWIR are required to undertake bore assessments in the Immediately Affected Area (as defined by the UWIR) to evaluate whether bores are likely to experience an impaired capacity i.e., no longer be able to supply the quantity or quality of water it is authorised for as a result of extraction of water during production of coal seam gas. If an impaired capacity is identified, the tenure holder must negotiate a make good agreement with the bore owner. The make good agreement must then be implemented to ensure management and continuity of groundwater supply prior to impacts occurring.</p> <p>Obligations for individual petroleum tenure holders for activities arising from the UWIR are legally enforceable, and EHP is responsible for ensuring petroleum tenure holders comply with their obligations.</p> <p>The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the specific situation and may include (in descending order of preference):</p> <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation (considerate of the use of the bore).

Table 19.12 Surface water

Issue No.	Submission No.	Issue	Reference	Responses
R12001	S053, S108	Any road or pipeline access to and on the property would potentially cause water ponding and subsequent erosion. A 20-m right-of-way (ROW) for pipelines, elevation of access roads above the level of the fields and the differing road surface will alter surface water flow patterns in the catchment system, causing increased erosion which cannot be effectively managed.	EIS Chapter 13, sections 13.4.6, 13.6.2, 13.6.3, 13.6.4 and Chapter 15, Section 15.6.1 SREIS Attachment 4	Existing access tracks and trafficked areas will be used where possible (Commitment C088). Arrow will develop construction methods and design access tracks in cultivation paddocks to maintain the existing hydrologic and hydraulic regime of the site and in a way that does not cause erosion (Commitment C089). Arrow will develop an erosion and sediment control plan and install and maintain appropriate site specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). Arrow will locate pipelines to avoid or reduce the impact on irrigation flow or current farming practices (Commitment C047). Pipeline trenches will be backfilled in a manner that promotes successful rehabilitation, including capping of exposed subsoil with topsoil and replacement of the land surface to preconstruction levels to reduce trench subsidence and concentration of flow (Commitment C071). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12002	S086	Trench blocks to prevent subsurface water flows and erosion along trenches won't be effective on flood plains or irrigation fields. This practice will divert water flows creating erosion in other places or stop irrigation runs.	EIS Chapter 13, Section 13.6.4	Arrow has committed to prevent subsurface water flows and erosion along backfilled trenches by appropriate means, such as trench blocks and compaction of backfilled soils (Commitment C503). Arrow recognises that alternative mitigation measures may need to be implemented if the use of trench blocks is inappropriate in certain areas.
R12003	S150	The proposed erosion control measures should aim to avoid discharge of sediment-laden water to local watercourses rather than merely limiting discharge to those watercourses.	EIS Chapter 15, Section 15.6.1 SREIS Attachment 4	Arrow will prepare an erosion and sediment control plan and install and maintain appropriate site specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). The erosion and sediment control plan will include measures to prevent the discharge of sediment-laden water to local watercourses.
R12004	S162	If the effects from the project accelerate surface water velocity above 0.3 m/s, the resulting erosion will not only impact the coal seam gas project, it will heavily impact the area down slope from the initial site.	EIS Chapter 12, Section 12.6.2 and Chapter 15, sections 15.6.1, 15.6.2 and 15.6.4 SREIS Attachment 4	Water from project activities will be discharged at a rate and location that will not cause or exacerbate erosion. Erosion protection measures, including energy dissipation structures will be installed at discharge outlets (Commitment C066). An erosion and sediment control plan will be developed, and Arrow will install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). Project activities also have the potential to interfere with overland flow. Arrow will avoid disrupting overland natural flow paths, and where avoidance is not practical, undertake actions to maintain connectivity of flow in watercourses (Commitment C053).
R12005	S121	The EIS should include additional information	EIS	At the time the EIS was published, there was no publically available flood

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R12005	S121	relating to the natural hazard management area – identifying land inundated by a defined flood event on a map or aerial photograph.	Chapter 15, sections 15.6.1, 15.6.3 and Appendix H, Section 4.6 SREIS Chapter 9, Section 9.5	mapping for the areas of the sub-basins covered by the project development area, except for parts of the Condamine River sub-basin (EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology, Section 4.6). Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Flood modelling of these locations has been undertaken for the SREIS. Within each facility location, areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13. Further flood assessments will be undertaken to inform the site selection for additional facilities.
R12006	S121	The EIS should include evidence that flood free access is available to remove personnel to higher ground in the likelihood of a flood event.	EIS Chapter 15, sections 15.6.1, 15.6.3 and Chapter 25, Section 25.6.2 SREIS Chapter 9, Section 9.5 and Attachment 4	Further flood modelling of four potential central gas processing sites and temporary workers accommodation facility site has been undertaken since the publication of the EIS. Within each facility location, areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. Refer to SREIS Chapter 9, Surface Water, Figures 9.11, 9.12 and 9.13. When selecting facility locations, Arrow will site facilities above the 1-in-100-year average recurrence interval flood event where practicable and will design infrastructure taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas (Commitment C155). Arrow will develop emergency response plans in consultation with emergency services organisations that include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including flooding). Emergency plans will also include safe evacuation procedures and communication protocols (Commitment C424). When developing plans, Arrow will consider flooding regimes that have been informed by flood mapping and modelling.
R12007	S050, S162	Chapter 15 seems to give little regard to the alluvial floodplain and the surface water issues involved. It is incomplete and is purely based around water bodies and streams without any discussion of the movement of surface water across the floodplain and the project's impacts to this. The chapter is incomplete and does not give faith that Arrow will control runoff and erosion at their worksites on the Jimbour floodplain.	EIS Chapter 12, Section 12.6, Chapter 13, Section 13.6.2 and Chapter 15, sections 15.6.1 and 15.6.4 SREIS Chapter 3, Section 3.2, Chapter 9, Section 9.5, Appendix 5, Section 5 and Attachment 4	Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1. Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practicable, maintain connectivity of flow in watercourses (Commitment C053). Landholders will be consulted for their local knowledge of overland flow regimes which occur on their properties. In regards to erosion caused by uncontrolled runoff, Arrow will develop erosion and sediment control plans as necessary and install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). Further detail of erosion management controls is provided in EIS Chapter 12, Soils, Landform and

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Issue No.	Submission No.	Issue	Reference	Responses
R12007	S050, S162			Geology, Section 12.6. Further flood modelling of four potential central gas processing sites and a potential temporary workers accommodation facility site has been undertaken since the publication of the EIS with results presented in SREIS Chapter 9, Surface Water, Section 9.5 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5. In addition to riverine flooding, these models also consider rainfall runoff in order to determine overland flow paths. Facilities will be designed to reduce impacts to overland flow and will be sited outside of the modelled 1-in-100-year average recurrence interval flood extents where practicable. Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12008	S072	Limited information is presented on how construction and operations within the Captains Mountain area will impact on erosion, water run-off alteration, and impact upon Bora Creek. This should be addressed in the EIS. The potential for problems to be caused by installation of production wells, underground gathering lines and roads is a lot higher in such areas.	EIS Chapter 12, Section 12.6	Specific locations for infrastructure in the area of Captains Mountain and Bora Creek have not been determined. Notwithstanding this, EIS Chapter 12, Geology, Landform and Soils, Section 12.6 sets out the processes that will be put in place to manage erosion, including in more sensitive environments.
R12009	S079	Disposal of coal seam gas water to watercourses poses serious risks to the environment and to people's health as this water may be used for human consumption or irrigation.	EIS Chapter 15, sections 15.6.1 and 15.8 SREIS Chapter 9, Section 9.6 and Attachment 4	Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation (Commitment C498) including the Environmental Protection Act 1994 (Qld)(EP Act) and the Water Supply (Safety and Reliability) Act 2008 (Qld), which are set to pose minimal risks to human health and irrigation. The volume and quality of coal seam gas water released to surface waters will be measured on a routine basis in accordance with legislative requirements and approved release limits (Commitment C529). The discharge strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. (Commitment C498). The implementation of the strategy and the monitoring program will monitor water quality parameters in the receiving watercourse during coal seam gas water discharges.
R12010	S079	How will disposal to watercourses be monitored?	EIS Chapter 15, Section 15.8 SREIS Chapter 9, Section 9.6 and Attachment 4	The distribution or disposal of coal seam gas water to watercourses will be outlined in an Environmental Management Plan implemented following EIS approval. Procedures will involve: • Monitoring of the physical form integrity, hydrology, turbidity and pH, upstream and downstream of locations where water is to be discharged

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R12010	S079			<p>directly to a watercourse (Commitment 527).</p> <ul style="list-style-type: none"> • Routine measurement of the volume and quality of coal seam gas water released to surface waters in accordance with legislative requirements and approved release limits (Commitment C529). • As part of a discharge strategy, incorporation of a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. Periodic inspections of the physical form and hydrology of the watercourse will also be incorporated in the strategy to monitor geomorphic performance. (Commitment C498).
R12011	S079	What are the penalties to companies that do not follow the guidelines of disposal to watercourses?	–	The regulatory requirements for release of coal seam gas water to watercourses are outlined in the EP Act and the <i>Water Supply (Safety and Reliability) Act 2008</i> and failure to comply with these requirements constitutes an offence under these acts.
R12012	S079	How much and how often will coal seam gas water be able to be released into watercourses?	SREIS Chapter 9, Section 9.6, Appendix 5, Appendix 6, Appendix 7 and Attachment 4	<p>Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).</p> <p>Further assessment of the potential impacts of discharge to watercourses has been undertaken for the SREIS. Two receiving environments have been investigated, based on two potential water treatment facility sites, which have been identified since the publication of the EIS. The assessment includes characterisation of the physical, chemical and ecological aspects of the receiving environment, to help inform the determination of appropriate release limits and conditions. The results of the assessment are described in SREIS Chapter 9, Surface Water, Section 9.6 and SREIS Surface Water Appendices 5, 6 and 7.</p>
R12013	S119	The construction of wells, gathering lines and production facilities should avoid, minimise and mitigate potential impacts to the physical form or water quality from pipeline or vehicle watercourse crossings that cause bed or bank erosion and result in the mobilisation of sediment.	EIS Chapter 15, sections 15.6.1 and 15.6.2 SREIS Attachment 4	Arrow has committed to construct watercourse crossings in a manner that reduces sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation (Commitment C164). Arrow will delay clearance of stream banks until the watercourse crossing is due to be constructed (to the greatest extent practicable) and implement appropriate erosion and sediment control measures on watercourse approaches and banks and ensure prompt completion of construction (Commitment C162).
R12014	S119	Changes to the physical form of waterways due to scour and generation of sediment at waterway crossings caused by the use and maintenance of	EIS Chapter 15, sections 15.6.2 and 15.8	As described in EIS Chapter 15, Surface Water, Section 15.6.2, Arrow will consider bank and stream bed stability when siting watercourse crossings, where practicable (Commitment C160). During operations, dust suppression

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Issue No.	Submission No.	Issue	Reference	Responses
R12014	S119	access tracks during operation and decommissioning of the project should be avoided, minimised and mitigated.	SREIS Attachment 4	measures will be used on roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012). Appropriate erosion and sediment control measures (e.g., silt fences, sediment basins and erosion berms) will be implemented on watercourse approaches and banks (Commitment C162). Arrow will inspect erosion and sediment control measures following significant rainfall events and carry out repairs and/or maintain as required to retain the effectiveness of the measures (Commitment C505).
R12015	S119	The Coordinator General should consider conditions that require the following: <ul style="list-style-type: none"> • Any waterway works, stream crossing or waterway diversion provide for fish passage. • Any waterway works, stream crossing or waterway diversion minimise and mitigate any impacts upon waterway habitats. • Any waterway diversion includes the creation of similar natural habitats and conditions to the original waterway. • Any disturbances of waterways adjacent to any permanent waterway works and or stream crossings include measures to promote regeneration of natural waterway habitats adjacent to the structures. • Decommissioning of any temporary waterway works and or stream crossings include measures to support regeneration of natural waterway habitats. 	EIS Chapter 15, sections 15.6.1, 15.6.2 and Chapter 16, Section 16.6.4 SREIS Attachment 4	Arrow has made the following commitments in relation to the construction of watercourse crossings: <ul style="list-style-type: none"> • Design flumes used to construct watercourse crossings to a suitable size to maintain flows and enable fish passage. Protect the bed of the watercourse from scouring at the site of the downstream discharge of any flumes or pipes (Commitment C196). • In order to maintain the condition of the original watercourse, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (Commitment C152). • To promote regeneration of natural waterway habitats, site-specific management plans will be developed for permanent and semi-permanent watercourse crossings detailing construction and environmental management requirements (Commitment C158). • Following decommissioning, rehabilitation will be implemented as soon as practicable and remedial works will be carried out if required, for example, after significant flow events (see Commitments C015 and C173).
R12016	S119	Waterway crossings should be located in existing disturbance footprints where possible and where minimal disturbance of aquatic fish habitats will be required.	EIS Chapter 15, sections 15.6.1 and 15.6.2 SREIS Attachment 4	As described in EIS, Chapter 15, Surface Water, Section 15.6.2, Arrow will, where practicable, utilise existing stable watercourse crossings or locations where bedrock control exists to reduce the potential for erosion and generation of sediment (Commitment C160). Arrow will also select crossing locations to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (Commitment C152). Where practicable, Arrow will co-locate facilities to reduce the project footprint (Commitment 263).
R12017	S143	No mention has been given to the Upper Condamine or Brigalow-Jimbour floodplain management plans or the Regional Natural Resource Management Plans or accompanying Regional Investment Strategies.	SREIS Chapter 9, Section 9.3	Noted. Reference to these planning documents has been included in SREIS Chapter 9, Surface Water, Section 9.3.
R12018	S143	More information is needed on the construction of wells and all weather roads on floodplains and the	EIS Chapter 13, sections 13.6	Arrow has committed to utilise existing access tracks where practicable (Commitment C088). If new tracks are required, they will be designed and

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R12018	S143	impacts on flow diversions. Disagree with the significance of such impacts being low to negligible.	and 13.6.2	constructed to maintain the existing hydrologic and hydraulic regime of the site in cultivation paddocks (Commitment C089). In addition, consultations with landowners will be conducted prior to the installation of access tracks and other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12019	S143	There are six hydraulic and water quality parameters with a significant residual impact ranking of moderate. This is unacceptable and avoidable for two ecosystems already in crisis (Murray Darling Basin and potentially the Great Barrier Reef lagoon).	EIS Chapter 15, sections 15.1, 15.7.4, Table 15.7 and Appendix I, Section 3.2 SREIS Chapter 9, Section 9.6, Appendix 5, Appendix 6, Appendix 7 and Attachment 4.	With the implementation of management and mitigation measures, such as avoiding wetlands and other environmentally sensitive areas, the significance of residual impacts on physical form, hydrology and water quality degradation have been reduced to negligible to moderate depending on the type of existing environment and the impact considered (EIS Chapter 15, Section 15.7.4, Table 15.7). Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility site. Discharge of coal seam gas water is only proposed to occur at two of the four central gas processing facility locations identified since publication of the EIS. The watercourses identified at these two locations as potential receiving watercourses are not located within the Fitzroy basin, which ultimately discharges into the Great Barrier Reef lagoon. As such, discharge of coal seam gas water will not affect the watercourses within this basin, nor the Great Barrier Reef lagoon. Other project activities likely to be conducted within the Fitzroy basin, including watercourse crossings, will be carried out in accordance with relevant legislation and appropriate management controls in place. Any residual impacts on the Great Barrier Reef lagoon will be negligible due to distance from the project development area. The headwaters of the Dawson River (located within the Fitzroy basin) flow 700 km from the project development area before reaching the Great Barrier Reef lagoon (EIS Appendix I, Surface Water Assessment Part B: Water Quality, Section 3.2). The proposed coal seam gas water discharge locations are located within the Murray-Darling drainage division (of which the project development area occupies 0.54%). Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation (Commitment C498). Within recommended discharge limits and prescribed water quality standards, there are expected to be no geomorphic changes or impacts to water quality of the watercourses. Further details of the results of the assessment of potential impacts from discharges are provided in SREIS Chapter 9, Surface Water, Section 9.6 and SREIS Surface Water Appendices 5, 6 and 7. Other project activities likely to be conducted within the Murray Darling

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R12019	S143			drainage division, that have the potential to impact on surface water values (e.g., watercourse crossings), will be carried out in accordance with appropriate management controls in place. Any residual impacts on the broader Murray Darling drainage division will be negligible because these potential impacts will be managed at the source, therefore limiting the potential for downstream impacts to other areas and reducing residual impacts to manageable levels.
R12020	S146	Arrow has not mapped the connectivity of flow in watercourses in the Surat Gas Project area, but if it does it should provide the administrating authority and the public with a baseline of this map.	SREIS Chapter 9, Section 9.5 and Appendix 5, Section 5.4	Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a possible temporary workers accommodation facility site. Flood modelling for these sites has been undertaken for the SREIS. Modelling results, including mapping of connectivity of flow of watercourses in these locations during the 1-in-100-year average recurrence interval flood event is provided in SREIS Chapter 9, Surface Water, Section 9.5 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.4. The map imagery used in Appendix 5 is a combination of high-resolution imagery provided by Arrow, Google imagery and ArcMap Bing Maps.
R12021	S150	Queensland Murray Darling Committee would like to highlight details in their policy document pertaining to buffer zones of up to 500 m from major stream orders.	SREIS Attachment 4	Noted. Arrow will determine buffer zone distances in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157).
R12022	S150	The intersection of pipelines with barriers (such as watercourses and other existing infrastructure) warrants greater investigation, especially with regards to watercourse flow diversion during construction and operations.	EIS Chapter 15, Section 15.6.1 SREIS Attachment 4	Arrow has committed to minimise watercourse crossings where practicable during route selection (Commitment C152). The crossing location will be at low-velocity, straight sections, with the pipeline or road orientated as near as perpendicular to the water flow as practicable (Commitment C164). Additionally, Arrow has committed to develop site-specific management plans for permanent and semi-permanent watercourse crossings detailing construction and environmental management requirements (Commitment C158).
R12023	S150	The description of the water resources in the project development area fails to recognise the complexity and interconnectedness of those water resources and their catchments.	EIS Appendices H and I SREIS Chapter 9, Section 9.4 and Appendix 5, Section 5	The hydrology and fluvial geomorphology and water quality assessments for the project (EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment and Appendix I, Surface Water Part B: Water Quality Impact Assessment) were prepared to meet the EIS terms of reference and to describe, quantify and assess a complex system at a high level. Significant environmental values across the project development area were identified together with a range of measures to protect these values. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Surface water investigations for these locations have been undertaken as part of the SREIS. The connectivity of watercourses within these locations, particularly for sites that are proposed to receive coal

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R12023	S150			seam gas water discharge, is reported on in SREIS Chapter 9, Surface Water, Section 9.4 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5. As further facility sites are selected, site-specific investigations will be undertaken to inform design and environmental conditioning under an environmental authority (EA) or EA amendment application process.
R12024	S159	Surface water impacts identified in the EIS are descriptive and do not assess the level of risk associated with specific areas.	EIS Appendix H, Section 4.3, Table 4-1 and Section 5.3, tables 5-2 and 5-3 SREIS Chapter 9, sections 9.4, 9.5 and 9.6 and Appendix 5, Section 5	The exact locations for project facilities and other infrastructure were unknown at the time EIS studies were prepared. The surface water assessment therefore identified the sensitivity of environmental values associated with each of the river styles found within the project development area, described in EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Section 4.3, Table 4-1. The magnitude and significance of potential impacts on river styles with low sensitivity environmental values have been outlined in Table 5-2 of Section 5.3. Table 5-3 of the same section outlines the significance of potential impacts for moderate sensitivity environmental values. Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Surface water investigations for these locations have been undertaken as part of the SREIS and the results are reported on in SREIS Chapter 9, Surface Water, sections 9.4, 9.5 and 9.6 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5. As further facility sites are selected, site-specific investigations will be undertaken to inform design and environmental conditioning under an environmental authority (EA) or EA amendment application process.
R12025	S159	Due to a lack of knowledge and research in relation to the long-term effects of current practices, there may be unforeseen impacts on surface water.	EIS Chapter 15, Section 15.8	As set out in EIS Chapter 15, Surface Water, Section 15.8, Arrow will implement an inspection and monitoring program for surface water to verify residual impacts throughout the life of the project and to confirm the effectiveness of mitigation measures is maintained. This will assist in reducing potential long-term impacts to surface water environmental values. As further facility sites are selected, site-specific investigations will be undertaken to inform design and environmental conditioning under an environmental authority (EA) or EA amendment application process.
R12026	S161	EIS does not acknowledge that the impacts of short term (35 years) coal seam gas extraction have long-term (100+ years) implications for the composition and movement of surface water.	EIS Chapter 15, sections 15.7 and 15.8	EIS Chapter 15, Surface Water, Section 15.7 describes the potential residual impacts after proposed mitigation measures are applied. Section 15.8 describes the inspection and monitoring program Arrow proposes to verify residual impacts throughout the life of the project and to confirm the effectiveness of mitigation measures is maintained. This will assist in reducing potential long-term impacts to surface water environmental values.
R12027	S001	Impacts of flooding have not been addressed adequately with respect to brine impacts, human	EIS Chapter 5, Section 5.2.4,	A review of historical flood information, including the flooding during the 2010 to 2011 wet season, has been undertaken for major waterways within the

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R12027	S001	error and potential huge flood events as occurred in 2010/11. This is in regards to the proximity of high concentrations of brine and salt on or near prime farming land and is high risk.	Chapter 15, sections 15.6.1, 15.6.3, 15.6.4 and Appendix H, Attachment A4 SREIS Chapter 9, Section 9.5, Appendix 5, Section 5.4, Attachment 4 and Attachment 5	project development area (EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Attachment A4). Arrow will consider flooding regimes and areas subject to inundation when siting production facilities (Commitment C151) and, where practicable, site facilities above the 1-in-100-year average recurrence interval flood event (Commitment C155). Since publication of the EIS, potential locations have been identified for two water treatment facilities at which brine will be stored temporarily prior to disposal in accordance with Arrow's Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5). Flood modelling of these locations has been undertaken for the SREIS and areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. The results of the modelling are further described in SREIS Chapter 9, Surface Water, Section 9.5 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.4. As described in EIS Chapter 5, Project Description, Section 5.2.4, dams will be designed in accordance with relevant legislation, Queensland standards and EHP guidelines, with independent third party certification. Arrow will also monitor dam levels (Commitment C528) to provide early warning of overflowing.
R12028	S001	The development of access tracks and ancillary equipment for coal seam gas purposes will further impact upon land use and promote impacts to farming through changed water characteristics e.g., ponding and hindering water flow.	EIS Chapter 13, sections 13.6.2, 13.6.3 and Chapter 15, Section 15.6.4	Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Existing access tracks will be utilised where practicable (Commitment C088). If new tracks are required, they will be designed and constructed to maintain the existing hydrologic and hydraulic regime of the site in cultivation paddocks (Commitment C089). In addition, consultations with landowners will be conducted prior to the installation of access tracks and other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12029	S005	How will Arrow deal with access to infrastructure during flood events in areas that routinely become isolated for extended periods of time and have flooding rains?	EIS Chapter 25, Section 25.6 SREIS Chapter 9 Section 9.5	To reduce the risk of isolation caused by flooding, Arrow will site facilities above the 1-in-100-year average recurrence interval flood event where practicable (Commitment C155). Flood modelling of four potential central gas processing sites and a potential temporary workers accommodation facility site has been undertaken since the publication of the EIS. Within each facility location, areas have been identified that lie outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. The siting of facilities and access roads at these

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R12029	S005			sites will be informed by this constraints analysis. Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13. In terms of smaller infrastructure, field compression facilities and wells will be remotely operated and monitored and well site remote telemetry units (RTUs) will initiate a shutdown in case of an incident. Well site infrastructure will be fenced, which will also help to protect it from flood-related debris. Additionally, Arrow will develop emergency response plans in consultation with emergency services organisations that include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including flooding) (Commitment C424). When developing plans, Arrow will consider flooding regimes that have been informed by flood mapping and modelling.
R12030	S014, S044, S149	In the past, diverted overland flow has resulted in legal action from impacted parties. If it is proven that overland flow has been diverted away from an existing water user who has developed irrigation infrastructure based on traditional drainage paths, who will be liable if it as a result of coal seam gas development? Who pays the compensation from damage caused by flow diversion from new roads?	EIS Chapter 13, sections 13.6.2, 13.6.3, 13.6.4 and Chapter 15, Section 15.6.4	Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Arrow will utilise existing access tracks where practicable (Commitment C088) and new tracks (if required) will be designed and constructed to maintain the existing hydrologic and hydraulic regime of the site in cultivation paddocks (Commitment C089). If it is alleged that loss or damage has occurred to existing water users that is not covered under an existing compensation agreement, compensation may be sought through a variety of different avenues involving the appropriate authorities, depending on the details of the situation.
R12031	S015, S050	The EIS states that consideration of existing drainage patterns when designing new access tracks and well pads will reduce the potential for diversion of overland flows. Water is a powerful force and new access tracks and well pads could well provide diversion of overland flows.	EIS Chapter 13, sections 13.6.2, 13.6.3, 13.6.4 and Chapter 15, Section 15.4.1	As described in EIS Chapter 15, Surface Water, Section 15.4.1, placing infrastructure such as access roads and well pads in surface water flow paths has the potential to alter hydrology. Arrow will utilise existing access tracks where practicable (Commitment C088) and new tracks (where required) will be designed and constructed to maintain the existing hydrologic and hydraulic regime of the site in cultivation paddocks (Commitment C089). The location of pipelines will also be agreed with landholders and located to avoid or minimise impact on irrigation flow or current farming practices. Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12032	S032	Small areas of land contaminated by water pipeline failures could impact substantially larger areas during an overland flood event, leading to toxic soil sodium levels over a larger area. Pipeline failures on very fragile and micro-managed soil would not be isolated events.	EIS Chapter 12, Section 12.6.3 and Chapter 25, Section 25.6.3 and Appendix S SREIS Attachment 4	Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). As discussed in Section 3.6 of this report, the high pressure coal seam gas pipeline will be designed, installed and operated in accordance with the suite of standards AS 2885

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R12032	S032			Pipelines - Gas and Liquid Petroleum (Standards Australia, 2008a). Requirements under the standards include depth of burial in accordance with loading condition and type of soil / rock. Requirements to reduce the risk of buckling and flotation in polyethylene pipes is also provided. Arrow will develop and implement emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or any loss of containment of storage equipment (Commitment C036) and carry out corrective actions immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities (Commitment C038).
R12033	S034, S069	How would large trees, one metre in diameter, impact on gas field infrastructure in the event of a flood?	EIS Chapter 25, Table 25.11	Provided large trees remain in-situ during flood events, they will pose no risk to gas field infrastructure. If a tree was unearthed during a flood it may have the potential to damage infrastructure, depending on the path of flow and the location of infrastructure. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.7, Table 25.11 broadly summarises the potential impacts involving external events, including flooding which may encroach upon project infrastructure resulting in harm to workers, damage or loss of integrity of the equipment and potential escalation of an incident. The mitigation measures that Arrow will implement include but are not limited to the following: <ul style="list-style-type: none"> • Flood risk will be managed through site selection. • The State Planning Policy 1/03 for Mitigating the Adverse Impacts of Flood, Bushfire and Landslide will be considered. • Emergency response plans will be developed in consultation with emergency services which include safe evacuation procedures and communication protocols.
R12034	S034, S069	How will the proposed road network be installed without disruption to the natural flow and spread of floodwater?	EIS Chapter 13, Section 13.6 and Chapter 15, Section 15.6.1	As described in EIS Chapter 15, Surface Water, Section 15.4.1, Arrow will avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Arrow will utilise existing access tracks where practicable and new tracks (where required) will be designed and constructed to maintain the existing hydrologic and hydraulic regime of the site, particularly in cultivation paddocks (Commitment C089). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12035	S024, S026, S050, S081, S086, S146, S162	The EIS has not addressed how production wells, gathering lines, access tracks and other associated infrastructure will affect overland flows, or erosion. Overland flows across the Jimbour flood plain have	EIS Chapter 12, Section 12.4.2, Chapter 13, sections 13.6.2, 13.6.4. and Chapter 15,	Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.

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R12035	S024, S026, S050, S081, S086, S146, S162	enormous impacts on agriculture and the entire catchment system. It has been a largely a damaging factor in the last couple of years causing reduction in yields, and substantial damage to paddocks with erosion. However, in drier years, overland flow is welcomed as it provides crucial moisture for cropping operations. It is a delicate balancing act, and is a vital issue for the landholders of the Jimbour Plain. The environmental value of overland flow water must be identified and properly described, and the appropriate impact assessment must be undertaken and mitigation strategies proposed to minimise harm.	Section 15.4.1 SREIS Chapter 3, Figure 3.1, Appendix 5, Section 5.4	As described in EIS Chapter 15, Surface Water, Section 15.4.1, placing infrastructure such as access roads and well pads in surface water flow paths has the potential to alter hydrology. Arrow recognises that agricultural enterprises rely on surface flows to varying degrees, dependant on the nature and configuration of the land use (EIS Appendix F, Agricultural Report, Section 7.2.3). Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Mitigation measures are outlined for the construction of ROWs, pipeline trenches and access tracks, which will reduce impacts as a result of altered overland flow in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.2, and EIS Chapter 13, Agriculture, sections 13.6.2 and 13.6.4. Mitigation measures for areas such as the Jimbour floodplain will be consistent with those described in the EIS, however further detail will be included with statutory information requirements to be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to support an application for an environmental authority (EA) or EA amendment following the completion of the EIS process. A discussion about the Jimbour floodplain is included in SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology. Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12036	S014, S044, S066, S081, S105, S139	When brine is stored in dams, what will happen when floods are experienced? Will there be a risk of salt/coal seam gas water overflowing during a flood event? What considerations have been made to minimise flood impacts on proposed infrastructure? What measures does Arrow have in place to prevent dams from spilling over and flowing on to fertile agricultural land?	EIS Chapter 15, Section 15.6.3 and Chapter 25, Section 25.6.3	In the first instance, Arrow will seek to site facilities (including associated dams) above the 1-in-100-year average recurrence interval flood event (Commitment C155), thereby reducing potential impacts from flooding through avoidance. Further to this, dam safety is heavily controlled through dam safety guidelines and the application of the State Planning Policy 1/03 for Mitigating the Adverse Impacts of Flood, Bushfire and Landslide, which will apply to all facilities that form part of the project. Dams will be designed and sized to account for predicted flood conditions (Commitment C211), with each dam subject to separate approval, which will consider specific controls to avoid, mitigate or manage threats associated with flooding (Commitment C206).
R12037	S002, S003, S009, S018, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065,	What impact will new road infrastructure have on overland water flows, including flooding?	EIS Chapter 13, Section, 13.6.3 and Chapter 15, Section 15.4.1	As described in EIS Chapter 15, Surface Water, Section 15.4.1, placing infrastructure such as access roads in surface water flow paths has the potential to alter hydrology. Arrow will utilise existing access tracks where practicable and new tracks (where required) will be designed and constructed to maintain the existing hydrologic and hydraulic regime of the site,

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R12037	S002, S003, S009, S018, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065,			particularly in cultivation paddocks (Commitment C089). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12038	S024, S026, S081, S130	Arrow must correctly describe the Condamine River. It is not largely a continuous flowing river, as it undergoes periods of no flow during dry times. It is crucial to understand the fluvial morphology of this river given coal seam gas proponents are gaining approvals to dispose coal seam gas water in it. Arrow is requested to revise all parts of the EIS to redescribe the Condamine river as 'ephemeral' and the implications of this (particularly in regard to the discharge of coal seam gas water.)	EIS Appendix H, Attachment A, sections 4 and 5 SREIS Chapter 9, sections 9.4 and 9.6 and Appendix 5, Section 5.2	The EIS recognised that the Condamine River comprises permanent bodies of water but that it also undergoes periods of no flow during dry periods. This is consistent with the semi-permanent classification for watercourses that recognises cases where watercourses are reduced to series of isolated pools during the dry season. A description of the hydrology and fluvial geomorphology of the Condamine River sub-basin is set out in EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Attachment A, Sections 4 and 5, respectively. Since publication of the EIS, two receiving watercourses have been investigated based on two potential water treatment facility sites proposed to discharge to associated watercourses. The Condamine River was one of the systems investigated and further assessments of fluvial geomorphology and hydrology have been conducted at specific sites along this watercourse (refer to SREIS Chapter 9, Surface Water, Section 9.4 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.2). The assessment includes recommendations for appropriate release limits and conditions which may be used to inform the development of a coal seam gas water discharge strategy that will take into consideration the flow regime of the Condamine River. Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).
R12039	S024, S026, S081	A review of historical flood information for overland flow on the Condamine floodplain must be undertaken to ensure its importance is realised.	EIS Appendix H, Section A4.6 SREIS Chapter 9, Section 9.5 and Appendix 5, Section 5.4	As described in EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Section A4.6, Condamine River overland flow modelling was undertaken by Land Resource Assessment and Management Pty Ltd (LRAM), with the delineation of the Condamine River floodplain reproduced in Figure A4-3. Additionally, a flood frequency analysis undertaken for the Condamine River is summarised in Table A4-10. Since the publication of the EIS, potential locations have been identified for

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R12039	S024, S026, S081			<p>four central gas processing facilities and a temporary workers accommodation facility. Further surface water investigations, including an updated review of historical flood information for the preparation of flood modelling, have been undertaken for these sites, three of which lie partially within the Condamine floodplain. The results of these investigations are described in SREIS Chapter 9, Surface Water, Section 9.5 and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.4.</p> <p>Arrow has undertaken an Area Wide Planning trial where information on overland flow is collected from landholders and used in the planning and siting of field infrastructure.</p> <p>Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.</p>
R12040	S024, S026, S081	<p>The December 2010 flood is presented as a 30 to 50 year 'Average Recurrence Interval' event, however, anecdotal evidence from landholders in the area suggest it was the largest in living memory. The data needs to be changed to reflect the December 2010 flood as a 50 to 100 year 'Average Recurrence Interval' event.</p>	<p>EIS Appendix H, Section A4.6</p> <p>SREIS Chapter 9, Section 9.5 and Appendix 5, Section 5.4</p>	<p>The December 2010 flood event was estimated differently for different watercourses. From Loudons Bridge (immediately upstream of the Condamine River's confluence with Myall Creek and downstream of Dalby) to Chinchilla, the December 2010 flood event was estimated as a 75 to 100 year average recurrence interval flood event, rather than a 30 to 50 year average recurrence interval flood event (EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Section 4.6, Table A4-11).</p> <p>Flood investigations undertaken for the SREIS consider the 1-in-100 year average recurrence interval flood extent for the locations identified to site four central gas processing facilities and a temporary workers accommodation facility. These flood models are then compared to the December 2010 flood event. Modelling results are presented in SREIS Chapter 9, Surface Water, Section 9.5 and Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.4.</p>
R12041	S014, S044, S081, S123, S139	<p>How close to the floodplain will coal seam gas infrastructure be? How will this impact overland flow during flood events? Greater floodplain information requested as a large area of strategic cropping land is located on the floodplain and works may affect downstream activities. Greater baseline flood plain information/modelling is required, as well as predictive modelling of the floodplain and effects from additional infrastructure. Assurance is required that issues can be overcome successfully.</p>	<p>EIS Chapter 12, Section 12.6.2, Chapter 13, sections 13.6.2 and 13.6.4, Chapter 15, Section 15.6.3</p> <p>SREIS Chapter 9, Section 9.5 and Attachment 4</p>	<p>At the time the EIS was published, the exact location of project facilities and other infrastructure was unknown and there was no publically available flood mapping for the areas of the sub-basins covered by the project development area, except for parts of the Condamine River sub-basin (EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment, Section 4.6).</p> <p>Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Flood modelling of these locations has been undertaken for the SREIS and areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent</p>

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R12041	S014, S044, S081, S123, S139			<p>predicted by the models. Facilities will be sited above the 1-in-100-year average recurrence interval flood extent, where practicable and facilities will be designed taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas (Commitment C155). Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13. Further flood assessments will be undertaken to inform the site selection for additional facilities.</p> <p>The locations of wells, access tracks and gas and water gathering infrastructure placed on the floodplain will be agreed with landholders. Mitigation and management measures, including consultation with landholders, are outlined for the construction of ROWs, pipeline trenches and access tracks, which will reduce impacts as a result of altered overland flow, in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.2, and EIS Chapter 13, Agriculture, sections 13.6.2 and 13.6.4.</p> <p>Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.</p>
R12042	S014, S044, S081, S139	What flood levels are used for modelling? Have January 2011 and January 2012 levels been taken into account?	<p>EIS Appendix H, Section A4.6 SREIS Chapter 9, Section 9.5 and Appendix 5, Section 5.4</p>	<p>EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment used December 2010 and January 2011 flood levels obtained from the Bureau of Meteorology to determine the extent of flooding in the project development area, as well as data from major floods since 1862 (see EIS Appendix H, Section 4.6).</p> <p>Further flood modelling for the 1-in-100-year average recurrence interval flood event has been undertaken for the SREIS. This assessment incorporates an updated review of historical flood information (including January 2011 and January 2012 levels) and provides a comparison of flood modelling to the December 2010 flood event, which is generally a larger event than the flood events in January 2011 and 2012. Refer to SREIS Chapter 9, Surface Water, Section 9.5 and Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 5.4.</p>
R12043	S089	As the project area encompasses flood plains, there is concern with the toxic by-products in the event of a flood or severe storm which will be exacerbated by climatic changes.	<p>EIS Chapter 25, sections 25.4.2 and 25.6.3</p>	<p>The requirements of State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide will be considered when designing, constructing and operating the project (Commitment C538). Where practicable, Arrow will site facilities above the 1-in-100-year average recurrence interval flood event (Commitment C155) to protect against flooding and the project's vulnerability to changing climate patterns.</p> <p>The loss of containment of bulk volumes of liquid pollutant materials (concentrated brine, diesel, drilling muds, chemicals) was identified as a potential hazard in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2, Table 25.12. A number of mitigation measures that will be</p>

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R12043	S089			<p>implemented to reduce this risk include but are not limited to the following:</p> <ul style="list-style-type: none"> • Applying appropriate standards and codes for the storage and handling of hazardous materials. • Establishing overflow and operational controls for tanks and dams. • Implementing internal and external hazard audit programs. • Designing appropriate drainages for waste spills. <p>Climate change has also been considered in the design process given the longevity of the project.</p>
R12044	S121	The EIS should include identification of the location of temporary work camps in relation to the 1% 'Annual Exceedance Probability' flood.	SREIS Chapter 9, Section 9.5	<p>At the time the EIS was published, exact locations for project infrastructure were unknown.</p> <p>Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility (TWAF). Flood modelling of these locations has been undertaken for the SREIS and areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. Facilities, including the TWAF, will be sited outside of the modelled 1-in-100-year average recurrence interval flood extents where practicable. Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13.</p>
R12045	S121	The EIS should identify the possible impacts that vegetation clearing may have on run-off and flooding, and provide mitigation measures to address these impacts in the EMP.	EIS Chapter 15, sections 15.4 and 15.6 SREIS Attachment 4	<p>The potential for increased runoff and sedimentation in watercourses due to vegetation clearing is presented in EIS Chapter 15, Surface Water, Section 15.4. Mitigation measures to reduce runoff, as set out in Section 15.6, include but are not limited to the following:</p> <ul style="list-style-type: none"> • Developing an erosion and sediment control plan and installing and maintaining appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment. (Commitment C034). • Minimising the disturbance footprint and vegetation clearing (Commitment C020). • Progressively clearing and rehabilitating areas as soon as practicable following construction and decommissioning activities (Commitment C015). <p>Further to this, Arrow will implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within these buffers (other than construction of watercourse crossings for roads and, pipelines, and discharge infrastructure and associated stream monitoring equipment). Buffer zone distances will be determined in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157).</p> <p>EIS Attachment 5, Environmental Management Plan (EMP) provides a broad overview of the management measures that will be implemented during project activities. Further detail of management measures will be included with the statutory information requirements.</p>
R12046	S119, S123	If a water barrier or crossing is required to facilitate	EIS	As described in EIS Chapter 16, Aquatic Ecology, Section 16.6.4, Arrow will

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R12046	S119, S123	the project, Arrow must obtain a development approval under the Sustainable Planning Act 2009 (Qld) and in accordance with the conditions of S. 76D of the Fisheries Act 1994 (Qld). This will require additional accurate information on aquatic flora, fauna and habitats. Conditions should include the following: <ul style="list-style-type: none"> • Provision for fish passage must be made. • Minimise impact to waterways. • Create similar habitats to original waterway, promote natural regeneration, and consult Fisheries Queensland for advice and approvals. 	Chapter 15, sections 15.6.1, 15.6.2 and Chapter 16, Section 16.6.4 SREIS Attachment 4	obtain all relevant permits required under the Fisheries Act 1994 (Qld), including permits for construction of waterway barriers or disturbance of fish habitat (Commitment C192). Additionally, Arrow has made the following commitments in terms of construction and regeneration of watercourse crossings: <ul style="list-style-type: none"> • Design flumes used to construct watercourse crossings to a suitable size to maintain flows and enable fish passage (Commitment C196). • In order to maintain the condition of the original waterway, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (Commitment C152). • Following decommissioning, rehabilitation will be implemented as soon as practicable and remedial works will be carried out if required, for example, after significant flow events (Commitment C015).
R12047	S124	Arrow is required to fully determine the surface water effects from previous projects before new projects can be considered. Independent reviews are requested.	EIS Chapter 15, Section 15.4 and Chapter 28, Section 28.3.4 SREIS Chapter 9, Section 9.6.5	Previous projects have contributed to the existing surface water environment of the project development area which is described in EIS Chapter 15, Surface Water, Section 15.4. A cumulative impact assessment of future developments on surface water is presented in EIS Chapter 28, Cumulative Impacts, Section 28.3.4. In addition, further assessment of the impact of coal seam gas water discharge to the receiving environment has been undertaken for the SREIS. Investigations have been undertaken based on two potential water treatment facility sites, which have been identified since the publication of the EIS. The assessment includes a discussion of the cumulative impacts of discharge to these receiving environments in the absence of information regarding the discharge plans of other proponents' projects. This information is contained in SREIS Chapter 9, Surface Water, Section 9.6.5.
R12048	S130	Arrow has not recognised importance of overland flows on the Condamine floodplain that flow to the stream systems. Agriculture as an environmental value of surface water has not been identified or properly described. It is requested that Arrow identifies the values and undertakes appropriate impact assessment and mitigation strategies to minimise harm. All relevant sections of the EIS should be revised.	EIS Chapter 13, sections 13.6.2, 13.6.4, Chapter 15, Section 15.6.4 and Appendix F, Section 7.2.3	Arrow recognises that agricultural enterprises rely on surface flows to varying degrees, dependant on the nature and configuration of the land use (EIS Appendix F, Agricultural Report, Section 7.2.3). Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Consultations with landowners will be conducted prior to the installation of gathering lines, wells and access tracks to minimise disruption to overland flow in cultivation paddocks (Commitment C088).
R12049	S134	Arrow is requested to provide reference to the Queensland Reconstruction Authority flood mapping where applicable.	SREIS Appendix 5, Section 4.3	Noted. Reference to the Queensland Reconstruction Authority flood mapping has been included in SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology, Section 4.3.
R12050	S134	Provide the source of predicted flood extents, and describe how these have been used to determine and/or limit development within the flood zone.	EIS Chapter 13, Section 13.6.2, Chapter 25, Section 25.6.3	EIS Appendix H, Surface Water Part A: Fluvial Geomorphology and Hydrology Impact Assessment used December 2010 and January 2011 flood levels obtained from the Bureau of Meteorology to determine the extent of

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Issue No.	Submission No.	Issue	Reference	Responses
R12050	S134		and Appendix H, Section 4.6 SREIS Chapter 9, Section 9.5	flooding in the project development area, as well as data from major floods since 1862 (see EIS Appendix H, Section 4.6). Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Flood modelling of these locations has been undertaken for the SREIS and areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. Refer to SREIS Chapter 9, Surface Water, Figures 9.11, 9.12 and 9.13. Further flood assessments will be undertaken to inform the site selection for additional facilities. Arrow will consider flooding regimes and areas subject to inundation when siting production facilities (Commitment C151) and where practicable site facilities above the 1-in-100-year average recurrence interval flood event and design infrastructure taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas. (Commitment C155). The requirements of State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide will be taken into consideration (Commitment C538).
R12051	S139	Provide further details regarding impacts of land deformation and subsidence (no matter how small) to the Condamine Floodplain and subsequent alterations to surface water flow patterns (especially in relation to laser levelled fields).	SREIS Chapter 8 and Chapter 9, Section 9.7	The results of a collaborative study referred to in in Commitment C136, on the potential for natural surface deformation using historical and baseline data from the Advanced Land Observation Satellite and covering a time lapse period from January 2007 until January 2011 (Altamira Information, 2012a; 2012b), have been presented in the SREIS Chapter 8, Groundwater. The findings of the collaborative study, review of additional literature and a discussion of the significance of potential impacts of subsidence on overland flow, is presented in SREIS Chapter 9, Surface Water, Section 9.7.
R12052	S014, S044, S081, S139	Will access roads create a levy for overland flow water?	EIS Chapter 13, sections 13.6.2, 13.6.3 and Chapter 15, Section 15.6.4	Access roads are not intended to create a levy for overland flow water. Arrow has committed to avoid disrupting overland natural flow paths and, where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Consultations with landowners will be conducted prior to the installation of access tracks and other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12053	S146	If Arrow's activities cannot avoid altering natural flow paths, then those activities should be prohibited in areas of overland flow.	EIS Chapter 13, Section 13.6.2 and Chapter 15, Section 15.6.4	Arrow has committed to avoid disrupting overland natural flow paths and, where avoidance is not practicable, maintain connectivity of flow in watercourses (Commitment C053). Consultations with landowners will be conducted prior to the installation of gathering lines, wells, access tracks and

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Issue No.	Submission No.	Issue	Reference	Responses
R12053	S146		SREIS Chapter 9, Section 9.5	other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). With regard to facilities, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility since publication of the EIS. Surface water investigations for these locations have been undertaken as part of the SREIS. Flood modelling of these locations has been undertaken and areas have been identified that lie inside and outside of the 1-in-100-year average recurrence interval flood extent predicted by the models. Facilities will be designed to reduce impacts to overland flow and will be sited outside of the modelled 1-in-100-year average recurrence interval flood extents where practicable. Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13. Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12054	S149	Even small changes in gradient which are likely to result from pipeline work can have a severe impact on field drainage.	EIS Chapter 12, Section and Chapter 13, sections 13.4 and 13.6.2 SREIS Attachment 4	Project activities, including pipelines, have the potential to impact on natural flows and drainage patterns (EIS Chapter 13, Agriculture, Section 13.4). Arrow has committed to locate pipelines to avoid or reduce the impact on irrigation flow or current farming practices. If the right-of-way (ROW) must cross actively farmed arable land, Arrow will ensure soil cover above the pipeline is deep enough to allow normal cultivation practices to resume (Commitment C047). Consultations with landowners will be conducted prior to the installation of gathering lines and other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12055	S022, S078	The project will cause contamination of rivers, creeks and other waterways. What guarantees can be given that the towns of Millmerran and Cecil Plains water supplies will not be contaminated?	EIS Chapter 15, sections 15.6.1, 15.8 and Chapter 26, Section 26.6.6 SREIS Chapter 9, Section 9.6	Failure to properly manage waste storage and containment systems could potentially result in soil, surface water and groundwater contamination. As described in EIS Chapter 26, Waste Management, Section 26.6.6, wastes produced as a result of project activities will be handled, stored and disposed of in accordance with relevant standards and the Environmental Protection (Waste Management) Regulation 2000 (Commitment C494). The discharge of any coal seam gas water to watercourses must be in accordance with specific parameters, including discharge volumes, flows and duration, and water quality. Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water

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Issue No.	Submission No.	Issue	Reference	Responses
R12055	S022, S078			quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy (Commitment C498).
R12056	S033	Arrow needs to address potential impacts of drilling lubricants in surface water on native fauna.	EIS Chapter 26, Section 26.6.4	As described in EIS Chapter 26, Waste Management, Section 26.6.4, all waste fluids and muds resulting from drilling activities will be contained in properly lined dams or storage tanks for in situ treatment or disposal (Commitment C411). Putrescible solid waste will be stored in covered containers to prevent odours, public health hazards and access by fauna (Commitment C330).
R12057	S035	Water contamination has not been adequately addressed in EIS, especially in relation to organic farming practices.	EIS Chapter 13, Section 13.3.3. and Chapter 26, Section 26.4, and 26.6.4.	Failure to properly manage waste storage and containment systems could potentially result in soil and water contamination (EIS Chapter 26, Waste Management, Section 26.4). Wastes produced as a result of project activities will be handled, stored and disposed of in accordance with relevant standards and the <i>Environmental Protection (Waste Management) Regulation 2000</i> (Commitment C494). Arrow notes that several certified organic farms operate in the region (EIS Chapter 13, Agriculture, Section 13.3.3). Should Arrow seek to conduct project activities on an organic farm, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084), as well as specific rehabilitation requirements to address organic farming practices and certification requirements. Terms will be set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing land uses.
R12058	S134	The surface water survey period reported in the EIS is limited. Arrow is requested to conduct ongoing surface water surveys year round, over several years to get more accurate results.	EIS Chapter 15, Section 15.2.2 SREIS Chapter 9, Section 9.6	As described in EIS Chapter 15, Surface Water, Section 15.2.2, the surface water impact assessment considered baseline water quality data collected at 35 sites during surveys undertaken in October 2009, November 2009 and March 2010. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Surface water investigations, including water quality sampling at proposed water treatment facility sites, have been undertaken as part of the SREIS and are reported on in SREIS Chapter 9, Surface Water, Section 9.6. As part of a discharge strategy, Arrow will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).

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Issue No.	Submission No.	Issue	Reference	Responses
R12059	S134	There is concern that impacts on water quality through spillages will affect recreational uses (fishing, swimming). Request that Arrow uphold mitigation measures to prevent impacts.	EIS Chapter 26, sections 26.6.4 and 26.6.6 SREIS Attachment 4	Noted. As described in EIS Chapter 26, Waste Management, Section 26.6.4 (Spill Response and Remediation), regulated wastes produced as a result of project activities will be handled, stored and disposed of in accordance with relevant standards and the <i>Environmental Protection (Waste Management) Regulation 2000</i> (Qld) (Commitment C494). Mitigation measures described in this regulation as well as national and international industry standards and codes of practice will be applied by Arrow to reduce the risk of spills. Arrow will also develop emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or any loss of containment of storage equipment (Commitment C036).
R12060	S134	Arrow should provide details of whether consideration has been given to the impacts on Lake Broadwater resulting from upstream releases of water.	EIS Chapter 15, sections 15.5, 15.6.1, 15.6.4 and 15.8 SREIS Chapter 9, Section 9.6 and Attachment 4	One of Arrow's environmental protection objectives for surface water is to protect Lake Broadwater Conservation Park (EIS Chapter 15, Surface Water, Section 15.5). Arrow has committed to manage potential impacts on Lake Broadwater Conservation Park, which is a Category A environmentally sensitive area. Arrow will manage potential impacts on Lake Broadwater Conservation Park (Category A environmentally sensitive area) through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156). With regard to upstream water releases, any water discharged to watercourses from project activities must be discharged at a rate and location that will not cause or exacerbate erosion (Commitment C066). Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498). Additionally, discharge of coal seam gas water is only proposed to occur at two of four potential central gas processing facility locations identified since publication of the EIS. The watercourses identified at these two locations as potential receiving watercourses do not flow to Lake Broadwater (Refer to SREIS Chapter 9, Surface Water, Section 9.6).
R12061	S088	Any approval of this EIS must ensure that commitments are "conditions of approval" so that Arrow is forced to address these serious impacts on floodplain businesses.	-	Noted.
R12062	S088	Any approval of this EIS should exclude the floodplain.	EIS Chapter 15, Section 15.6.3	Arrow will seek to place wells, access tracks and gas and water gathering infrastructure on the floodplain in locations agreed with landholders.

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Issue No.	Submission No.	Issue	Reference	Responses
R12062	S088		and Chapter 25, Section 25.6.3	In the case of facilities, Arrow has committed to consider flooding regimes and areas subject to inundation when siting production facilities (Commitment C151) and where practicable site facilities above the 1-in-100-year average recurrence interval flood event (Commitment C155). The requirements of State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide will be taken into consideration (Commitment C538). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12063	S014, S044	If the project is approved, the administering authority should impose conditions that prevent the diversion of overland flow on the Condamine Floodplain.	EIS Chapter 15, Section 15.6.4	Noted. Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practical, maintain connectivity of flow in watercourses (Commitment C053). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12064	S050	The introduction of more foreign obstacles on the floodplain needs to be avoided at all costs. Any proposal to introduce infrastructure on the floodplain should be conditioned that it is approved not only by the landowner, but also by the relevant floodplain representative body (e.g., the Brigalow Jimbour Floodplain Group). Additionally, compensation agreements should reflect potential loss of yield due to location of infrastructure.	EIS Chapter 13, Section 13.6.2, Chapter 22, Section 22.8.3 and Chapter 25, Section 25.6.3 SREIS Chapter 9, Section 9.5	Noted. Arrow will seek to place wells, access tracks and gas and water gathering infrastructure on the floodplain in locations agreed with landholders. In the case of facilities, Arrow has committed to consider flooding regimes and areas subject to inundation when siting production facilities (Commitment C151) and where practicable site facilities above the 1-in-100 year average recurrence interval flood event and design infrastructure taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas (Commitment C155). The requirements of State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide will be taken into consideration (Commitment C538). Conduct and compensation agreements address factors including the loss of productivity due to the footprint of coal seam gas infrastructure. Arrow will develop and implement a compensation framework to 'add value' rather than solely compensating for impacts (Commitment C081). Arrow has used Area Wide Planning to collect and collate information from landholders on the overland flow characteristics on their properties. This information combined with the detailed topography data that Arrow has for the Surat basin (LiDAR) provides Arrow with information to plan and develop infrastructure that reduce the impact on the floodplain. Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative

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Issue No.	Submission No.	Issue	Reference	Responses
R12064	S050			requirements.
R12065	S150	Should EHP (formerly DERM) not require Arrow to reconsider the EIS, then EHP should manage changes to land use and environmental management practices by placing stringent conditions on Arrow to protect and conserve regional and catchment environmental values.	EIS Chapter 14 and Chapter 15 SREIS Chapter 8 and Chapter 9	Noted. Results of specialist studies to assess potential project impacts on water resources in the project development area are presented in EIS Chapter 14, Groundwater, EIS Chapter 15, Surface Water, SREIS Chapter 8, Groundwater and SREIS Chapter 9, Surface Water. Arrow has made a number of commitments which seek to protect surface water environmental values. A number of these commitments are expected to become conditions of approval. Detailed information on the mitigation measures to reduce surface water impacts will be provided in statutory information requirements provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' (EHP, 2013) to accompany environmental authority (EA) or EA amendment application(s). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12066	S150	Arrow should consider (Draft 2011) The Queensland Murray Darling Committee policy document: Mining and Energy Industry Impacts on Natural Resources in the Queensland Murray-Darling Basin.	SREIS Chapter 9, Section 9.3	Noted. Reference to this policy document has been included in SREIS Chapter 9, Surface Water, Section 9.3.
R12067	S024, S026, S036, S057, S069, S081, S083	Commitment (C053) 'Avoid disrupting overland natural flow paths and, where avoidance is not practicable, maintain connectivity of flow in watercourses.' – If Arrow's petroleum activities cannot avoid altering overland flood flow paths, then those activities must be prohibited in areas of overland flow.	EIS Chapter 13, Section 13.6.2 and Chapter 15, Section 15.6.4 SREIS Chapter 9, Section 9.5, Figures 9.11, 9.12 and 9.13 and Attachment 4	Consultations with landowners will be conducted prior to the installation of gathering lines, wells, access tracks and other infrastructure to minimise disruption to overland flow in cultivation paddocks (Commitment C088). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements. In terms of larger infrastructure, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility since the publication of the EIS. Flood modelling of these locations has been undertaken for the SREIS and areas have been identified that lie inside and outside of the 1-in-100 year average recurrence interval flood extent predicted by the models. Facilities will be sited above the 1-in-100-year average flood recurrence interval, where practicable, and infrastructure will be designed taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas (Commitment C155). Refer to SREIS Chapter 9, Surface Water, Section 9.5, Figures 9.11, 9.12 and 9.13.

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Issue No.	Submission No.	Issue	Reference	Responses
R12068	S021	Commitment C052 states that Arrow will '[r]educe flow concentration and gully creation by minimising disruption to natural overland flow paths through the re-establishment of natural surface drainage lines.' How will this be achieved and by what specific means? Is this a breach of current EA conditions?	EIS Chapter 13, Section 13.6.3 and 13.6.4	Arrow has committed to avoid disrupting overland natural flow paths, and where avoidance is not practicable, Arrow will aim to maintain connectivity of flow in watercourses (Commitment C053). Further detail of management measures will be included with the statutory information requirements provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' (EHP, 2013) to accompany environmental authority (EA) or EA amendment application(s). As such, EA conditions for the project are yet to be determined.
R12069	S108	Commitment C053 states that Arrow will '[a]void disrupting overland natural flow paths and, where avoidance is not practicable, maintain connectivity of flow in watercourses'. Maintaining connectivity of flow may be achieved via a very winding course and may do nothing to protect from erosion arising from the Arrow infrastructure	EIS Chapter 15, Section 15.6.1 SREIS Attachment 4	Arrow does not anticipate the need to permanently divert watercourses in order to maintain connectivity of flow in watercourses. The commitments made in the EIS are consistent with Australian Pipeline Industry Association (APIA) guidelines and as such any watercourse crossings that result in temporary diversions will be conducted in accordance with relevant legislation. In addition, Arrow has committed to develop an erosion and sediment control plan and install and maintain appropriate site-specific controls, established on the basis of the sensitivity of the surrounding environment (Commitment C034). Arrow will be required to meet the requirements regarding impacts on overland water flow of the Strategic Cropping Land: Standard Conditions Code for Resource Activities (DNRM, 2012a) that are triggered for assessment under the Strategic Cropping Land Act 2011 or other legislative requirements.
R12070	S159	Site-based mitigation of surface water quality is inappropriate given the connectivity of the systems.	EIS Chapter 15, Section 15.6	Site-based mitigation of potential surface water quality impacts is a standard step in complying with environmental authority conditions and relevant standards. Mitigation is also most effective when applied at the source.
R12071	S145	There is concern that the expanding coal seam gas industry will have significant cumulative impacts on the Fitzroy Natural Resource Management region, including water quality and quantity.	EIS Chapter 28, Section 28.3.4	EIS Chapter 28, Cumulative Impacts, discusses the potential cumulative impacts of future developments on the environmental values of the project development area. Discharge of coal seam gas water is only proposed to occur at two of four central gas processing facility locations identified since publication of the EIS. The watercourses identified at these two locations as potential receiving watercourses are not within the Fitzroy basin. Subsequently, discharges at these locations are not expected to impact cumulatively on the Fitzroy basin. Other project activities likely to be conducted within the Fitzroy basin, including watercourse crossings, will be carried out in accordance with relevant legislation and appropriate management controls in place.

Table 19.13 Aquatic Ecology

Issue No.	Submission No.	Issue	Reference	Responses
R13001	S119	If mounding of soils to allow for settling is proposed only in terrestrial areas, this statement should be removed from Chapter 16 Aquatic Ecology. Alternatively, if settling is expected within waterways, following the backfilling of trenches, the EIS should discuss alternative methodologies that will return the bed and banks to preconstruction levels while accommodating fish passage.	SREIS Chapter 10	Noted. Mounding of soils is proposed only in terrestrial areas. SREIS Chapter 10, Aquatic Ecology, provides an updated list of commitments relevant to the protection of aquatic ecology values and excludes Commitment C071.
R13002	S143	The EIS should assess impacts on stygofauna.	–	The typical habitat for stygofaunal communities in groundwater systems is within aquifers containing macropores and having a high degree of interaction with surface water. Macropores are spaces in the rock strata larger than 75 µm; these cavities increase hydraulic conductivity and allow shallow groundwater to move through lateral flow. The rock types where macropores would be typically found are not present in the project development area. It is therefore unlikely that stygofauna species occur in the project development area.
R13003	S156	Fish have been released into the Condamine River (over 1 million freshwater fingerlings). What measures will Arrow have in place to ensure contaminated water does not enter the Condamine River or the North Branch of the Condamine River and negatively impact the fish?	EIS Chapter 16, Section 16.6.2 SREIS Chapter 10, Section 10.7	Arrow recognises the need to prevent spills or accidental releases of potentially hazardous materials including any contaminated water. Arrow will develop and implement emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or loss of containment of storage equipment (Commitment C036). EIS Chapter 16, Aquatic Ecology, Section 16.6.2 identifies the measures Arrow will implement to reduce project impacts to water quality, including through the accidental release of contaminated water. These measures include the commitment that Arrow will implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads and pipelines, discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157). In regard to discharges, Arrow will develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy (Commitment C498). SREIS Chapter 10, Aquatic Ecology provides further information on the aquatic ecology values in the project development area and potential impacts on these values. Section 10.7 describes and updates the commitments Arrow has made to protect aquatic ecology values, including water quality.

Table 19.13 Aquatic Ecology

Issue No.	Submission No.	Issue	Reference	Responses
R13004	S119, S156	How does Arrow intend to protect recreational fishing assets when they are proposing the discharge of coal seam gas water to watercourses? Provide greater discussion of the recreational fisheries within the project development area, how the recreational fisheries may be impacted by the project and the proposed measures to protect or mitigate and avoid impacts from the project on recreational fisheries within the project development area.	EIS Chapter 16, sections 16.3.1 and 16.6 SREIS Chapter 10, Section 10.4.4	EIS Chapter 16, Aquatic Ecology, Section 16.3.1 identifies the general aquatic ecology values within the project development area, including recreational fisheries. These fisheries are considered an asset that requires protection. Recreational fisheries are dependent on the general aquatic ecosystem health. If the aquatic ecosystems are healthy then recreational fish species are likely to flourish. The mitigation measures included in EIS Chapter 16, Aquatic Ecology, Section 16.6, aim to maintain or improve aquatic ecosystems and communities, of which recreational fisheries are one aspect. Infrastructure associated with the project is not expected to impede access to public waterways, and thus cause no lost recreational opportunities. In 2012, Arrow entered into a partnership with the Condamine Alliance to restore the Loudin Weir on the Condamine River as part of the Alliance's River Rescue Project to restore native fish populations to 60% of pre-European settlement levels. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 describes the two receiving environments for which the discharge of coal seam gas water is proposed. The additional mitigation and management measures proposed to reduce the impacts associated with discharge are described in Section 10.4.4.
R13005	S119	Provide qualified and quantified information regarding the potential impacts on Murray cod from the project and the measures proposed to avoid, minimise and mitigate these impacts.	EIS Chapter 7 Chapter 16, Section 16.6 and Table 16.7 SREIS Chapter 10, Section 10.4.4 and Appendix 8	Desktop studies undertaken for the EIS found that Murray cod has been recorded in the project development area, with potential for remnant populations to exist. Murray cod was not recorded during field surveys carried out to support the EIS, but was recorded during field investigations for the SREIS (SREIS Chapter 10, Aquatic Ecology, Section 10.6.2). The significance of potential impacts on the aquatic ecological values was assessed for the EIS using the sensitivity of the value and the magnitude of the potential impact, as described in EIS Chapter 7, Impact Assessment Method. Activities with the potential to impact on aquatic ecological values during the construction, operation and decommissioning phases of the project are described in EIS Chapter 16, Table 16.7, including the premitigated and residual significance of the impact. Section 16.6 outlines the avoidance, mitigation and management measures proposed to reduce impacts to aquatic ecology values. Additional specialist studies, described in SREIS Chapter 10, Aquatic Ecology and SREIS Appendix 8, Supplementary Aquatic Ecology Assessment, provide greater detail on the water quality and aquatic ecology of watercourses where coal seam gas water discharge points are proposed. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4, identifies additional mitigation and management measures Arrow has proposed to reduce potential impacts to receiving watercourses in the project development area.

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Issue No.	Submission No.	Issue	Reference	Responses
R13006	S119	Provide qualified and quantified information regarding the potential impacts on Oakey Creek and the locally threatened river blackfish from the project and the measures proposed to avoid, minimise and mitigate these impacts.	EIS Chapter 16, Section 16.6 and Table 16.7 Appendix J, Section 6	A single specimen of river blackfish was recorded during the EIS surveys, approximately 48 km upstream of the project development area in Gowrie Creek. The presence of this individual at this site was most likely due to artificially elevated flows from the treated sewage releases from Toowoomba. Typically the river blackfish would be found at higher altitudes. River blackfish are therefore highly unlikely to occur as far downstream as Oakey Creek. Nevertheless, a precautionary approach has been taken and the mitigation measures presented in EIS Chapter 16, Aquatic Ecology, Section 16.6 (and summarised in Table 16.7) aim to avoid, mitigate or manage project impacts at this site (also see EIS Appendix J, Aquatic Ecology Impact Assessment, Section 6).
R13007	S156	Does Arrow have a figure which they believe is acceptable when counting aquatic losses? It is suggested that the figure should be zero.	EIS Chapter 16, Section 16.6 SREIS Chapter 10, Section 10.4.4	Arrow aims to reduce potential impacts to as low as reasonably practicable through the avoidance, mitigation and management measures set out in EIS Chapter 16, Aquatic Ecology, Section 16.6. These measures are supplemented with additional mitigation and management measures presented in SREIS Chapter 10, Aquatic Ecology, Section 10.4.4, to reduce the impact to receiving watercourses.
R13008	S123	Ensure weed and pest training in relation to Class 2 aquatic pest forms part of a species specific pest management plan for project, with liaison with local government pest management plans. Though not in the project area, the declared Class 2 aquatic weeds salvina, water lettuce and water hyacinth are known to occur in the region and therefore pose a potential risk (flooding, vehicles, machinery).	EIS Chapter 16, Section 16.6.3	EIS Chapter 16, Aquatic Ecology, Section 16.6.3 notes that aquatic weeds may be introduced when watercourses are crossed by equipment or vehicles, or by vehicle washdown runoff. Arrow will develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Arrow recognises the importance of training for its project staff to provide them with the skills to successfully implement the plan. Accordingly, the pest management plan will specify training requirements including on awareness of potential weed species at risk of spread through project activities, mechanisms for the spread of pests, management of any infestations, requirements for crossing and working around pest fences and monitoring the effectiveness of control measures (Commitment C188).
R13009	S134	Is there research to back up the proposed 1 km buffer zone to be put around Lake Broadwater Conservation Park? The proponent is to take on board updated recommendations regarding buffer distances around Lake Broadwater Conservation Park following ongoing discussions with DERM.	EIS Chapter 16, Table 16.6	EIS Chapter 16, Aquatic Ecology, Table 16.6 describes example buffer distances, as proposed in the Model Conditions for Level 1 Environmental Authorities for Coal Seam Gas Activities. Arrow has committed to manage potential impacts on Lake Broadwater Conservation Park through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156). The Australian Petroleum Production and Exploration Association is continuing discussions with EHP regarding appropriate buffer distances from environmentally sensitive areas. Arrow will implement agreed (conditioned) buffers.
R13010	S150	Due consideration should be given to the protection	EIS	Noted. Arrow recognises the need to protect environmentally sensitive areas

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Issue No.	Submission No.	Issue	Reference	Responses
R13010	S150	of ESAs and waterways.	Chapter 16, sections 16.3.7, and 16.6.2 SREIS Chapter 10, Section 10.4.4	<p>(ESAs) and to identify and manage impacts on significant values of waterways in the project development areas. EIS Chapter 16, Aquatic Ecology, Section 16.3.7 identified these values, including the location of any relevant ESAs for aquatic ecology in the project development area. Arrow has committed to a range of measures to protect aquatic values, seeking as a first option to avoid impacts occurring. The primary means by which avoidance is achieved is through the design of the project and associated facilities and infrastructure and the selection of sites.</p> <p>The only ESA directly relevant to aquatic ecology is Lake Broadwater Conservation Park, a Category A ESA. Arrow will manage potential impacts on Lake Broadwater Conservation Park through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156).</p> <p>Similarly, as identified in EIS Chapter 16, Aquatic Ecology, Section 16.6.2 and revised Commitment C157, Arrow will manage potential impacts on waterways through the commitment to implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157).</p> <p>The SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 describes the detailed site-specific field surveys undertaken at the two proposed discharge locations for coal seam gas water, and proposes additional mitigation and management measures to reduce the potential impacts to the identified waterways.</p>
R13011	S119	Detail and discuss the potential impacts of the project on the aquatic fish habitats of Oakey Creek, particularly upstream of Site C, and Lake Broadwater which supports the Murray cod and how these impacts will be avoided, minimised and mitigated.	EIS Chapter 16, Section 16.6 and Figure 16.1 Appendix J, sections 6 and 10	<p>At present, no project activities are proposed in Oakey Creek, upstream of site C (see EIS Chapter 16, Aquatic Ecology, Figure 16.1), therefore no project impacts on aquatic habitat are expected to occur in this location. Irrespective of this, as with any watercourse, Arrow will manage potential impacts through the commitment to implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157).</p> <p>Lake Broadwater is highly ephemeral, and does not contain permanent habitat for Murray cod (EIS Appendix J, Aquatic Ecology Impact Assessment, Section 10). The lake may provide occasional foraging or breeding habitat for this species. While the extent of Murray cod use of Lake Broadwater is likely to be minimal, measures to avoid, mitigate or manage potential impacts are included in the EIS Chapter 16, Aquatic Ecology, Section 16.6, and explained</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R13011	S119			in EIS Appendix J, Aquatic Ecology Impact Assessment, Section 6. Arrow will manage potential impacts on Lake Broadwater Conservation Park through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156).
R13012	S119, S123	The EIS acknowledges that development approvals for waterway barrier works will be required. In accordance with Section 76D of the Fisheries Act 1994, the supporting information for the development application will require details including the waterway characteristics or aquatic fish habitat value that will be disturbed, the location of works within a waterway, the proposed designs of works and the specific construction methodologies. Arrow should be conditioned to obtain a development approval for waterway barrier works under the Sustainable Planning Act 2009 for any and all waterway crossings that do not meet the requirement of a self-assessable code.	EIS Chapter 16, Section 16.6.4	EIS Chapter 16, Aquatic Ecology, Section 16.6.4, states that Arrow will obtain all relevant permits required under the <i>Fisheries Act 1994</i> (Qld), including permits for construction of waterway barriers or disturbance of fish habitat (Commitment C192). Arrow notes that where waterway crossings do not meet the requirements of a self-assessable code under the <i>Sustainable Planning Act 2009</i> , this will require the submission of design plans and a range of supporting environmental information.
R13013	S119	If dams are to be located on waterways, for the purposes of the Fisheries Act 1994, it is requested that the Coordinator General consider a condition that will require Arrow obtain development approval for operational works that is the building or raising of waterway barrier works under the Sustainable Planning Act 2009 for any and all dams and/or weirs that do not meet the requirement of a self-assessable code.	–	Noted. It is not intended to construct dams on waterways in the project development area. However, should a dam be required, Arrow will obtain all necessary approvals as specified in relevant legislation.
R13014	S134, S145	Concern over potential impacts on aquatic ecology, as well as general concern regarding impacts on groundwater dependent ecosystems and endangered, vulnerable or near-threatened vegetation, flora and fauna.	EIS Chapter 16, Section 16.6 Attachment 3, sections 4, 5 and 7 SREIS Chapter 10, Section 10.6.5	Noted. EIS Chapter 16, Aquatic Ecology, describes the aquatic ecology values in the project development area, the significance of potential impacts on those values and proposes avoidance, mitigation and management measures to address these impacts (Section 16.6). EIS Attachment 3, Matters of National Environmental Significance, Section 4 describes the nationally listed species within the existing environment and Section 5 identifies the issues and potential impacts to these values. Section 7 outlines the avoidance, mitigation and management measures proposed to achieve the environmental protection objectives for Matters of National Environmental Significance, which are: <ul style="list-style-type: none"> • To minimise EPBC Act-listed habitat loss and fauna mortality. • To avoid or minimise adverse effects on and to protect terrestrial ecosystems and associated biodiversity and habitat of EPBC communities. • To control the introduction or spread of new or existing pest flora or fauna.

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Issue No.	Submission No.	Issue	Reference	Responses
R13014	S134, S145			<ul style="list-style-type: none"> To protect areas identified for avoidance. The SREIS Chapter 10, Aquatic Ecology, summarises the detailed site-specific field studies undertaken to further characterise the existing environment, including the two proposed coal seam gas water discharge locations. Section 10.6.5 identifies additional mitigation and management measures proposed to reduce potential impacts to the aquatic ecology values.
R13015	S150	The Queensland Murray Darling Committee asserts that DERM [EHP] should not support any more development within the ESA [Lake Broad water buffer area] when viable alternatives exist.	EIS Chapter 16	Noted. Arrow has committed to avoid undertaking project activities in the Lake Broadwater Conservation Park (Category A ESA) (Commitment C217). Arrow will manage potential impacts on Lake Broadwater Conservation Park through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156).
R13016	S150	The EIS should demonstrate how the siting of the project's facilities and any associated infrastructure will impact on high-conservation areas and remain outside appropriate buffer zones.	EIS Chapter 16 SREIS Attachment 8	Constraints mapping (SREIS Attachment 8, Constraints Mapping Update) will be used to plan the location of project related infrastructure. Areas of high conservation identified in the project development area are described in EIS Chapter 16, Aquatic Ecology, with example buffer distances, as proposed in the Model Conditions for Level 1 Environmental Authorities for Coal Seam Gas Activities, for differing environmentally significant areas presented. However the need for buffers and buffer distances will be determined by legislative requirements at the time of development. No works are proposed in watercourses except the construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment.
R13017	S156	What does Arrow define as a watercourse? In reference to Arrow stating they will implement a 100 m buffer zone from the high bank of all watercourses.	EIS Chapter 16, Section 16.3.1	<p>Arrow's definition of a watercourse is consistent with current legislation. The Water Act 2000 and the Fisheries Act 1994 are applicable. The Water Act defines a watercourse as the following:</p> <p>Meaning of watercourse</p> <p>(1) A watercourse is a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events—</p> <p>(a) in a natural channel, whether artificially modified or not; or</p> <p>(b) in an artificial channel that has changed the course of the stream.</p> <p>(2) A watercourse includes any of the following located in it—(a) in-stream islands;</p> <p>(b) benches;</p> <p>(c) bars.</p> <p>(3) However, a watercourse does not include a drainage feature.</p> <p>While the Fisheries Act 1994 states the following:</p> <p>'watercourse see the Water Act 2000, schedule 4.'</p> <p>Appendix II of the Waterway Barrier Works Development Approvals - Fish Habitat Management Operational Policy FHMOP 008 (DAFF, 2012) provides guidelines for identification of a waterway. Under this policy, a waterway must</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R13017	S156			<p>have:</p> <ol style="list-style-type: none"> 1. Defined bed and banks - the bed and banks need to be continuous upstream and downstream of the site rather than isolated and broken sections of a depression. 2. An extended, if non-permanent, period of flow - flow must continue beyond the duration of a rain event and have some reliability commensurate with rainfall. Distinguish between channels just funnelling immediate localised rainfall and waterways that have flow arising from an upstream catchment. 3. Flow adequacy - the flow needs to be sufficient to sustain basic ecological processes and habitats and to maintain biodiversity within or across the feature. Adequacy depends on the ecological function of the channel e.g., waterways that connect to fish habitat like a wetland or waterhole may only need infrequent and short-duration flows to provide connectivity for fish. 4. Fish habitat at, or upstream, of the site - most instream features would provide habitat for fish under adequate flow conditions or, in the case of pools, during dry periods, so it is important to have some knowledge of the fish species for the site and their habitat usage, particularly in headwater streams. Periodic connectivity to upstream, offstream fish habitat would also count. <p>A high proportion of the ephemeral systems within the project development area are unnamed first- or second-order systems that flow for very limited periods each year. Permanent and semi-permanent watercourses within the project development area include the Condamine River, Wilkie Creek, Oakey Creek and Braemar Creek. These systems contain water year round, although in many cases they are reduced to series of isolated pools during the dry season.</p>
R13018	S150	The establishment of buffer zones to protect natural resources should not be undermined, the buffer zone around Lake Broadwater for example should be 2 km, not 200 m.	EIS Chapter 16	Arrow appreciates the importance of buffer zones, and has committed to avoid undertaking project activities in the Lake Broadwater Conservation Park (Category A ESA) (Commitment C217). Arrow will manage potential impacts on Lake Broadwater Conservation Park through implementation of relevant buffers in accordance with legislative requirements at the time of development in this region (Commitment C156).
R13019	S134	To ensure buffer zones around environmentally sensitive areas are sufficient, Arrow to conduct ongoing monitoring of buffer zones and act upon any deviations from initial conditions.	EIS Chapter 16, Section 16.8	Noted. EIS Chapter 16, Aquatic Ecology, Section 16.8 outlines Arrow's commitment to routinely monitor buffer zones and project footprint using satellite imagery (Commitment C509). Other methods, such as site assessments, will also be used to monitor buffer zones. Such an approach facilitates early detection and intervention should any deviations occur, and allows appropriate action to address any issues.
R13020	S119	Arrow to provide details of the location of dams (including whether dams will be constructed on	SREIS Chapter 3, Section 3.5	Dams will be co-located with central gas processing facilities. It is not intended to construct dams on waterways in the project development area.

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Issue No.	Submission No.	Issue	Reference	Responses
R13020	S119	waterways), and any anticipated impacts to flows, fish or aquatic fish habitats as a result of the construction of each dam.		However should a dam be required, Arrow will obtain all necessary approvals as specified in relevant legislation. The SREIS Chapter 3, Project Description, Section 3.5 identifies the proposed locations of four central gas processing facilities, as well as the indicative locations of the remaining four facilities. The specific location, orientation and layout of the facilities will be guided by site-specific technical, environmental and social features, including ground stability, elevation, remnant vegetation, topography, proximity of sensitive receptors and landholder consultation.
R13021	S119, S156	Provide details of the waterways which may receive coal seam gas water, including the possible volumes and potential direct and indirect impacts on aquatic fish habitats, waterways and aquatic species within the project development area.	SREIS Chapter 10, sections 10.6, 10.6.2, 10.6.4 and 10.6.5	SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 identifies the waterways where the discharge of coal seam gas water is proposed. Section 10.4.4 discusses the additional site-specific assessments undertaken through targeted field surveys. Potential impacts of the discharges on aquatic ecology values are identified and additional mitigation and management measures are proposed to reduce the potential impacts to the identified waterways.
R13022	S134	What is the definition of 'normal operation' (Table 5) under which water is not discharged. Arrow should revise the statement to ensure coal seam gas water will not be discharged prior to treatment/assessment.	SREIS Chapter 10, Section 10.4.4	The discharge of coal seam gas water to watercourses is now proposed during all stages of operation. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 identifies the proposed receiving waterways for coal seam gas water discharge. The quantity and quality of coal seam gas water discharged to watercourses will be within the limits prescribed within the relevant environmental authority.
R13023	S012, S013, S016, S045, S047, S084, S100, S101, S102, S103, S107, S119, S151, S164	More information is required regarding the proposed ocean outfall pipeline including but not limited to the proposed ocean outfall design, location, disturbance footprint, impact to marine plants and the alignment to allow assessment of this aspect of the project. The potential environmental impact on Moreton Bay cannot be assessed, as the EIS does not specify where the ocean outfall pipeline is likely to be.	EIS Chapter 5, Section 5.6.4 SREIS Attachment 5	EIS Chapter 5, Project Description, Section 5.6.4 identifies the disposal of coal seam gas water to the sea via an ocean outfall pipeline as a feasible option undergoing evaluation as part of the detailed design of the gas field and production facilities. If the ocean outfall pipeline becomes the preferred option for coal seam gas water disposal, it will be assessed under a separate approval process. Further details of coal seam gas water management options are provided in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Plan.
R13024	S119	Provide details qualifying the statement that the aquatic environments have been moderately or highly disturbed through modification.	EIS Appendix J, Sections 3.2, 3.3 and 4.1	EIS Appendix J, Aquatic Ecology Impact Assessment, Sections 3.2, 3.3 and 4.1 provide further context for the description of aquatic ecology values in the study area, including an overview of the history of the study area, and past activities affecting these ecosystems.
R13025	S119	Provide further details qualifying the statement that the ephemeral watercourses in the project development area contain no fisheries value and no species.	EIS Chapter 16, Section 16.3.1 SREIS Chapter 10, Section 10.4.4	EIS Chapter 16, Aquatic Ecology, Section 16.3.1 noted that there was no species of special conservation significance present within the ephemeral systems. The term 'ephemeral systems' is used for lower order streams that do not

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Issue No.	Submission No.	Issue	Reference	Responses
R13025	S119			<p>hold water for extended periods of time. All the streams within the project development area are ephemeral to some extent in that they do not flow all year round. Most of these ephemeral systems do not hold sufficient water or do not hold water for sufficient periods of time to enable fish of recreational value to migrate into them. While the value of these systems for opportunistic spawning and foraging is recognised, and protected by the proposed mitigation measures, aquatic communities in ephemeral systems tend to be adapted to widely varying conditions, in contrast to more permanent waterways that provide greater fisheries value and are more sensitive to altered flow hydrology. Surveys and associated sampling focussed on those streams that held sufficient permanent water to contain aquatic values representative of those across the project development area. Additional surveys targeting ephemeral watercourses have been undertaken to inform the SREIS, with the findings described in SREIS Chapter 10, Aquatic Ecology. The value of ephemeral watercourses is recognised, with the Murray cod recorded during SREIS surveys in an ephemeral system (see Section 10.4.4). Irrespective of this, as with any watercourse, Arrow will manage potential impacts through the commitment to implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys. (Commitment C157).</p>
R13026	S119	<p>The EIS should include a more detailed assessment of the specific ephemeral waterways that will be disturbed as part of the project, their fish habitat values and the potential to provide fish habitat during times of flow.</p>	<p>SREIS Chapter 10, sections 10.6, 10.6.2 and 10.4.4</p>	<p>SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 outlines specific sites and watercourses that could be directly impacted by the project, through the proposed coal seam gas water discharge to watercourses. Section 10.4.4 summarises the detailed targeted surveys undertaken to further characterise the existing environment of the identified receiving waterways, including the additional watercourses surveyed to supplement the total number of ephemeral systems described. Additional mitigation and management measures to reduce the potential impacts to the identified watercourses are also proposed.</p>
R13027	S134	<p>Arrow to adequately assess impacts on aquatic ecology in regards to cumulative and indirect impacts associated with groundwater drawdown impacts on ecosystems, gas emissions into creek systems, changes to surface hydrology, subsurface works impacting on stream beds, and potential salinisation of soils.</p>	<p>EIS Chapter 28, Section 28.3.5</p>	<p>EIS Chapter 28, Cumulative Impacts, Section 28.3.5 discusses potential cumulative impacts on aquatic ecological values resulting from project activities.</p>
R13028	S134	<p>Aquatic ecology literature review is limited and</p>	<p>EIS</p>	<p>A broader range of literature was reviewed as part of the Aquatic Ecology</p>

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R13028	S134	does not include research or information from local information sources. Arrow to access information from local bodies.	Appendix J, Section 3.2 SREIS Appendix 8	Impact Assessment (EIS Appendix J, Aquatic Ecology Impact Assessment, Section 3.2) than is referenced in the report. Specific papers and reports were only referenced in the text where necessary. Relevant literature was also reviewed in the aquatic studies completed for the SREIS (SREIS Appendix 8, Supplementary Aquatic Ecology Assessment).
R13029	S134	Sites used for ground truthing are not necessarily representative of the aquatic ecology environment over the whole project area.	SREIS Chapter 10, sections 10.5 and 10.4.4	Noted. Ephemeral streams were underrepresented in the surveys undertaken for the EIS given the dry conditions under which the sampling was undertaken. The permanent/ semi-permanent streams were considered more likely to contain dry season refugia for aquatic biota and more likely to contain less resilient species, communities and habitats than the low order ephemeral streams typical of much of the project development area. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 describes the additional field surveys undertaken to further characterise the aquatic ecology environment present within the project development area.
R13030	S134	Field surveys need revision as several watercourses were dry at the time of sampling for aquatic flora and fauna. Arrow to expand its aquatic ecology field survey operations to capture more detailed and accurate results. Arrow to carry out aquatic ecology field surveys over a longer period of time, and report on the findings in the SEIS.	SREIS Chapter 10, Section 10.4.4 Appendix 8	Noted. Additional detailed site-specific surveys have been undertaken to further characterise aquatic ecology values. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 summarises the field surveys undertaken for the SREIS and their main findings. Further details are presented in SREIS Appendix 8, Aquatic Ecology. Surveys were carried out throughout March and May (the post-wet sampling period). Additional sites in the Dawson River and Macintyre and Weir rivers sub-basins have also been included to supplement the original EIS findings.
R13031	S134	What criteria are used to assign levels of value using AquaBAMM aquatic conservation assessment?	EIS Appendix J, Section 11	EIS Appendix J, Aquatic Ecology Impact Assessment, Section 11 identifies the paper prepared by Clayton et al. (2008) which discusses the use of AquaBAMM in the Condamine River sub-basin.
R13032	S150	The description of the terrestrial and aquatic ecology in the project development area is inadequate and fails to recognise their complexity and interconnectedness.	EIS Chapter 16 Chapter 17 SREIS Chapter 8, Chapter 9, Chapter 10 and Chapter 11	Arrow acknowledges the interconnectedness that exists between terrestrial and aquatic ecology, as discussed in EIS Chapter 16, Aquatic Ecology and EIS Chapter 17, Terrestrial Ecology, which describes riparian habitat in the project development area. EIS Chapter 16, Aquatic Ecology discusses the health of aquatic ecosystems being dependent on the water quality of surface water and any groundwater systems that discharge to watercourses. Further groundwater, surface water, aquatic ecology and terrestrial ecology investigations have been undertaken for the EIS and are presented in SREIS chapters 8, 9, 10 and 11 respectively.
R13033	S150	The value of the terrestrial and aquatic ecology studies already conducted in the development area are recognised, however further study is required to ascertain which processes have the greatest influence in this area, their role, the spatial extent over which they operate and the kinds of threats	EIS Chapter 16, Section 16.3 SREIS Chapter 10, Section 10.4.4	Surveys undertaken throughout the EIS process informed EIS Chapter 16, Aquatic Ecology. Section 16.3, which describes the general characteristics of the aquatic ecology environment, identifies environmentally sensitive areas, and describes the water quality, sediment and aquatic flora and fauna within and around the project development area. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 describes the additional

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Issue No.	Submission No.	Issue	Reference	Responses
R13033	S150	that are limiting their function.		field surveys undertaken for the SREIS with regard to aquatic ecological values in the study area.
R13034	S123	Provide greater detail of the aquatic values that will be directly or indirectly impacted by the project, including details of the waterways, aquatic values, fish habitat and aquatic species that are found in the project development area. The current level of detail does not allow assessment of the potential impact to fisheries resources and aquatic fish habitats.	EIS Chapter 16 Appendix J SREIS Chapter 10, Section 10.4.4	The EIS adopted a risk-based approach, as the exact location of proposed infrastructure was not available at the time the EIS was prepared. This approach consisted of sampling a number of sites representative of the aquatic systems of the study area and categorising watercourses according to the Strahler stream order and associated aquatic values. Areas known or suspected of supporting high value or particularly sensitive aquatic species/communities/systems were labelled as 'no go' zones. Guidelines for acceptable activities and associated mitigations were identified for systems of high, moderate and low conservation value (EIS Chapter 16, Aquatic Ecology and EIS Appendix J, Aquatic Ecology Impact Assessment). This approach provides a generic framework that protects aquatic values across the study area without the need to identify precise locations at which infrastructure/activities will impact on aquatic systems. SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 outlines the extensive aquatic ecology surveys undertaken to supplement the EIS findings and identifies mitigation and management measures at the proposed discharge sites, to protect aquatic ecosystems, including fisheries values. At such time that the location of further facilities is determined, additional field surveys may be undertaken where infrastructure has the potential to impact directly on watercourses, including watercourse crossings and coal seam gas water discharge points.
R13035	S156	What guarantee can Arrow give to ensure that the project has no negative effects on aquatic life?	EIS Chapter 7 Chapter 16, sections 16.6, 16.8 and Table 16.7 SREIS Chapter 10, Section 10.4.4	The significance of potential impacts on the aquatic ecological values was assessed in the EIS using the sensitivity of the value and the magnitude of the potential impact (as described in EIS Chapter 7, Impact Assessment Method). EIS Chapter 16, Aquatic Ecology, Section 16.6 describes the avoidance, mitigation and management measures that will be implemented to avoid or reduce potential impacts to as low as reasonably practicable. Table 16.7 provides a summary of the residual impacts following the implementation of the proposed mitigation measures. Section 16.8 identifies the inspection and monitoring of avoidance, mitigation and management measures to be implemented to contain the residual impacts at low throughout the lifetime of the project. SREIS Chapter 10, Section 10.4.4 identifies the additional mitigation and management measures proposed to reduce the potential impact of coal seam gas water discharge to watercourses. Section 10.6.6 describes the residual impacts assessed following the implementation of the mitigation and management measures, as informed by the additional surveys undertaken for the SREIS. Inspection will be undertaken to monitor the effectiveness of mitigation measures and demonstrate achievement of the environmental objectives.

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Issue No.	Submission No.	Issue	Reference	Responses
R13036	S134	Arrow to implement operations to prevent downstream contamination of aquatic environments.	EIS Chapter 16, Section 16.6	Noted. EIS Chapter 16, Aquatic Ecology, Section 16.6 identifies a number of mitigation measures that Arrow will implement to protect water quality and prevent contamination entering watercourses. These include commitments to: <ul style="list-style-type: none"> • Develop and implement emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or loss of containment of storage equipment (Commitment C036). • Ensure appropriate spill response equipment, including containment and recovery equipment, is available on site, and that relevant personnel are appropriately trained. (Commitment C037).
R13037	S156	What does Arrow propose to do if contamination of waterways does occur?	EIS Chapter 15, Section 15.6.4 SREIS Chapter 10, Section 10.9	Under the Environmental Protection Act 1994 (Qld), Arrow is legally required to remediate any contamination caused by project activities. As set out in EIS Chapter 15, Surface Water, Section 15.6.4 and the updated commitment, Arrow will, where appropriate and as part of a discharge strategy, incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy (Commitment C498). Arrow will routinely inspect spill containment controls and spill response kits (Commitment C516).
R13038	S134	Arrow to avoid areas of threatened native aquatic species.	EIS Chapter 16, Section 16.6.2 and Attachment 3, sections 7, 7.8, 8 and Table 8.1 SREIS Chapter 10, Section 10.4.4 and Attachment 8	Noted. No legislatively significant aquatic species were recorded within the project development area in the course of EIS fieldwork investigations (EIS Chapter 16, Aquatic Ecology). As a general principle, the Surat Gas Project will aim to avoid threatened species and communities. For example, Lake Broadwater will be avoided as it is an important wetland which is likely to provide suitable habitat for threatened flora and fauna species and could also be seasonally inhabited by EPBC Act-listed species, such as the Murray cod and migratory birds. Arrow will manage potential impacts to watercourses through the commitment to implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157). The constraints mapping (SREIS Attachment 8, Constraints Mapping Update) will be used to plan the location of infrastructure. Pre-clearance surveys will be undertaken prior to clearance works in areas potentially containing threatened species. Threatened species management procedures will be developed as and when project activities are identified as likely to impact upon threatened species. These measures will serve to avoid and reduce

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Issue No.	Submission No.	Issue	Reference	Responses
R13038	S134			<p>impacts on threatened species habitat (EIS Attachment 3, Matters of National Environmental Significance, Section 7 and 8, Table 8.1). Where impacts cannot be avoided, offsets will be provided (EIS Attachment 3, Matters of National Environmental Significance, Section 7.8).</p> <p>The field surveys undertaken to inform the SREIS recorded one legislatively significant species, the Murray cod, as described in SREIS Chapter 10, Aquatic Ecology. The general mitigation and management measures presented in the EIS were assessed as adequate in the SREIS. Additional mitigation and management measures were still proposed however, to reduce the potential impacts of coal seam gas water discharge to watercourses, as described in Section 10.4.4.</p>
R13039	S134	<p>Arrow to adequately assess direct and cumulative impacts on aquatic ecology.</p>	<p>EIS Chapter 28, Section 28.3.5</p>	<p>Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.5 describes the cumulative impacts with respect to aquatic ecology.</p>
R13040	S156	<p>During operations and decommissioning, what impact will an accident, spill or release of waste into or near a watercourse have on the ecosystem?</p>	<p>EIS Chapter 16, Table 16.7 Appendix J, Section 3.10</p>	<p>EIS Chapter 16, Aquatic Ecology, Table 16.7 describes the residual impacts, following the implementation of mitigation measures, resulting from an accident, spill or release of waste into or near a watercourse, as having been assessed as low magnitude and mostly negligible significance (in accordance with the method of applying sensitivity criteria and rankings described in detail in EIS Appendix J, Aquatic Ecology Impact Assessment, Section 3.10).</p>

Table 19.14 Terrestrial Ecology

Issue No.	Submission No.	Issue	Reference	Responses
R14001	S150	Destroying habitat before equivalent habitat has been restored increases the risk of species extinction. Additionally, species need time to colonise a restored habitat and too frequent a turnover of habitat may increase the risk of species extinction.	EIS Chapter 17 and Appendix K, appendices C, E and I SREIS Attachment 1, Attachment 2 and Attachment 6	Noted. The primary means by which environmental protection terrestrial ecology values will be achieved is through design and site selection that results in avoidance of high-value sites (EIS Chapter 17, Terrestrial Ecology). Arrow has committed to constructing production wells, gathering lines and access tracks within cleared areas, where possible, with the aim of avoiding remnant vegetation and high-value regrowth (Commitment C240) and core habitat for species (Commitment C218). Species profiles have been prepared for species listed under the Nature Conservation Act 1992 (EIS Appendix K, Terrestrial Ecology Impact Assessment, appendices C, E and I) and the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act), (SREIS Attachment 1, MNES, Appendix C) that provides detail on the ability of species to tolerate project related impacts. From these species profiles, species management procedures will be developed as required (Commitment C224). The proposed structure of a species management procedure is contained in Attachment 2, Strategic Environmental Management Plan. Where significant impacts from project related activities on species are expected, habitat will be avoided wherever possible. Further to this, Arrow will develop offsets for species habitats in accordance with legislative requirements as set out in SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan.
R14002	S134	Arrow to include existing areas of moderate to highly disturbed environments as part of their offset schemes.	SREIS Attachment 6	Arrow will develop offsets in accordance with legislative requirements as set out in SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan. Where moderate and highly disturbed environments are identified as providing a suitable offset for vegetation or habitat loss, these areas will be considered for use as offset areas. All areas identified as potential offset sites will be presented to the administering authorities for approval.
R14003	S134	Information in EIS regarding offsets is inadequate. Arrow to develop and make their Habitat Offsets Strategy (C219) publically available for comment in order to meet TOR 4.8.2.	SREIS Attachment 6	Noted. Arrow has developed a company-wide Draft Environmental Offset Strategy (Appendix 1 to SREIS Attachment 6) which defines how environmental offsets will be managed across all of Arrow's current and future projects. This outlines how Arrow's operations will be conducted at or above the legal requirements and standards expected by administering authorities. Arrow's Draft Environmental Offset Strategy will be supported by a number of management plans specific to each project, including the Surat Gas Project. These management plans will be developed prior to construction for each project. The Draft Environmental Offsets Strategic Management Plan for the Surat Gas Project is presented in SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan.
R14004	S011	Koalas status in EPBC Act has been upgraded to "vulnerable" in early 2012. This is not identified in	EIS Chapter 17, Section 17.6.2	Noted. As determined by the process for a project to be referred under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cwlth)

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Issue No.	Submission No.	Issue	Reference	Responses
R14004	S011	Appendix K, Table 19. The report should be updated to provide an impact assessment and proposed mitigation measures for Koala populations in the proposed area with the new classification.	and Appendix K, Section 7.9.3	(EPBC Act), the Minister has determined the Surat Gas Project to be a controlled action. In accordance with Section 158A of the EPBC Act, the upgrade of the EPBC status for the koala (<i>Phascolarctos cinereus</i>) does not impact on the project as the listing event occurred after the approval process decision: '(3) The validity of the primary decision [i.e., a controlled action decision and decision on controlling provisions under s. 75], or any other approval process decision made in relation to the relevant action before the listing event occurred, is not affected by the listing event, nor can it be revoked, varied, suspended, challenged, reviewed, set aside or called in question because of, or for reasons relating to, the listing event. (4) After the listing event occurs, the listing event is to be disregarded: (a) in making any further approval process decision in relation to the relevant action.' The assessment of impacts on koala and associated mitigation measures therefore remain as assessed in EIS Chapter 17, Terrestrial Ecology, Section 17.6.2. This section provides mitigations for fauna mortality and the inspection and retention of identified koala trees (Commitments C234 and C236). EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 7.9.3 identifies the requirement for offsets under the Nature Conservation (Koala) Conservation Plan (2006).
R14005	S011	The EIS does not fulfil TOR 4.8.1 as the terrestrial ecology report fails to identify any sensitive areas that contain feeding, breeding, resting areas for populations of echidna, koala, platypus and other species of cultural significance. These areas are believed to exist in the project area and relevant mitigation measures should be applied.	EIS Chapter 17 and Appendix K SREIS Appendix 7, sections 5.3 and 5.6	In accordance with the TOR, the EIS identifies the likely presence of fauna species and their habitat requirements. The assessment of the terrestrial environment in EIS Chapter 17, Terrestrial Ecology and EIS Appendix K, Terrestrial Ecology Impact Assessment identifies areas of potential habitat for species that are not endangered, vulnerable or near threatened species (including culturally significant and bioregionally significant species). These species are presented and assessed with consideration of Environmentally Sensitive Areas, regional ecosystems and other protected areas. Arrow will use preconstruction clearance surveys to identify the presence of, and implement measures required for the management of species identified. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary works accommodation facility. The findings of site specific surveys in these areas are presented in SREIS Appendix 9, Supplementary Terrestrial Ecology Assessment, sections 5.3 and 5.6. Section 5.3 presents the survey effort used for site specific assessments which suitable to identify sensitive areas as described in TOR 4.8.1.
R14006	S089	The EIS does not provide a satisfactory plan for the conservation of endangered Brigalow ecological communities. Much of the project area is covered by a Brigalow bioregion. Soils associated with Brigalow bioregions are especially fertile and	EIS Chapter 12 and Appendix K, Section 6.8.4 SREIS Chapter 8, Chapter 11,	The Environmental Protection and Biodiversity Conservation Act (EPBC Act) listed Brigalow threatened ecological community has been identified as occupying 7,387 ha (1.21%) of the project development area in the EIS. Further mapping verification, relinquishment of sub-tenements and ground truthing has refined the known areas of vegetation communities, such as

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Issue No.	Submission No.	Issue	Reference	Responses
R14006	S089	vulnerable to salinity levels and erosion. This will be compounded by coal seam gas activities, particularly as brigalows are sensitive to changes in water table levels and salinity.	Section 11.4.2 and Attachment 4	<p>Brigalow, as presented in SREIS Chapter 11, Terrestrial Ecology, Section 11.4.2.</p> <p>Brigalow communities are protected under the EPBC Act, Environmental Protection Act 1994, Vegetation Management Act 1999 and Nature Conservation Act 1992 (protection of species). Arrow will be conditioned on activities in and around EPBC Act listed communities.</p> <p>The primary means by which environmental protection for terrestrial ecology will be achieved is through design and site selection that results in avoidance of high-value sites such as locations of significant remnant vegetation and high value regrowth where practical. Activities within the vicinity of these areas are constrained through clearance and buffer restrictions, or additional control measures. Offsets are required where these communities cannot be avoided and are impacted.</p> <p>EIS Chapter 12, Geology, Landform and Soils, contained several commitments around the management and protection of soils from erosion and salinity.</p> <p>The EIS presented predicted drawdown levels in the shallow groundwater system, primarily the Condamine Alluvium. Under Arrow's extraction profile, less than 1 m maximum drawdown was predicted in the Condamine Alluvium. Since the release of the EIS, the Office of Groundwater Impact Assessment (OGIA) released the results of the groundwater flow model used to inform the Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA). The drawdown in shallow aquifers predicted by the OGIA model is comparable to the levels predicted by the model prepared for the EIS, indicating limited drawdown propagating from the Walloon Coal Measures to the shallow, unconfined Condamine Alluvium. EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 6.8.4 identified the potential for secondary salinity resulting from land clearing and impacts on the groundwater levels. Potential impacts from secondary salinity on brigalow ecological communities are low as areas of known occurrence of brigalow ecological communities (e.g., Chinchilla Sands Local Fossil Fauna Site) are mapped as areas of moderate to low potential for groundwater interaction in the Atlas of Groundwater Dependent Ecosystems (Australian Government, 2013).</p> <p>SREIS Chapter 8, Groundwater, SREIS Attachment 1, Matters of National Environmental Significance and SREIS Attachment 4, Supplementary Groundwater Assessment further discuss updated information on potentially groundwater dependent vegetation in the project development area.</p>
R14007	S137	All of the usual flora and fauna issues must be included and these have been adequately covered in all of their submissions. Contact WPSQ for further clarification.	SREIS Chapter 11 and Appendix 9, section 6.2	<p>The SREIS presents new information on the potential impacts to flora and fauna from changes made to the project description since publication of the EIS. This includes the identification of four proposed central gas processing facility locations and a temporary workers accommodation facility. Species and community specific assessments which consider potential impacts to conservation listed species and communities are presented in SREIS</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R14007	S137			Appendix 9, Supplementary Terrestrial Ecology Assessment, Section 6.2. SREIS Chapter 11, Terrestrial Ecology, provides an update of associated environmental values, potential impacts new mitigation and management measures (commitments). Existing and updated commitments are in SREIS Appendix 4, Commitments Update.
R14008	S145	General concern regarding removal of habitat and habitat fragmentation, threatening endangered flora and fauna.	EIS Chapter 17, section 17.4 and Appendix K, Section 6 SREIS Chapter 11, Section 5.6 and Attachment 1, Appendix C	Noted. The potential impact of vegetation loss and habitat fragmentation is presented in EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 6 and EIS Chapter 17, Terrestrial Ecology, Section 17.4. Arrow will aim to avoid areas of high sensitivity when siting infrastructure, including, but not limited to 'endangered' EPBC Act communities, national and state listed communities and essential and core habitat as discussed in Commitment C218 in EIS Chapter 17, Section 17.6.1. Site specific assessments have been undertaken for the SREIS to identify habitat areas of listed flora and fauna at four proposed central gas processing facility locations and a temporary workers accommodation facility. The findings of these site specific assessments are presented in SREIS Chapter 11, Terrestrial Ecology, Section 5.6. Species specific assessments in consideration of potential impacts to EPBC Act listed communities and species are presented in SREIS Attachment 1, MNES, Appendix C.
R14009	S145	General concern regarding disruption of habitat due to construction of infrastructure, reducing habitat integrity.	EIS Appendix K, Section 6 Chapter 17, sections 17.4 and 17.6.1 SREIS Chapter 11, Section 11.4.9 and Attachment 1, Appendix C	Noted. The potential impact of reduced habitat integrity through fragmentation is presented in EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 6 and EIS Chapter 17, Terrestrial Ecology, Section 17.4. Arrow will aim to avoid areas of high sensitivity when siting infrastructure, including but not limited to 'endangered' EPBC Act communities, national and state listed communities and essential and core habitat as per Commitment C218 in EIS Chapter 17, Section 17.6.1. Additional commitments made in Section 17.6 have been designed to reduce impacts on the terrestrial environment and maintain existing habitat function. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Site specific assessments have been undertaken at these locations and the findings presented in SREIS Chapter 11, Terrestrial Ecology, Section 11.4.9. Species specific assessments in consideration of potential impacts to EPBC Act listed species are presented in SREIS Attachment 1, MNES, Appendix C.
R14010	S150	The decline in populations of 'at risk' flora and fauna species must be prevented. Native fauna are territorial and cannot simply move to another area if disturbed by noise or dust etc.	EIS Chapter 17, Sections 17.4 and 17.6 SREIS Chapter 11, sections 11.4.4,	Noted. Issues and potential impacts on the identified terrestrial ecology environmental values, including factors such as noise and dust and litter, are discussed within EIS Chapter 17, Terrestrial Ecology, Section 17.4. Measures to avoid, mitigate and manage these potential impacts are discussed in EIS Chapter 17, Section 17.6.

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Issue No.	Submission No.	Issue	Reference	Responses
R14010	S150		11.4.5, 11.5 and Attachment 1, Appendix C	The terrestrial ecology objectives and methodology (i.e., preconstruction clearance surveys) employed by Arrow aims to reduce disturbance to sensitive environmental features such as threatened wildlife and communities on the site and in the surrounding areas. Where populations of 'at risk' flora and fauna species are more likely to be present in areas, avoidance and mitigation measures (e.g., buffers) will be applied. The use of mitigation measures for dust and noise generation will assist in minimising impacts to these species. SREIS Chapter 11, Terrestrial Ecology, section 11.4.4 and 11.4.5, and SREIS Attachment 1, MNES, Appendix C has further assessed 'at risk' species and updated the findings of the EIS where necessary. SREIS Chapter 11, Terrestrial Ecology, Section 11.5, provides an overview of Arrow's terrestrial ecology survey methodology to identify 'at risk' populations and sensitive environmental features.
R14011	S150	The siting of a telecommunication tower, for example, in an area mapped as an Environmentally Sensitive Area fails to understand the significance of the established buffer zone. Modification or destruction of ecological processes are in practice often irreversible and an ecosystem will not necessarily rehabilitate to its prior function.	EIS Chapter 17, Section 17.6 SREIS Attachment 6	Noted. Environmentally Sensitive Areas (ESA) are described under the <i>Environmental Protection Act 1994</i> and comprise faunal and floral communities of varying complexity and constraint. EIS Chapter 17, Terrestrial Ecology, Section 17.6 identifies commitments pertaining to the protection of these areas: Category A ESAs - Are designated as 'no go' areas. Clearing will not occur within these areas and buffer areas in accordance with regulatory requirements at the time will be applied to restrict activities within the surrounding area. Category B ESAs - Activities within these areas will be reduced where practicable. Where vegetation loss occurs, offsets will be provided in accordance with SREIS Attachment 6, Draft Environmental Offsets Strategic Management Plan.
R14012	S011	Does not fulfil TOR 4.8.1.2 as vertebrate animal surveying undertaken was not comprehensive as it was heavily concentrated in the northern half of project area, with only 6 sites in the Cecil Plains to northwest Goondiwindi.	EIS Chapter 8 and Chapter 17, Section 17.3 SREIS Chapter 11, Section 11.5	Surveys undertaken throughout the EIS process informed EIS Chapter 17, Terrestrial Ecology, Section 17.3, which described the general characteristics of the terrestrial ecology environment, identifies environmentally sensitive areas, and describes terrestrial flora and fauna within and around the project development area. Regional ecosystem mapping (DERM, 2009c) was used to identify vegetation occurrence and habitat potential where survey effort was restricted. Further work undertaken for the SREIS Chapter 11, Terrestrial Ecology, Section 11.5 demonstrates a targeted approach to how Arrow will continue to refine knowledge of regional ecosystem extent a presence of fauna and flora habitat. Through the refinement of vegetation mapping and the use of planning and design tools, Arrow will aim to avoid sensitive areas. As discussed in EIS Chapter 8, Environmental Framework, the objectives of the framework approach implemented for the EIS is to protect the environmental values of the project development area (as defined in government policies and

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Issue No.	Submission No.	Issue	Reference	Responses
R14012	S011			regulations or as an attribute to the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environmental values. Impacts to sensitive areas will be avoided or reduced through environmental management controls that reflect the sensitivity of the environmental values. The need for buffers and buffer distances will be determined by legislative requirements at the time of development of a site.
R14013	S134	Terrestrial ecology field surveys undertaken in the Toowoomba Regional Council local government area are not sufficient and do not provide an indication of plant and animal values over all seasons, as per TOR 4.8. Arrow to undertake additional terrestrial, flora and fauna field studies in the Toowoomba Regional Council local government area to address information gaps (including the accuracy of vegetation mapping, including RE's, threatened ecological communities, grassland communities and flora and fauna locations), and to better inform site planning.	EIS Chapter 8 and Chapter 17, Section 17.3 SREIS Chapter 11, Section 11.5 Appendix 9, Section A5	Surveys undertaken throughout the EIS process informed EIS Chapter 17, Terrestrial Ecology, Section 17.3, which described the general characteristics of the terrestrial ecology environment, identifies environmentally sensitive areas, and describes terrestrial flora and fauna within and around the project development area. Regional ecosystem mapping (DERM, 2009c) was used to identify vegetation occurrence and habitat potential where survey effort was restricted. Further work undertaken for the SREIS Chapter 11, Terrestrial Ecology, Section 11.5 demonstrates a targeted approach to how Arrow will continue to refine knowledge of regional ecosystem extent and the presence of fauna and flora habitat. Survey requirements for seasonal variability and a species specific survey approach in accordance with survey guidelines has been provided in SREIS Appendix 9, Supplementary Terrestrial Ecology Assessment, Section A5. Through the refinement of vegetation mapping and the use of planning and design tools, Arrow will aim to avoid sensitive areas. As discussed in EIS Chapter 8, Environmental Framework, the objectives of the framework approach implemented for the EIS is to protect the environmental values of the project development area (as defined in government policies and regulations or as an attribute to the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environmental values.
R14014	S134	Information from any additional field surveys including preconstruction clearance surveys, to be made publically available and provided to DERM.	SREIS Chapter 11 and Appendix 9, Section 6	The findings of additional terrestrial ecology studies undertaken for the SREIS are provided within SREIS Appendix 9, Supplementary Terrestrial Ecology Assessment, Section 6, and summarised within SREIS Chapter 11, Terrestrial Ecology. As per EIS Commitment C220, Arrow will conduct preconstruction clearance surveys to identify any additional areas that may need to be avoided. Arrow will consult with relevant Queensland government authorities regarding the findings of preconstruction clearance surveys. It is expected that once approval is received there will be a process in place for demonstrating the findings of preconstruction clearance surveys.

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Issue No.	Submission No.	Issue	Reference	Responses
R14014	S134			
R14015	S162	Chapter 17 is incomplete due to field surveys not being taken on a representative area, only on the petroleum lease not prospecting leases. Jimbour Floodplain is part of the critically endangered 11.3.21 bioregion. The road reserves and stock routes provide the last continuous refuge for this bioregion.	EIS Chapter 17, Section 17.3 SREIS Chapter 3, Figure 3.1 and Chapter 11, Section 11.5	Surveys undertaken throughout the EIS process informed EIS Chapter 17, Terrestrial Ecology, Section 17.3, which describes the general characteristics of the terrestrial ecology environment, identifies environmentally sensitive areas, and describes terrestrial flora and fauna within and around the project development area. Regional ecosystem mapping (DERM, 2009c) was used to identify vegetation occurrence and habitat potential where survey effort was restricted. As set out in SREIS Chapter 11, Terrestrial Ecology, Section 11.5, further work undertaken for the SREIS demonstrates the methodology behind the targeted approach and how Arrow will continue to refine knowledge of regional ecosystem extent and presence of fauna and flora habitat. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced (see SREIS Chapter 3, Project Description, Figure 3.1). The original extent of 11.3.21 in the area has been significantly reduced due to cultivation. The remaining area of recognised grassland (11.3.21) has been identified on the Dalby Kogan Road Reserve west of Dalby.
R14016	S060	Will not allow the destruction of any of the 100 acres of natural wildlife refuge on their property.	–	Noted. Where possible, Arrow will be flexible in the location of wells and infrastructure. In accordance with the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld), Arrow will conduct and negotiate compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses.
R14017	S150	Priority landscape scale regional ecosystems should be maintained or improved so that ecological processes and ecosystem linkages are increased in extent and abundance at priority catchment scales.	EIS Chapter 17, Section 17.6 and 17.6.1	Noted. Arrow will aim to avoid areas of high sensitivity when siting infrastructure, including but not limited to 'endangered' EPBC Act communities, national and state listed communities and essential and core habitat as discussed in Commitment C218 in EIS Chapter 17, Section 17.6.1. Additional commitments made in Section 17.6 have been designed to reduce impacts on the terrestrial environment and maintain existing habitat function.
R14018	S150	The EIS must demonstrate scientific understanding of the importance of remnant vegetation and the habitat requirements of native fauna by preventing further fragmentation or destruction of ecosystem corridors. It should not be assumed that fauna can be removed to another ecosystem if found where vegetation is to be cleared.	EIS Chapter 4, Chapter 17, sections 17.2, 17.4 and Appendix K, Section 4 SREIS Chapter 11, Section 11.4.6 and Attachment 4	The technical study undertaken for the EIS incorporated a substantial desktop literature and database review, habitat suitability assessment, field assessment and habitat suitability refinement to establish terrestrial flora and fauna values within the project development area. Further information regarding this methodology is provided within EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 4. This technical study was used to inform EIS Chapter 17, Terrestrial Ecology. As discussed in Section 17.2, aerial photography of recent and historical imagery was also assessed to assist with the verification of remnant

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Issue No.	Submission No.	Issue	Reference	Responses
R14018	S150			<p>vegetation and EPBC Act listed vegetation communities. The imagery also served to correlate past land management practices to current vegetation conditions. Areas for field surveys were selected with representative examples of remnant vegetation which provided a reference condition for a number of sensitive regional ecosystems. Potential impacts on the identified terrestrial ecology environmental values such as remnant vegetation are discussed within Section 17.4. This includes habitat fragmentation preventing the movement of terrestrial fauna species, as well as habitat loss or degradation.</p> <p>SREIS Chapter 11, Terrestrial Ecology, Section 11.4.6 describes bioregional corridors and fauna species susceptible to fragmentation. Measures to avoid, mitigate and manage potential impacts are discussed in SREIS, Attachment 4. The primary means by which environmental protection for terrestrial ecology will be achieved is through design and site selection that results in avoidance of high-value sites such as locations of significant remnant vegetation. Arrow has committed to constructing production wells, gathering lines and access tracks within cleared areas, where possible, with the aim of avoiding remnant vegetation and high-value regrowth (Commitment C240).</p>
R14019	S134	Arrow to adequately assess impacts on terrestrial ecology.	<p>EIS Chapter 7, Chapter 17, sections 17.4 and 17.6 and Appendix K</p> <p>SREIS Chapter 11 Appendix 9, Section A5</p>	<p>An assessment of the terrestrial ecological values across the project development area was undertaken as part of the EIS process, and is provided within EIS Attachment K, Terrestrial Ecology Impact Assessment. A summary of this assessment, including the environmental values of terrestrial ecology within the project development area, and an assessment of the potential for these values to be affected by direct and indirect impacts associated with various phases of the project is provided within EIS Chapter 17, Terrestrial Ecology.</p> <p>The significance of potential impacts on the identified terrestrial ecology environmental values has been assessed by considering the sensitivity of the value and the magnitude of the potential impact as described in EIS Chapter 7, Impact Assessment Method. Potential direct and indirect impacts on the environmental values from associated project activities are discussed in EIS Chapter 17, Terrestrial Ecology, Section 17.4. Measures to avoid, mitigate and manage potential impacts are discussed in EIS Chapter 17, Terrestrial Ecology, Section 17.6.</p> <p>Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. As such, SREIS Chapter 11, Terrestrial Ecology, provides an update of associated environmental values, potential impacts and mitigation and management measures.</p> <p>Arrow has committed to conduct preconstruction clearance surveys to identify any additional areas that may need to be avoided (Commitment C220). The requirements for these surveys are described in SREIS Appendix 9, Supplementary Terrestrial Ecology Assessment and survey effort required in</p>

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R14019	S134			accordance with relevant guidelines described in SREIS, Appendix 9, Supplementary Terrestrial Ecology Assessment, Section A5.
R14020	S145	General concern regarding impacts on Endangered, Vulnerable or Threatened vegetation communities, flora and fauna.	<p>EIS Chapter 17, sections 17.1, 17.3.3, 17.3.4 and 17.4</p> <p>SREIS Chapter 11, Section 11.5 and Appendix 9, Section A5</p>	<p>Noted. As discussed within EIS Chapter 17, Terrestrial Ecology, Section 17.1, relevant Commonwealth and state legislation, policy and guidelines were utilised in identifying terrestrial ecology values and to provide guidance for avoidance, mitigation and management measures. In particular, the Environmental Protection and Biodiversity Conservation Act provides for the protection of matters of national environmental significance, including listed threatened terrestrial species and communities and listed migratory species. The existing environment and environmental values for terrestrial ecology and specifically with regard to nationally classified vegetation and fauna communities are discussed within Section 17.3.3 and 17.3.4 respectively. Issues and potential impacts on the identified terrestrial ecology values are discussed within Section 17.4.</p> <p>Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. SREIS Chapter 11, Terrestrial Ecology, provides an update of associated environmental values, potential impacts and mitigation and management measures.</p> <p>Arrow has employed a site selection approach to avoid areas of high-value terrestrial ecology, as discussed in SREIS Chapter 11, Section 11.5. Arrow has made a number of commitments to avoidance of high-value and highly sensitive areas, which are discussed within Attachment 4, Commitment Update.</p>
R14021	S150	The EIS fails to respond adequately to the complexities in the ways in which threats affect ecological processes and regional ecosystems, including the distance between the source of impact and the impacted receptor, non-linear responses to impacts, the time delays between activity and impact, combined impacts versus independent impacts, species and environmental variation resulting and unpredictable impacts in response to an activity.	<p>EIS Chapter 17, Section 17.8</p> <p>SREIS Chapter 11, Section 11.3 Attachment 1, Appendix C and Appendix 9, Section 5.6</p>	<p>Noted. The EIS provided an assessment of the terrestrial environment to determine if the project will have a significant or irreversible impact on flora and fauna within the project development area. Where the potential impacts associated with activities are considered to be a high risk to an area, these areas have been identified for avoidance. This assessment has been applied at the bioregional, regional and individual species level. Targeted surveys as demonstrated in SREIS Chapter 11, Terrestrial Ecology, Section 11.3. SREIS Attachment 1, Matters of National Environmental Significance, Appendix C and SREIS Appendix 9, Supplementary Terrestrial Ecology Assessment, Section 5.6 will be used to verify existing data sources.</p> <p>Monitoring, as outlined in EIS Chapter 17, Terrestrial Ecology, Section 17.8 provides a mechanism to develop monitoring programs that are site-specific and based on the identified risk to the conservation or maintenance of a population (see Commitment C303).</p>
R14022	S150	There is no independently peer reviewed evidence or information provided that outlines what potential impacts may be to ESAs and Regional Ecosystems. Additionally, no attempts have been	<p>EIS Chapter 7 and Chapter 17, sections 17.6 and 17.8 and Table 17.7</p>	Arrow engaged specialists with extensive experience in the region to assess potential impacts on environmental values (including ESAs and REs) .The significance of potential impacts on the terrestrial ecological values was assessed in the EIS using the sensitivity of the value and the magnitude of

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Issue No.	Submission No.	Issue	Reference	Responses
R14022	S150	made by Arrow to demonstrate or guarantee no impact.		the potential impact (as described in EIS Chapter 7, Impact Assessment Method). EIS Chapter 17, Terrestrial Ecology, Section 17.6 describes the avoidance, mitigation and management measures that will be implemented to avoid or reduce potential impacts to as low as reasonably practicable, based on the hierarchy of avoid, minimise, manage and offset. Table 17.7 provides a summary of the residual impacts following the implementation of the proposed mitigation measures. Section 17.8 identifies the inspection and monitoring of avoidance, mitigation and management measures to be implemented to contain the residual impacts at low throughout the lifetime of the project. Inspection will be undertaken regularly to verify that mitigation measures are effective and monitoring will be undertaken to demonstrate achievement of the environmental objectives.
R14023	S150	The description of the terrestrial and aquatic ecology in the project development is inadequate and fails to recognise their complexity and interconnectedness.	EIS Chapter 16 and Chapter 17 SREIS Chapter 9, Chapter 10, Chapter 11 and Chapter 12	Arrow acknowledges the interconnectedness that exists between terrestrial and aquatic ecology, as discussed in EIS Chapter 16, Aquatic Ecology and EIS Chapter 17, Terrestrial Ecology, which describes riparian habitat in the project development area. EIS Chapter 16, Aquatic Ecology discusses the health of aquatic ecosystems being dependent on the water quality of surface water and any groundwater systems that discharge to watercourses. Further groundwater, surface water, aquatic ecology and terrestrial ecology investigations have been undertaken for the EIS and are presented in SREIS chapters 9, 10, 11 and 12 respectively.
R14024	S150	The value of the terrestrial and aquatic ecology studies already conducted in the development area is recognized, however, further study is required to ascertain which processes have the greatest influence in this area, their role, the spatial extent over which they operate and the kinds of threats that are limiting their function.	EIS Chapter 16 Chapter 17 SREIS Chapter 10 Chapter 11	Noted. Summaries of environmental values of terrestrial and aquatic ecology within the project development area and the potential direct and indirect impacts associated with phases of the project are discussed within EIS Chapter 16, Aquatic Ecology; and EIS Chapter 17, Terrestrial Ecology. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. As such, SREIS Chapter 10, Aquatic Ecology, and SREIS Chapter 11, Terrestrial Ecology, provide an update of associated environmental values, potential impacts and mitigation and management measures (commitments).
R14025	S158	Greater awareness should be demonstrated in the EIS of the additional impacts upon biodiversity beyond vegetation clearing, such as vehicles strikes, movement impediments and stress caused to animals from human presence from factors such as noise, dust, light, or litter.	EIS Chapter 17, sections 17.4 and 17.6 SREIS Chapter 11	Noted. Issues and potential impacts on the identified terrestrial ecology environmental values, including factors such as noise, light, dust and litter, are discussed within EIS Chapter 17, Terrestrial Ecology, Section 17.4. Measures to avoid, mitigate and manage these potential impacts are discussed in EIS Chapter 17, Section 17.6. Additional studies have been undertaken since publication of the EIS to assess changes made to the project description, including the identification of four proposed central gas processing facility locations and a temporary workers accommodation facility. As such SREIS Chapter 11, Terrestrial Ecology, provides an update of

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Issue No.	Submission No.	Issue	Reference	Responses
R14025	S158			associated environmental values, potential impacts and mitigation and management measures.
R14026	S134	Arrow to add terrestrial ecology values of high sensitivity to the list of areas/values to avoid, as per TOR 4.8.	EIS Chapter 17, Section 17.6.1 and Appendix K Section 4 SREIS Chapter 11	Noted. The technical study undertaken for the EIS incorporated a substantial desktop literature and database review, habitat suitability assessment, field assessment and habitat suitability refinement to establish terrestrial flora and fauna values within the project development area. Further information regarding this methodology is provided within EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 4. Additional studies have been undertaken since publication of the EIS to assess changes made to the project description, including the identification of four proposed central gas processing facility locations and a temporary workers accommodation facility. As such, SREIS Chapter 11, Terrestrial Ecology, provides information from additional field surveys and an update of associated environmental values, potential impacts and mitigation and management measures (commitments). Arrow will aim to avoid areas of high and extremely high sensitivity when siting infrastructure, including but not limited to 'critically endangered' EPBC Act communities, national and state listed communities and essential and core habitat as discussed in Commitments C217 and C218 in EIS Chapter 17, Section 17.6.1. Arrow will conduct preconstruction clearance surveys to identify any additional areas that may need to be avoided as per Commitment C220. Where required, buffer zones will be implemented in accordance with the regulatory requirements at the time to further protect environmental values.
R14027	S134	Arrow to provide additional clarification on the adequacy of design/site planning as an impact mitigation/avoidance mechanism, as per TOR 4.8.2. – How is this possible? – How often is this possible? – On what is it dependant; resource or extraction feasibility, cost? – How will Arrow respond to current insufficiencies in mapping information?	EIS Chapter 8 and Chapter 17, Section 17.3 SREIS Chapter 11, sections 11.3 and 11.5	Through the refinement of vegetation mapping and the use of planning and design tools, Arrow will aim to avoid sensitive areas. As discussed in EIS Chapter 8, Environmental Framework, the objectives of the framework approach implemented for the EIS is to protect the environmental values of the project development area (as defined in government policies and regulations or as an attribute to the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environmental values. Arrow will undertake the appropriate internal planning phase of the project where constraints mapping will assist in informing the initial site location. Once the site is ground truthed, and where further constraints are discovered, the site will re-enter the planning phase and be adjusted to avoid the identified constraint where possible. Where a constraint cannot be avoided the site will be considered in consultation with the relevant authority. Surveys undertaken throughout the EIS process informed EIS Chapter 17, Terrestrial Ecology, Section 17.3, which described the general characteristics of the terrestrial ecology environment, identifies environmentally sensitive areas, and describes terrestrial flora and fauna within and around the project

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Issue No.	Submission No.	Issue	Reference	Responses
R14027	S134			<p>development area. Regional ecosystem mapping (DERM, 2009c) was used to identify vegetation occurrence and habitat potential where survey effort was restricted.</p> <p>As set out in SREIS Chapter 11, Terrestrial Ecology, sections 11.3. and 11.5, further work undertaken for the SREIS demonstrates the methodology behind the targeted approach and how Arrow will continue to refine knowledge of regional ecosystem extent and presence of fauna and flora habitat.</p>
R14028	S150	<p>Long term conservation of biodiversity and the well-being of the region's communities depend upon both the protection of natural assets and maintaining the integrity of the ecological processes that sustain them.</p>	<p>EIS Chapter 17, sections 17.6 and 17.8 and Appendix K</p>	<p>Noted. The legislative context under which the project is assessed is applicable to identifying terrestrial ecology environmental values and providing guidance for avoidance, mitigation and management measures. This context also provides for the long term conservation of biodiversity locally, sub-regionally and regionally through the EPBC Act, Environmental Protection Act 1994 (Qld) (EP Act), Nature Conservation Act 1992 (Qld) and Vegetation Management Act 1999 (Qld), along with other forms of policy, guidelines and guidance documents.</p> <p>In addressing the requirements of this legislative context, Arrow has established avoidance, mitigation and management measures as recommended by terrestrial ecology specialists within EIS Appendix K, Terrestrial Ecology Impact Assessment, and summarised in EIS Chapter 17, Terrestrial Ecology, Section 17.6 as a series of commitments.</p> <p>Arrow will inspect and monitor terrestrial ecology to observe and report on the performance of the proposed mitigation and management measures as well as evaluate the success of landscape recovery techniques, detailed in EIS Chapter 17, Terrestrial Ecology, Section 17.8.</p>
R14029	S150	<p>The EIS must demonstrate how the Project will protect ESAs, regardless of the effect of cost on a company's profits.</p>	<p>EIS Chapter 8, Section 8.5 SREIS Attachment 6</p>	<p>The environmental framework, as presented in EIS Chapter 8, Environmental Framework, Section 8.5, is an internal process developed by Arrow for managing impacts in the planning phase and in the construction and operation phases through the application of environmental controls that reflect the sensitivity or vulnerability of environmental values. Constraints mapping, an integral part of the environmental framework, is informed by the environmental impact assessment and guides site and route selection that seeks to avoid and reduce impacts, thereby protecting environmental values. Environmentally Sensitive Areas (ESA) comprise regional ecosystems and communities of varying complexity and constraint. ESAs identified under the Environmental Protection Act 1994 identify two levels of protection:</p> <p>Category A ESAs - Are designated as 'no go' areas. Clearing will not occur within these areas and buffer areas in accordance with regulatory requirements at the time, will be applied to restrict activities within the surrounding area.</p> <p>Category B ESAs - Activities within these areas will be reduced where practicable. Where vegetation loss occurs, offsets will be provided in accordance with SREIS Attachment 6, Draft Environmental Offsets Strategic</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R14029	S150			Management Plan.
R14030	S150	The siting of project infrastructure should aim to avoid potential land use conflicts and long term impacts on regional ecosystems.	EIS Chapter 8 SREIS Attachment 6	Noted. As discussed in EIS Chapter 8, Environmental Framework, the objectives of the framework approach implemented for the EIS is to protect the environmental values of the project development area (as defined in government policies and regulations or as an attribute to the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environmental values. This approach allows Arrow to identify constraints to coal seam gas development in the project development area having regard to the sensitivity of identified environmental values, and to document these constraints through mapping or the establishment of guidelines to inform site and route selection for coal seam gas infrastructure. As such, field development engineers will utilise the constraints maps and supporting information to determine the feasibility of designing a conceptual gas field layout having regard to the environmental, social and cultural constraints of varying levels of value, i.e., 'No Go' areas and areas of high, moderate and low constraint to development. SREIS Attachment 6, Constraints Mapping Update, provides updated constraints mapping following further desktop study and fieldwork undertaken for the SREIS.
R14031	S150	The establishment of buffer zones to protect natural resources should not be undermined, the buffer zone around Lake Broadwater for example should be 2 km, not 200 m.	SREIS Chapter 11, Table 11.6	SREIS Chapter 11, Terrestrial Ecology, Table 11.6, provides an example of the buffer distances framework based on the current <i>Environmental Protection Act 1994</i> , Model Conditions for Level 1 Environmental Authorities for Coal Seam Gas Activities. Arrow will implement agreed (conditioned) buffers in accordance with regulatory requirements at the time.
R14032	S150	The EIS should demonstrate how the siting of the Project's facilities and any associated infrastructure will impact on high-conservation areas and remain outside appropriate buffer zones.	EIS Chapter 8, Section 8.4.2, Chapter 17, Section 17.6.1 SREIS Chapter 11, sections 11.3 and 11.5	Through the planning and design phase, Arrow will aim to avoid sensitive areas. As discussed in EIS Chapter 8, Environmental Framework, the objectives of the framework approach implemented for the EIS is to protect the environmental values of the project development area (as defined in government policies and regulations or as an attribute to the environment that is conducive to ecological health, public amenity or safety), and to identify appropriate environmental management controls for project activities having regard to the constraints imposed by the environmental values. Section 8.4.2 discusses the preliminary constraints analysis undertaken for the EIS for each environmental aspect, including terrestrial ecology, and outlines 'No Go' areas and areas of high, moderate and low constraint to development. As set out in SREIS Chapter 11, Terrestrial Ecology, sections 11.3. and 11.5, further work undertaken for the SREIS demonstrates the methodology behind

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Issue No.	Submission No.	Issue	Reference	Responses
R14032	S150			the framework approach and how Arrow will continue to refine knowledge of regional ecosystem extent and presence of fauna and flora habitat. The establishment and management of buffers and relevant control measures will be undertaken through site specific plans. Arrow will implement agreed (conditioned) buffers in accordance with regulatory requirements at the time.
R14033	S014, S044, S081, S139	Which wash down facility will vehicles use? How often are vehicles inspected? Who undertakes inspection? How do the companies mitigate the spread of declared weeds? How do the companies mitigate the spread of other 'non-declared' weeds?	–	Arrow will develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008) (Commitment C188). This will include training for its project staff to enable them to successfully implement the plan. Accordingly, the pest management plan will specify training requirements including awareness of potential pests and weeds in the project development area, mechanisms for the spread of pests, and management and monitoring of any introductions and infestations. This will include detail on weed wash down requirements and responsibilities.
R14034	S123	Arrow is required to apply for relevant permissions and accurate location mapping where pest fences are crossed, in accordance with the Land Protection (Pest and Stock Route Management) Act 2002. The EIS does not mention declared pest fences, despite the fact that all three fences converge on project site (Wild Dog Barrier Fence; Rabbit Fence; and Wild Dog Check Fence). Staff and contractors need to comply with appropriate protocols associated with these fences.	SREIS Attachment 4	Noted. Commitment C188 has been updated to note requirements relating to crossing and working around pest fences. This will be undertaken in accordance with the Land Protection (Pest and Stock Route Management) Act 2002. See SREIS Attachment 4, Commitments Update.
R14035	S123	The list of invasive species provided in Chapter 17 does not include some moderate risk species including Class 2 species as listed in Appendix K Table 28. Other high risk weeds/feral animals known to be in the area include: prickly acacia, hymenachne, giant rats tail grass, honey locust, and African boxthorn. The use of Biosecurity Queensland's Annual Pest Distribution Survey data and predictive pest maps available on the Queensland Government website should be utilised in conjunction with Queensland Herbarium naturalised flora data to source the occurrence of pest plants in the project area. In addition, local government area pest management plans should be utilised to source the occurrence and distribution of pest animals in the project area. The occurrence of pest plants (weeds) particularly	–	Noted. Arrow will develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008) (Commitment C188). The plan will be developed in accordance with acceptable guidelines, protocols and available resources such as the Biosecurity Queensland's Annual Pest Distribution Survey data, predictive pest maps and local government area pest management plans. The plan will include training requirements for its project staff to enable them to successfully implement the plan. Accordingly, the pest management plan will specify training requirements including on awareness of potential pests and weeds in the project development area, mechanisms for the spread of pests, and management and monitoring of any introductions and infestations. This will include detail on weed wash down requirements and responsibilities.

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R14035	S123	declared plants under the Land Protection (Pest and Stock Route Management) Act 2002 should be shown on a map at an appropriate scale.		
R14036	S123	There are several known, introduced vertebrate pest species not listed in Chapter 17, but are listed in Appendix K and presented as a moderate risk. These include red deer, fallow deer and rabbits. The statement that the European rabbit does not pose a threat within the area due to unfavourable ecological conditions is not accurate, as rabbits are known to be present in the study area.	EIS Appendix K, Table 23	Noted. The risk of proliferation by terrestrial pest fauna species is presented in EIS Appendix K, Table 23. Modelling suggests that the rabbit, whilst known to be present, is low in abundance. Arrow will develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008) (Commitment C188). Arrow recognises the importance of training for its project staff to enable them to successfully implement the plan. Accordingly, the pest management plan will specify training requirements including on awareness of potential pests and weeds in the project development area, mechanisms for the spread of pests, and management and monitoring of any introductions and infestations.
R14037	S123	The Pest Management Plan should be developed in consultation with key parties such as local government officers and encompass construction, operational and rehabilitation phases. Reference should be made to the local government's pest management plans when determining control strategies in addition to include the measures recommended by DAFF in their suggested solutions. There is minimal focus on weed and pest animal risks and mitigation in Chapter 17. Weed hygiene practices should be as per Land Protection Act 2002 and also refer to the Land Access Code that relate to relevant person taking steps not to spread reproductive material of a declared pest.	–	Noted. Arrow will develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008) (Commitment C188). Arrow recognises the importance of training for its project staff to enable them to successfully implement the plan. Accordingly, the pest management plan will specify training requirements including on awareness of potential pests and weeds in the project development area, mechanisms for the spread of pests, and management and monitoring of any introductions and infestations.
R14038	S123	Arrow to reword outcome from 'control the introduction of weeds' to 'preventing the introduction of new species and to control the spread of new or existing aquatic flora or fauna species'.	–	Noted.
R14039	S123	Arrow to amend, pg. 100, as Indian myna is not a class 1 pest.	EIS Appendix K, Table 23	Noted. The common myna (<i>Acridotheres tristis</i>), also known as Indian myna, is not a declared pest under Queensland legislation.
R14040	S123	Table 29 in the terrestrial ecology assessment is misleading as pigs have the potential for high ecological impact.	EIS Appendix K, Table 29	The potential for impact of exotic pest species as shown in EIS Appendix K, Terrestrial Ecology Impact Assessment, Table 29, is based upon the suitability of climatic conditions and habitats in the study area to facilitate infestation, coupled with a range of other considerations including

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Issue No.	Submission No.	Issue	Reference	Responses
R14040	S123			<p>effectiveness of current biological controls.</p> <p>The management of pigs and all declared pest species will be through a declared weed and pest management plan to be developed by Arrow, in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations, and monitoring effectiveness of control measures (Commitment C188).</p>
R14041	S089	<p>The level of current, recorded knowledge of the flora and fauna in the large range of landscapes affected by the Surat Gas Project is not at a level that can support accurate future monitoring.</p>	<p>EIS Chapter 17, Section 17.8 and Appendix K, Section 4</p> <p>SREIS Chapter 11 and Appendix 9, Section 11.4.9</p>	<p>The technical study undertaken for the EIS incorporated a substantial desktop literature and database review, habitat suitability assessment, field assessment and habitat suitability refinement to establish terrestrial flora and fauna values within the project development area. Further information regarding this methodology is provided within EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 4.</p> <p>The size of the project development area (8,600 sq km at the time of the EIS) made detailed surveys for listed species and communities impractical within the scope of the EIS. Consequently, Arrow developed two approaches to identify and understand the extent of conservation listed species present within the project development area.</p> <p>Firstly, desktop study and detailed dossiers on species identified those species and communities potentially present and potentially at risk based on habitat. Field surveys were used to validate the viability of habitat assessed as most sensitive to impacts. This information was then used to compile constraints mapping that identified no go areas and areas of high, moderate and low constraint to development.</p> <p>The types of development that were appropriate for each level of constraint were identified as well as the appropriate level of environmental management i.e., standard or procedural, detailed and site specific controls. This approach is known as the 'environmental framework' and is designed to protect environmental values through avoidance (Arrow knows what is constrained and why) and minimisation (what controls are required for each level of constraint to reduce the potential impact).</p> <p>Areas presented in the EIS as potential facility locations have been further identified for the SREIS and have been surveyed to further refine habitat mapping and species. Detailed site assessments have been undertaken at four potential central gas processing facility locations and a temporary workers accommodation facility with detail provided at the property scale. SREIS, Appendix 9, Supplementary Terrestrial Ecology Assessment, Section 11.4.9, provides detail of each of these properties and describes conservation listed flora and fauna likely to be present on each property.</p> <p>Used in gas field design, this approach has been supported by ecological surveys of areas of interest as part of the detailed design process, again aimed primarily at avoidance and secondarily at minimisation of impacts on listed species including conservation listed species. Finally, where necessary</p>

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R14041	S089			(i.e., if not covered by the ecological surveys), preconstruction clearance surveys will implement procedures for the management of conservation listed species identified in areas to be cleared, such as translocation. This structured and rigorous approach while not specifically addressing the survey requirements of the EPBC Act for the entire project development area provides for the identification, management and protection of conservation listed species, as part of the coal seam gas field planning, design and execution processes. A set of inspection and monitoring measures have been designed to extend throughout the project and beyond the decommissioning phase until the process of landscape stabilisation is complete. These are discussed within EIS Section 17.8.
R14042	S011	Further terrestrial ecological surveying must be undertaken and Appendix K of the EIS updated and submitted for review before any project activities approved.	SREIS Chapter 11, Section 11.4	Additional studies have been undertaken since publication of the EIS to assess changes made to the project description, including the identification of four potential central gas processing facility locations and a temporary workers accommodation facility. SREIS Chapter 11, Terrestrial Ecology, Section 11.4, provides information from additional field surveys and an update of associated environmental values, potential impacts and mitigation and management measures.
R14043	S021	Commitment (C015) 'Clear areas progressively and implement rehabilitation as soon as practicable following construction and decommissioning activities.' – What does practicable mean.	–	Commitments have been made on the basis that in the vast majority of cases, these management measures can be implemented. The use of 'where practicable' or 'to the greatest extent practicable' is included to cover those circumstances where management measures may not be feasible or able to be implemented as stipulated, due to other constraints; for example, weather or seasonality issues, or specific land use on properties that requires a different approach.
R14044	S162	The individual impacts are understood and the cumulative environmental impacts across the floodplains, in isolation are small misses. However, in total they show a complete lack of environmental knowledge across a bioregion, considered critically endangered.	EIS Chapter 28, Section 28.3.6 and Appendix K, Section 10 SREIS Attachment 1, Appendix C	Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.6 describes the cumulative impacts with respect to terrestrial ecology. Further detail is provided in EIS Appendix K, Section 10. SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth). Site specific constraints maps aim to avoid areas of core habitat for communities and species. Siting of infrastructure away from these areas will reduce the potential for cumulative impacts.
R14045	S159	Site-based mitigation of terrestrial habitat fragmentation is inappropriate; a collaborative approach is required, so as to fully appreciate the cumulative impacts.	EIS Chapter 28, Section 28.3.6 and Appendix K, Section 10 SREIS Attachment 1, Appendix C	Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.6 describes the cumulative impacts with respect to terrestrial ecology. Further detail is provided in EIS Appendix K, Section 10. SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act

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R14045	S159			1999 (CwIth). Site specific constraints maps aim to avoid areas of core habitat for communities and species. Siting of infrastructure away from these areas will reduce the potential for cumulative impacts.
R14046	S134	Arrow to undertake additional studies to enable cumulative impacts to terrestrial ecology to be identified and a significance level for impacts from multiple developments to be assigned. If further studies cannot accurately quantify impacts, stronger avoidance measures should be put in place in accordance with the precautionary principle.	EIS Chapter 28, Section 28.3.6 and Appendix K, Section 10 SREIS Attachment 1, Appendix C	Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.6 describes the cumulative impacts with respect to terrestrial ecology. Further detail is provided in EIS Appendix K, Section 10. SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (CwIth). Site specific constraints maps aim to avoid areas of core habitat for communities and species. Siting of infrastructure away from these areas will reduce the potential for cumulative impacts.
R14047	S150	Because of the historical impact agriculture has had on the region's physical and natural environment, precaution should be encouraged with regards to further modification and impact by new developments and industry to ensure the cumulative impacts do not push ecosystems and natural resources over their threshold limits.	EIS Chapter 28, Section 28.3.6 and Appendix K, Section 10 SREIS Attachment 1, Appendix C	Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.6 describes the cumulative impacts with respect to terrestrial ecology. Further detail is provided in EIS Appendix K, Section 10. SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (CwIth). Site specific constraints maps aim to avoid areas of core habitat for communities and species. Siting of infrastructure away from these areas will reduce the potential cumulative impacts.
R14048	S134	Arrow to provide additional clarification on measures they will take to achieve successful management of cumulative impacts on terrestrial flora and fauna in collaboration with proponents of interacting developments.	SREIS Attachment 1. Appendix C and Attachment 4	Noted. SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (CwIth). Where commitments have been updated or new commitments have been developed, these have been presented in SREIS Attachment 4, Commitments Update.
R14049	S134	Arrow to adequately assess direct and cumulative impacts on terrestrial ecology.	EIS Chapter 17, Section 17.4, Chapter 28, sections 28.3.6 and Appendix K, Section 10 SREIS Chapter 11, Section 11.3.2 and Attachment 1. Appendix C and Attachment 4	An assessment of the terrestrial ecology values across the project development area, and the potential for these values to be affected by direct and indirect impacts associated with various phases of the project is provided within EIS Chapter 17, Terrestrial Ecology, Section 17.4. EIS Chapter 28, Cumulative Impacts describes cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned development or sources of contamination. Section 28.3.6 discusses the cumulative impacts to terrestrial ecology values. EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 10 provides a detailed breakdown of cumulative impacts discussed in Section 28.3.2. SREIS Attachment 1, MNES, Appendix C provides further clarification on

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Issue No.	Submission No.	Issue	Reference	Responses
R14049	S134			cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth). Where commitments have been updated or new commitments have been developed, these have been presented in SREIS Attachment 4, Commitments Update.
R14050	S011	The EIS does not fulfil terms of reference in Section 4.7.2 (Noise and Vibration - description of environmental values) as there is no information or consideration of possible impacts of noise on protected areas, terrestrial animals (apart from grazing livestock) and birds. The report also does not consider potential impacts on farm/domestic animals and birds beyond the statement that noise levels would be similar to those experienced by animals grazing beside a road. This inadequate for intensive livestock operations such as poultry and pig farming.	EIS Chapter 13, Chapter 17, Section 17.6.1 and Appendix N SREIS Appendix 10	Arrow will aim to avoid areas of high and extremely high sensitivity when siting infrastructure, including but not limited to 'critically endangered' EPBC Act communities, national and state listed communities and essential and core habitat as discussed in Commitments C217 and C218 in EIS Chapter 17, Section 17.6.1. Arrow will conduct preconstruction clearance surveys to identify any additional areas that may need to be avoided as per Commitment C220. Buffer zones (and/or other control measures) in accordance with regulatory requirements at the time will be implemented to further protect native fauna. Commitment C076 in EIS Chapter 13, Agriculture states that Arrow will avoid infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations. EIS Appendix N and SREIS Appendix 10 provide further information on the assessment of potential impacts of noise and vibration on livestock located close to project infrastructure.
R14051	S021, S158	No indication has been given of how much the 'right of way' can be narrowed in response to ecological sensitivity, or the implications of the phrase 'short distances'. Commitment (C020) 'Minimise the disturbance footprint and vegetation clearing.' – What are the specific measures by which this is achieved?	EIS Chapter 17, Section 17.6.1	The selected technique used for installing the piping, the number of pipes being laid and the diameter of pipe all have a significant effect on the width of the construction right of way (ROW). In addition to these construction factors topography and soil also impact the size of the ROW. The ROW route design will be detailed prior to construction commencing. Where practical and required, the route will be amended following site specific preconstruction clearance surveys. If it is not possible to avoid highly sensitive areas, techniques that reduce the width of the ROW will be considered. Arrow will aim to avoid areas of high sensitivity when siting infrastructure, including but not limited to 'endangered' Environmental Protection and Biodiversity Conservation Act 1999 communities, national and state listed communities and essential and core habitat as discussed in Commitment C218 in EIS Chapter 17, Section 17.6.1.
R14052	S150	Recommends that the EIS map out land for habitat connectivity to allow species to move as climate zones change.	EIS Appendix K, sections 5.4.5 and 5.6 SREIS Attachment 1, Section 5.6.2	Noted. EIS Appendix K, Terrestrial Ecology Impact Assessment, sections 5.4.5 and 5.6 identify riparian corridors and essential habitat areas which provide important movement corridors. SREIS Attachment 1, MNES, Section 5.6.2 provides further clarification on areas of known or potential corridor use by species listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).

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Table 19.14 Terrestrial Ecology

Issue No.	Submission No.	Issue	Reference	Responses
R14052	S150			Desktop assessment of narrow vegetation tracts of (potential corridors) connecting vegetation stands were identified as highly constrained (to inform constraints mapping for areas of importance to MNES species). SREIS Attachment 1, Section 5.6.2 also provides Arrow's approach for further delineating and identifying corridors during project development. Where important corridors for particular species exist, these will be identified.
R14053	S119	Provide details of the characteristics of riparian vegetation within the project development area, the potential impacts to riparian vegetation and measures to minimise, mitigate and avoid impacts to aquatic fish habitat and waterways within the project development area as a result of disturbance and removal of riparian vegetation.	<p>EIS Chapter 15, Section 15.6 Chapter 16, sections 16.5 and 16.6.4 and Chapter 17, Section 17.6 Appendix K, sections 5.4 and 5.7</p> <p>SREIS Chapter 10, sections 10.4, 10.5 and 10.6 Chapter 11, Section 11.4.9</p>	<p>The riparian vegetation and condition within the project development area is described in EIS Appendix K, Terrestrial Ecology Impact Assessment, sections 5.4 and 5.7.</p> <p>Commitments provided in EIS Chapter 15, Surface Water, Section 15.6, Chapter 17, Terrestrial Ecology, Section 17.6 and Chapter 16, Aquatic Ecology Section 16.5 outline measures to avoid, minimise and mitigate impacts to watercourses and riparian areas during watercourse crossings (see Commitments C296, C152, C158, C015, C173, C191, C261, C194 and C186).</p> <p>EIS Chapter 16, Aquatic Ecology, Section 16.6.4, states that Arrow will obtain all relevant permits required under the <i>Fisheries Act 1994</i> (Qld), including permits for construction of waterway barriers or disturbance of fish habitat (Commitment C192). Arrow notes that where waterway crossings do not meet the requirements of a self-assessable code, this will require the submission of design plans and a range of supporting environmental information.</p> <p>SREIS Chapter 10, Aquatic Ecology, sections 10.4 and 10.5 outline the extensive site-specific aquatic ecology surveys undertaken to supplement the EIS findings, and Section 10.6 identifies mitigation measures at the proposed discharge sites, to protect aquatic ecosystems, including fisheries values.</p> <p>SREIS Chapter 11, Terrestrial Ecology, Section 11.4.9 outlines the findings from the riparian habitat assessments undertaken along watercourses with newly proposed infrastructure locations.</p> <p>Additional field surveys may be required in the vicinity of key infrastructure that have the potential to impact directly on waterways including waterway crossings, and coal seam gas water discharge points.</p>
R14054	S145	Concerned about the cumulative impacts on ecologically significant habitats and species, waterways and Great Barrier Reef Marine Park assets	<p>EIS Chapter 16, Section 16.6 and Chapter 28, sections 28.3.5 and 28.3.6</p> <p>SREIS Attachment 1, Appendix C</p>	<p>Noted. EIS Chapter 28, Cumulative Impacts, Section 28.3.5 describes the cumulative impact with respect to aquatic ecology. Section 28.3.6 describes the cumulative impacts with respect to terrestrial ecology.</p> <p>SREIS Attachment 1, MNES, Appendix C provides further clarification on cumulative impacts on terrestrial flora and fauna communities and species listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).</p> <p>The Great Barrier Reef Marine Park was described in EIS Appendix I, Surface Water Part B: Water Quality Impact Assessment as receiving water from less</p>

Table 19.14 Terrestrial Ecology

Issue No.	Submission No.	Issue	Reference	Responses
R14054	S145			<p>than 1% of a catchment within the project development area. The water which had to flow approximately 700 km before discharging to the sea. Due to the distance separating the Great Barrier Reef Marine Park and the project development area, the potential for impact from the project was discounted and was therefore not assessed in the EIS.</p> <p>EIS Chapter 16, Aquatic Ecology, Section 16.6 identifies a number of mitigation measures that Arrow will implement to protect water quality and prevent contamination entering watercourses. These include commitments to:</p> <ul style="list-style-type: none"> • Develop and implement emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or loss of containment of storage equipment (Commitment C036). • Ensure appropriate spill response equipment, including containment and recovery equipment, is available on site, or can be mobilised to the impacted site within an acceptable response time and that relevant personnel are appropriately trained (Commitment C037).
R14055	S033	<p>The effects of electromagnetic disturbances caused by aquifer drawdown, on the electrical receptors of fauna (e.g., platypus and echidna) should be addressed.</p>	<p>EIS Chapter 8 SREIS Appendix 9</p>	<p>The predicted level of groundwater drawdown is provided in SREIS, Chapter 8, Groundwater. The predicted drawdown levels associated with Arrow activities are shown to be minor in comparison to that previously experienced in the region. Therefore, the potential for change in the electromagnetic field of groundwater aquifers is expected to be negligible.</p> <p>The EIS, Appendix K, Terrestrial Ecology Impact Assessment, Section 5.3.6 presented the platypus (<i>Ornithorhynchus anatinus</i>) as known from the study area based on WildNet database searches. Search options at the time allowed the project development area to be overlaid with 'blocks' which also covered areas outside of the project development area. At the time, species records that fell within or outside of the project development area within these blocks were unable to be differentiated. The desktop assessment for the SREIS, using the wetland database (based on WildNet records) showed that the individual Platypus record is near Millmerran – outside of the project development area. The species has since been assessed as being unlikely to be present in the project development area (SREIS, Appendix 9, Supplementary Terrestrial Ecology Assessment, Section 11.4.5).</p> <p>The echidna (<i>Tachyglossus aculeatus</i>) is still expected to be present in the project development area however, as described above, is not expected to be impacted by electromagnetic disturbances as a result of aquifer drawdown from project related activities.</p>

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Table 19.15 Landscape and Visual Amenity

Issue No.	Submission No.	Issue	Reference	Responses
R15001	S048	Landholders are concerned their privacy and lifestyle will be lost and replaced by light pollution.	EIS Chapter 18, Section 18.4	The use of night lighting will vary during the different phases of the project. Arrow has committed to use shrouded, downcast lighting to minimise spill and restrict it to the minimum required for safety and security. Lighting will be designed in accordance with AS 4282-1997, Control of the Obtrusive Effects of Outdoor Lighting (Standards Australia, 1997) (Commitment C262). The installation of each well and associated flow lines will take approximately 10 to 14 days. The drilling of wells will be conducted on a 24-hour, two by 12-hour shift rotation, which will require night lighting at the drill pad for safety. Once operational, wells will not be lit at night, with the exception of approximately every two to four years during a well workover operation, should these also be conducted on a 24-hour, two by 12-hour shift rotation. Gas production facilities will need to be lit at night during construction and operation.
R15002	S011, S157	Movements of vehicles 24 hours a day, seven days a week, 52 weeks a year will most likely lead to “sudden light impact” during night time hours with possible panic behaviour within barn and range flocks (i.e., leading to increased stress and drop of egg production). Flame, or flaring lights may produce the same reaction. Is this considered in the EIS?	EIS Chapter 19, Section 19.4	Where practicable, the movement of vehicles and equipment will occur during times of least visual impact (Commitment C273). Similarly, the vast majority of operational activities will occur during daylight hours, e.g., 6.00 a.m. to 6.00 p.m. As set out in EIS Chapter 19, Roads and Transport, Section 19.4, the greatest number of project-generated vehicle movements within the project development area will be associated with the main roads servicing townships. In the case of individual wells and associated flow lines, construction is expected to take 10 to 14 days, and will move across the project development area sequentially. Gas flaring is considered in the EIS, where Arrow has committed to conduct planned maintenance flaring during daylight hours to minimise light spill, where practicable (Commitment C270). In addition, where practicable, Arrow will schedule planned flaring events (e.g., those preceding shut-down maintenance) for the period between 6 a.m. and 10 p.m. (Commitment C313).
R15003	S050, S162	Throughout the EIS there has been very little mention of the flaring of gas as a light nuisance. Chapter 20, Noise and Vibration and Appendix N, Noise and Vibration Impact Assessment mentions flaring as part of the construction process of the wells and also a continuous process at gas compression and production facilities. Consistent flaring would be a large visual nuisance on the floodplain and there is very little written about mitigating this.	EIS Chapter 5, Section 5.3.2	Flaring requirements are described in EIS Chapter 5, Project Description, Section 5.3.2. Flaring at night is not expected during routine maintenance and Arrow has committed to conduct planned maintenance flaring during daylight hours to minimise light spill, where practicable (Commitment C270).
R15004	S050, S162	Chapter 18 and also Appendix L are incomplete	EIS	The EIS studies were undertaken with an understanding of the types of

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Issue No.	Submission No.	Issue	Reference	Responses
R15004	S050, S162	due to the only field survey data coming from the existing petroleum leases with the Arrow tenements. This does not include any of the prospecting tenures, and therefore the information does not correctly pertain to the entire EIS area.	Attachment 10 and Appendix L, Section 5	infrastructure and materials that will be used to develop the project. From this information, the potential impact of project infrastructure within different landscape types could be assessed. EIS Appendix L, Landscape and Visual Impact Assessment, Section 5 describes the landscape character types across the whole project development area, including all tenements encompassed by the development.
R15005	S050, S162	Appendix L, Figure 5 is incomplete and Figure 6 does not use representative viewpoints. Viewpoints B1-B4 are all located on the western side of the Condamine River in non-grassy floodplain areas. No care has been taken to represent the 30km of unrestricted views that occur on the native grassy floodplains.	EIS Attachment 10 and Appendix L, Figure 5 and Figure 6 SREIS Attachment 8	Noted. EIS Appendix L, Landscape and Visual Impact Assessment, Figure 5 shows only houses and other sensitive visual receptors in the area surrounding Dalby. Figures showing all potential dwellings known to Arrow at the time of preparing the EIS are provided in EIS Attachment 10, Preliminary Constraints Maps, Figures 10.2 to 10.10. These have been updated for the purposes of the SREIS and are included in SREIS Attachment 2, Strategic Environmental Management Plan. EIS Appendix L, Landscape and Visual Impact Assessment, Figure 6 does provide representative viewpoints. Representative viewpoints were selected on the basis of showing a general view within each landscape character type. The settled arable plains landscape character type, shown on the western side of the Condamine River between Chinchilla and Millmerran, is represented by viewpoint B2.
R15006	S099	The visual assessment does not consider that in areas of open treeless plains, the panoramic 360 degree view can be easily obstructed (when viewed from a flat surface).	EIS Appendix L, Section 7.2.1	EIS Appendix L, Landscape and Visual Impact Assessment, Section 7.2.1 discusses the sensitivity of the settled arable plains landscape character type. It was considered that the structured, regular landscape pattern and precedent modifications (i.e. water extraction) give this landscape a low inherent sensitivity to the introduction of project infrastructure. Some visual context for the introduction of project infrastructure (e.g., central gas processing facilities (CGPFs)) is provided by existing, similarly-sized buildings and structures such as large scale machinery sheds on rural properties.
R15007	S162	The information given does not accurately represent visual impacts. The impacts to the amenity and landscape of the treeless alluvial floodplain has not been fulfilled, hence the EIS is incomplete.	EIS Chapter 18, Table 18.5 Appendix L, Section 7.2, 7.6 and 7.7 SREIS Chapter 3, Figure 3.1	The Terms of Reference for the Surat Gas Project EIS require the landscape and visual impact assessment to identify important views and focal points, elements which contribute to the landscape, and landmarks in the project area. Potential impacts to the amenity and landscape of the treeless alluvial floodplain (Jimbour Plain) were summarised in EIS Chapter 18 Landscape and Visual Assessment, Table 18.5 and Appendix L, Landscape and Visual Impact Assessment, section 7.2. See Type B: Settled Arable Plains. However, since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.
R15008	S081	During the construction phase drill rigs, construction vehicles and bright lights pose a threat	EIS Chapter 18, Table 18.5 and	During the construction phase, the presence of drill rigs, construction vehicles and associated lighting will have an impact on visual amenity. However,

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Issue No.	Submission No.	Issue	Reference	Responses
R15008	S081	to the visual amenity on a flat, treeless plain. Additionally, during the operations phase well pads, gravel roads and power lines also pose a threat to the visual amenity.	Appendix L, Section 8	construction activities are expected to be short in duration as wells and facilities are established. Where possible, existing access tracks and power infrastructure will be used. The potential visual impact of wells and proposed mitigation measures to reduce these impacts during operations, discussed according to the various landscape character types, is presented in EIS Chapter 18, Landscape and Visual Amenity, Table 18.5 and Appendix L, Landscape and Visual Impact Assessment, Section 8.
R15009	S099	Incorrect information regarding the Jimbour Plain. The EIS (Appendix L) states that the landscape has been highly modified and mass cleared. However, Jimbour Plain is naturally treeless; it has not been mass cleared. Trees planted are short lived due to alkalinity and the shrink-swell nature of clay soils.	EIS Appendix L, Section 5.3.2.1	Noted. Appendix L, Landscape and Visual Impact Assessment, Section 5.3.2.1 describes 'Type B: Settled Arable Plains', which are also shown on Figure F4. This area is described as 'highly modified for agricultural practices, including mass clearing and levelling of land for cultivation of arable farmland, and to a lesser extent, pasture for grazing of cattle and sheep'. Pre-clearing vegetation mapping, informed by DERM (now EHP) indicates that the Jimbour plain was, in a pre-European context, formed by grassland ecosystems (RE11.3.21 and 11.3.24). This does not however negate the fact that the landscape has been highly modified, subject to broad scale conversion of native grassland vegetation to cultivated paddocks.
R15010	S050, S086, S162	Disagree with the classification of settled arable lands for the entire cropping area. The open grass based floodplain has far more visual sensitivity than the areas with a Brigalow, gum or box base plain. The treeless plains have no visual break from the foothills of the Great Dividing Range to the Condamine River, whereas the cleared areas still have remnant trees in fence lines, road reserves and stock routes providing some buffering. From this, the visual sensitivity of the grassy floodplain should be high, as opposed to medium. This would also mean Plate 18.2 would not work. Infrastructure will not be able to be hidden by trees on a treeless floodplain. The only trees that are on the Jimbour floodplain outside of the creek areas are introduced. These have taken a lot of care and a long time to grow. Black cracking clay soils are not conducive to growing of trees, including natives.	EIS Chapter 18, Figure 18.3 and Appendix L, Section 5.3.2 SREIS Chapter 3, Figure 3.1	The variation of landscapes within the settled arable plains classification is acknowledged in Appendix L, Landscape and Visual Impact Assessment, Section 5.3.2 and shown on Figure 18.3, Chapter 18, Landscape and Visual Amenity. Visual sensitivity has been determined according to the inherent landscape value and the likely ability of the project activities to be able to be absorbed into the landscape. The difficulties of introducing trees to the Jimbour Plain are noted. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.
R15011	S162	Jimbour plain is in full view of Jimbour House.	SREIS Chapter 3, Figure 3.1.	Noted. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. This will result in a larger separation distance between Jimbour House and project activities. See

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Issue No.	Submission No.	Issue	Reference	Responses
R15011	S162			SREIS Chapter 3, Project Description, Figure 3.1.
R15012	S099	Visual impacts to the Jimbour Plain (open treeless plain) have not been assessed. The view of treeless open fields will be destroyed by placement of wells. The magnitude of the impact should be revised to be higher (major). The sensitivity of visual amenity of Landscape Type B should be revised to be higher (medium).	EIS Appendix L, Section 7.6.1 SREIS Chapter 3, Figure 3.1.	The visual sensitivity of the Jimbour Plain (Landscape Type B) is assessed in Appendix L, Landscape and Visual Impact Assessment, Section 7.6.1. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1. The impact of introducing CGPFs, FCFs and water storage facilities into Landscape Type B is acknowledged as high. Field development is given as medium level impact on the basis that the introduction of rigid linear elements such as wells and field gas and water gathering systems would contrast with the perceived strong rural character, sense of remoteness and tranquillity. The presence of some low-lying, visually contained areas would help integrate field development into the landscape setting.
R15013	S014, S044	Coal seam gas activities as proposed in the EIS will have an extremely negative impact on the things that we value most about our property's amenity. On a naturally treeless plain there is no way to hide such an intrusion.	EIS Appendix L, Section 7.6.1 SREIS Chapter 3, Figure 3.1	Noted. The sensitivity of the settled arable plains is acknowledged in Appendix L, Landscape and Visual Impact Assessment, Section 7.6.1. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1.
R15014	S038	Concerned that the local environment will be severely impacted by coal seam gas developments in terms of visual amenity.	EIS Appendix L	Noted. Please refer to EIS Appendix L, Landscape and Visual Impact Assessment.
R15015	S034, S069	The project should not be allowed to proceed as it will take away the harmonious rural character, which is valued and celebrated by local communities and visitors.	EIS Appendix L	Noted. Please refer to EIS Appendix L, Landscape and Visual Impact Assessment.
R15016	S118	Concerned for infrastructure impacting on the landscape values of the study areas for reasons of being closely settled and the lifestyle of the people who are entitled to maintain the status quo.	EIS Appendix L	Noted. Please refer to EIS Appendix L, Landscape and Visual Impact Assessment.
R15017	S099	Sensitive receptors have not been ground truthed. The view from Jimbour House has not been ground truthed.	EIS Chapter 18, Attachment 10 and Appendix L, Section 7.6.2 SREIS Attachment 8	Subject to property accessibility, the location of houses and other sensitive receptors (i.e., businesses, schools, churches) has been ground-truthed in the area of Arrow's Dalby Expansion Project. Beyond this area, the other potential housing and sensitive receptor locations (shown in EIS Attachment 10, Constraints Mapping, Figures A10.2 to A10.10) were determined through analysis of publicly available, 2004 aerial imagery. Arrow has acquired and reviewed new, high-resolution aerial imagery over the project development area and updated figures are presented in SREIS

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Issue No.	Submission No.	Issue	Reference	Responses
R15017	S099			Attachment 2, Strategic Environmental Management Plan. Jimbour House was visited as part of the Landscape and Visual Impact Assessment. The viewpoint from this location is given and discussed in Appendix L, Landscape and Visual Impact Assessment, Section 7.6.2.
R15018	S050, S162	It is noted there are no visual standards for background brightness. It is disappointing that this project with others including completed Wilkie Creek coal mine and Braemar Power Stations have increased the background night light dramatically. Despite being 40km and 50+kms away, the effect is very visible at the eastern edge of the Jimbour Plain, and gets worse the further west you go. This report has not done any field studies to determine cumulative impacts with current infrastructure to add to that of future projects.	EIS Chapter 18, Section 18.6.1	Noted. The project may introduce up to 14 new facilities (8 CGPFs and 6 FCFs) across the region, between Wandoan and Millmerran. This has been revised down from 18 facilities proposed in the EIS. CGPFs, which will be approximately 8 to 12 m high with an associated emergency flare, are the largest structures that will require lighting at night. As stated in EIS Chapter 18, Landscape and Visual, Section 18.6.1, Arrow has committed to use shrouded, downcast lighting to minimise spill and restrict it to the minimum required for safety and security. Lighting will be designed in accordance with AS 4282-1997, Control of the Obtrusive Effects of Outdoor Lighting (Standards Australia, 1997) (Commitment C262).
R15019	S034, S069, S086	EIS Chapter 13, Agriculture, Section 13.6.6, Loss of Amenity, and EIS Chapter 18, Landscape and Visual Amenity, Section 18.3 fail to address loss of amenity in any substantial manner, when considering commitments C015, C093, and C115. Living and working on a natural treeless flood plain, is totally different to constructing a gas well in timbered grazing land. The effects of light, noise, visual and odour can travel great distances across the Jimbour Plain. Arrow has no idea of the different areas across their tenement.	EIS Chapter 13, Section 13.6.6, Chapter 17, Section 17.3, Chapter 18, Section 18.3 and Chapter 20, Section 20.3	Arrow understands the community is concerned about the potential loss of amenity due to the project. It is not possible for the installation of wells and gathering lines, and construction of facilities to have no visual impact. Arrow has committed to clear areas progressively and implement rehabilitation as soon as practicable following construction and decommissioning (Commitment C015), as well as to replace or rehabilitate all disturbed infrastructure to predisturbance condition (Commitment C115) in order to reduce visual impacts as soon as practicable. Arrow has also committed to install gates in fences of appropriate standard to restrict access to authorised personnel, vehicles, plant and equipment (Commitment 093) as a standard safety and security measure. The differences between the different landscape types within the project development area are acknowledged in EIS Chapter 17, Terrestrial Ecology, Section 17.3; Chapter 18, Landscape and Visual Amenity, Section 18.3; and Chapter 20, Noise and Vibration, Section 20.3.
R15020	S024, S026, S081, S130	Commitment (C267) 'Hide or screen production facilities using natural landscape features or planted native vegetation barriers, where appropriate. Avoid removal of mature trees and other woodland features that screen views to facilities. Establish screening barriers using endemic species in advance of construction of the facilities.' – How will Arrow effectively screen production facilities in areas where plant screens cause land subsidence and consequent issues to	EIS Chapter 18, Section 18.6	EIS Chapter 18, Landscape and Visual Amenity, Plates 18.1 to 18.10 provide examples of how vegetation may be used to screen a production facility. Arrow acknowledges that in some cases screening may not be practical, and as such alternative strategies to integrate facilities into the landscape will be required. Similarly, constructability issues associated with sensitive soils types found within the Type B settled arable plains landscape character type are also acknowledged. Arrow is working with landholders to understand how to best manage project impacts on sensitive soils.

Table 19.15 Landscape and Visual Amenity

Issue No.	Submission No.	Issue	Reference	Responses
R15020	S024, S026, S081, S130	current land use and irrigation? How does this information affect the results of Table 18.5 Summary of landscape and visual amenity impact assessment for Landscape Type B?		
R15021	S099	In an open treeless plain (such as Jimbour Plain), it will be impossible to implement Commitment (C265): 'Avoid visually sensitive locations and landscapes when siting facilities, where practicable. Seek backdrops when siting facilities to protect the skyline in distant views. Avoid siting facilities within view of sensitive viewpoints, particularly the bird hide and camping area at Lake Broadwater, Captains Mountain, Jimbour House, the Cunningham Highway, towns, schools and private residences.'	EIS Chapter 18, Section 18.6 SREIS Chapter 3, Figure 3.1	Commitment C265 seeks to avoid visually sensitive locations and landscapes when siting facilities, where practicable. This commitment aims to protect visually sensitive viewpoints, such as the view from Jimbour House. In order to meet this commitment, Arrow would have to conduct ground-truthing activities at sensitive viewpoints when considering site selection. Further knowledge of the gas reserves has been gained since the publication of the EIS and the portion of the project development area encompassing the Jimbour Plain has been reduced. This will result in a larger separation distance between Jimbour House and project activities which will reduce the potential project impact. See SREIS Chapter 3, Project Description, Figure 3.1.
R15022	S159	Disruption to agriculture and visual amenity are broader issues that need to be addressed beyond individual sites. Site-based mitigation of impacts to visual amenity is inappropriate; a collaborative approach is required.	EIS Chapter 18, Section 18.6 and Appendix L, Section 11.2	Appendix L, Landscape and Visual Impact Assessment, Section 11.2 discusses the cumulative impact of the Surat Gas Project, together with existing and proposed developments. It is acknowledged that coal seam gas activities are likely to be experienced cumulatively, and potentially change the perception of the landscape from one which is defined by farming and grazing, to one which is strongly characterised by coal seam gas development. Impacts will vary in intensity from location to location, depending on the availability of coal seam gas and associated project phasing and focus of activity at the time. However affected sites are likely to return to a more rural appearance over time, as sites are rehabilitated and the vegetation establishes and matures; resulting in a negligible impact on the appearance of the surface vegetation in the longer term. As it is not possible for the installation of wells and gathering lines, and the construction of facilities to have no visual impact, site-based mitigation such as progressive rehabilitation is critical to the overall reduction of local and cumulative impacts.

Table 19.16 Roads and Transport

Issue No.	Submission No.	Issue	Reference	Responses
R16001	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076, S085, S087, S088, S095, S096, S097, S098, S114, S116, S139, S140, S149, S152, S154, S167	The transport of brine, no matter what method is used, presents a significant risk to the soil and water resources of the region as well as already stressed road infrastructure.	<p>EIS Chapter 12, Section 12.6.3, and Chapter 19, sections 19.3.3 and 19.4</p> <p>SREIS Chapter 3, Section 3.6.7, and Chapter 12, Section 12.5</p>	<p>As set out in SREIS Chapter 3, Project Description, Section 3.6.7, landfill is not Arrow's preferred strategy for the disposal of brine. The preferred solution is to treat brine for beneficial use at a selective salt recovery plant. However, should disposal of brine be required, the chosen landfill may be located at a similar distance from the project development area as Swanbank (possibly closer). For worst case traffic modelling purposes, the scenario whereby brine is transported to a registered landfill at Swanbank was considered in the EIS, and the SREIS considers transport of brine by truck to a notional landfill to the east of Toowoomba.</p> <p>Arrow recognises the potential for loss of containment of potentially hazardous materials (such as brine) during unloading or transfer. Emergency and spill response procedures will be developed and implemented to reduce any impacts that could occur as a result of releases of hazardous materials or any loss of containment of storage equipment (Commitment C036).</p> <p>As described in the strategic traffic assessment, EIS Chapter 19, Roads and Transport, Section 19.4, the heavy vehicle traffic generated by the project, including the trucking of brine, represents less than 2% of the 2009 traffic levels. The updated assessment showed that heavy vehicle movements generated by the project are anticipated to increase heavy vehicle traffic volumes by 4.2% of 2011 traffic volumes (SREIS Chapter 12, Roads and Transport).</p> <p>Impacts on specific roads will be assessed in greater detail when the brine disposal strategy is finalised. At that time, specific routes and necessary road contributions will be determined during the preparation of road use management plans in consultation with the relevant council or DTMR.</p>
R16002	S019	There are concerns with the truck loads used to transport brine to Swanbank and the increased traffic on the Warrego Highway.	<p>EIS Chapter 19, Table 19.4.</p> <p>SREIS Chapter 3, Section 3.7.5, and Chapter 12, Section 12.5</p>	<p>As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow's preferred strategy for the disposal of brine. The preferred solution is to treat brine for beneficial use at a selective salt recovery plant. However, should disposal of brine be required, the chosen landfill may be located at a similar distance from the project development area as Swanbank (possibly closer). For worst case traffic modelling purposes, the scenario whereby brine is transported to a registered landfill at Swanbank was considered in the EIS, and the SREIS considers transport of brine by truck to a notional landfill to the east of Toowoomba.</p> <p>Highways in the project development area, such as the Warrego Highway, exhibit low sensitivity and a negligible to moderate rating for the significance of project impacts (EIS Chapter 19, Roads and Transport, Table 19.4). These findings were consistent with the updated assessment conducted for the SREIS (Chapter 12, Roads and Transport).</p> <p>Impacts specifically pertaining to the Warrego Highway will be assessed in greater detail during preparation of road use management plans after the locations of production facilities and associated infrastructure are finalised.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R16003	S004, S006, S007, S012, S013, S016, S024, S025, S026, S036, S045, S047, S051, S069, S081, S083, S084, S095, S100, S101, S102, S103, S104, S107, S134, S143, S151, S162, S164	In EIS Appendix M, Road Impact Assessment, it states that “for the purposes of this impact assessment it is assumed that the brine will be disposed to a suitably licenced landfill” and “this EIS has assumed that all brine concentrate will be trucked to Swanbank.” However, the EIS does not provide details of the large number of truck movements relating to transporting the brine from coal seam gas fields to the landfill at Swanbank, or consider the impacts of these truck movements on state and local roads, local communities and the environment, including the local fauna. Arrow to provide details regarding the quantity of brine to be trucked and the number of trucks required.	EIS Chapter 19, sections 19.2.3 and 19.4, and Appendix M, Section B.3.3.1 SREIS Chapter 12, Section 12.5	While Arrow’s preferred strategy is not to dispose of brine to landfill, the worst case scenario whereby brine is transported to a registered landfill has been considered in the EIS and SREIS. Travel to Swanbank was included in the EIS, and the SREIS assumes a notional landfill east of Toowoomba. Due to the strategic nature of the road impact assessment, travel routes identified were conceptual and based on the shortest travel time (EIS Chapter 19, Roads and Transport, Section 19.2.3). Appendix M, Road Impact Assessment, Section B.3.3.1 states that for modelling purposes, it was assumed that an average of five trucks per day per water treatment facility would be generated after 10 years of operation. The heavy vehicle traffic generated by the project, including the trucking of brine, represents less than 2% of the existing (2009) levels (EIS Chapter 19, Roads and Transport, Section 19.4). The updated assessment found heavy vehicle movements generated by the project are anticipated to increase traffic volumes by 4.2% of 2011 traffic volumes (SREIS Chapter 12, Roads and Transport).
R16004	S012, S013, S016, S045, S047, S051, S084, S095, S100, S101, S102, S103, S107, S151, S164	With regard to transport of brine via trucks from coal seam gas wells to landfill, what route will these trucks take? No roads are specified in the EIS. Will the route be associated with the possibility of a new Toowoomba Range Road? If the trucks are to use the proposed new Toowoomba Range Road, what is the cost of this new infrastructure to the community?	SREIS Chapter 3, Section 3.7.5	As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow’s preferred strategy for the disposal of brine. The preferred solution is to treat brine for beneficial use at a selective salt recovery plant. However, should disposal of brine be required, the chosen landfill may be located at a similar distance from the project development area as Swanbank (possibly closer). Impacts on specific roads will be assessed in greater detail when the brine disposal strategy is finalised. At that time, specific routes (including, if applicable, the Toowoomba Range Road) and necessary road contributions will be determined during the preparation of road use management plans in consultation with the relevant council or DTMR.
R16005	S004, S006	The submission presents calculations resulting in 117 to 175 million tonnes of salt. If 117 million tonnes of salt were transported to Swanbank, that would result in 2.9 million 40 tonne b-double trucks travelling to Swanbank via the Warrego Highway and Toowoomba.	EIS Appendix M, Section B.3.3.1 SREIS Chapter 12, Section 12.5.3, Table 12.2	EIS Appendix M, Road Impact Assessment, Section B.3.3.1 sets out the assumptions with regard to transport of brine to landfill. SREIS Chapter 12, Roads and Transport, Section 12.5.3, Table 12.2, presents the updated predicted traffic generation for water treatment facilities, which includes movements associated with the transport of brine in the operations phase by heavy vehicles. As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow’s preferred strategy for the disposal of brine. The preferred solution is to treat brine for beneficial use at a selective salt recovery plant.
R16006	S011	The terms of reference Section 4.3.1 has not been fulfilled as the Roads and Transport report does not provide information on typical heavy or oversized loads (which have a disproportionate effect on pavement damage levels) and the routes they are likely to travel.	EIS Chapter 19, sections 19.2.3, 19.4 and Table 19.2, and Appendix M SREIS Chapter 12, Section 12.5.5,	Due to the strategic nature of EIS Appendix M, Road Impact Assessment, travel routes identified were conceptual and based on the shortest travel time (EIS Chapter 19, Roads and Transport, Section 19.2.3). The Terms of Reference states that, where it is not possible to provide specific details relating to timing and specific routes, the EIS should provide an indication of the types of transport infrastructure and activity that could reasonably be

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R16006	S011		and Appendix 10, Appendix F	<p>expected for various petroleum activities. This information has been provided in EIS Chapter 19, Roads and Transport, Section 19.4, Table 19.2 and heavy vehicles have been considered in further detail in Appendix B to EIS Appendix M, Road Impact Assessment.</p> <p>As part of the SREIS, pavement impact assessment case studies, which consider impacts from various heavy vehicle types, were conducted on selected road sections in proximity to identified project facility locations. This information is provided in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and Appendix F of SREIS Appendix 10, Supplementary Roads and Transport Assessment.</p>
R16007	S011	<p>Using information taken from Figure 9.3 and Figure 4.3 it is possible to show that Millmerran–Cecil Plains Road will have a best case scenario traffic growth of 17.9% and 35.2% worst case. This is greater than the generalised 1 to 2% quoted in the report and a good example of why the modelling results presented in the report are not a suitable basis for assessing impacts on roads.</p>	<p>EIS Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5</p>	<p>At the time of publication of the EIS, potential locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). The predicted 1-2% increase above 2009 traffic volumes, due to total travel generated by the project, describes the regional increase across the entire Darling Downs region road network.</p> <p>Given the strategic nature of the assessment, location-specific mitigation measures were not identified. Proposed locations for four facilities and a temporary workers accommodation facility have since been determined. Case studies of traffic impacts at each of these sites were undertaken and management strategies determined by these case studies are discussed in SREIS Chapter 12, Roads and Transport, Section 12.5.5.</p> <p>Impacts on specific roads, such as Millmerran-Cecil Plains Road if required, will be assessed in greater detail as facility locations are selected. At that time, specific routes and necessary road contributions will be determined during the preparation of road use management plans in consultation with the relevant council or DTMR.</p>
R16008	S011	<p>Measures of impacts on the road system should not be limited to vehicle kilometres travelled, and should be considered in conjunction with the types and weights of vehicles used, and the actual routes they will use. Heavy vehicle traffic on a rural gravel road can cause a large amount of damage and evidence of this has been in the area surrounding the proponent’s facilities near Dalby, where some roads have been rendered virtually impassable to ordinary vehicles.</p>	<p>EIS Chapter 19, Section 19.2.3 SREIS Chapter 12, Section 12.5.5, and Appendix 10, Appendix F</p>	<p>Due to the strategic nature of the traffic assessment, travel routes identified were conceptual and oversize vehicles were considered together with heavy vehicles (EIS Chapter 19, Roads and Transport, Section 19.2.3). Specific routes and a breakdown of heavy vehicle types will be established during preparation of road use management plans in consultation with the relevant council or the DTMR following the EIS process.</p> <p>As part of the SREIS, pavement impact case studies, which consider impacts from various heavy vehicle types, were conducted on selected road sections in proximity to identified project facility locations. This information is provided in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and Appendix F of SREIS Appendix 10, Supplementary Roads and Transport Assessment.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R16009	S011	Crash statistics in Table 7.1 have not been included in the 'sensitivity' of road ratings. Safety is supposed to be one of the factors considered when rating "sensitivity". For example Millmerran–Cecil Plains Rd has been given a sensitivity rating of moderate, despite the fact that it suffers three times the average rate of crashes for the area, and a higher than average crash rate compared to the average for its road type in Queensland.	EIS Appendix M, Section 9.1, and Chapter 19, Section 19.6.1	At the time of publication of the EIS, potential locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that traffic associated with the project will result in localised impacts; however, these impacts will be addressed in road use management plans prepared in consultation with the relevant council or the DTMR as sites are selected, following the completion of the EIS process (Commitment C284). When preparing road use management plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The identification of these characteristics, and the preparation of road use management plans, will address matters including the safety of road links.
R16010	S011	Traffic generation calculations, particularly in the operation phase, states that trips to production sites are only included from the nearest depot for equipment, consumables etc., or nearest town (staff). This is an under-estimate, because supplies have to be trucked to the depot first, and these vehicle kilometres have not been counted. Also, it's fairly unlikely that all staff will reside in the nearest town; many will travel further due to housing constraints.	SREIS Attachment 3, Section 2.1	Since publication of the EIS, there have been a number of changes to the project description and potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. SREIS traffic modelling incorporates updated assumptions relating to depot locations and the operations workforce. The majority of materials and equipment have been modelled as originating from a location east of the project development area (i.e., via Toowoomba) and being transported to site via a depot i.e., at Dalby or Miles. With regard to the operations workforce, light vehicle traffic from the nearest town has been assumed for staff. SREIS Attachment 3, Social Impact Management Plan Update, Section 2.1 details a number of Arrow's commitments to housing and accommodation. These include developing an Operations Accommodation Strategy 12 months prior to the commencement of operations. The strategy will identify the preferred approach for facilitating accommodation for the operational workforce based on the ability of the market to meet project generated demand and required market interventions to reduce adverse impacts on the community (Commitment 381).
R16011	S011	The EIS has assumed that waste will go to local landfills, which are already under pressure and may not be able to handle the volumes of waste. Waste will likely have to be transported much further distances than modelled (due to increased levels from the addition of the project waste), which will increase project impacts on roads. Also, general waste from production facilities has been modelled	EIS Appendix M SREIS Chapter 12, Section 12.5.3	Due to the strategic nature of EIS Appendix M, Road Impact Assessment, depot locations were used as representative locations for landfills, which were assumed to be in proximity to the depots. Trips associated with waste described in Appendix M were conservative given that the project will reduce waste outputs where possible. Since publication of the EIS, there have been a number of changes to the project description and potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility.

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R16011	S011	as going from the facilities to the nearest depot, but there is nothing to show where it goes from there (i.e., the trips moving waste from the depot to a landfill have been omitted).		SREIS traffic modelling incorporates updated assumptions relating to depot locations, as the number of depots has reduced from three to two. Assessment results are included in SREIS Chapter 12, Roads and Transport, Section 12.5.3. In the long term, pressure on local landfills will typically lead to an expansion of existing landfills or the development of new landfills to meet local and regional demand.
R16012	S001	Moving up to 193,000 tonnes per annum of salt to a registered landfill, such as Swanbank is a logistic challenge and with such large quantities involved, is only moving the problem from one place to another.	SREIS Chapter 3, Section 3.7.5	Noted. As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow's preferred strategy for the disposal of brine. The preferred solution is to treat brine for beneficial use at a selective salt recovery plant.
R16013	S072, S134	There is no assessment in the EIS (specifically, Appendix B of Appendix M, Road Impact Assessment) of the impacts of heavy vehicles on the road types (e.g. drill rigs, gravel trucks and trucks carting materials and equipment to establish the flat drilling pads and water handling facilities). Arrow should indicate how they will identify roads which are of an unsuitable standard for additional and heavy traffic, and how these roads will be managed.	EIS Chapter 19, 19.6.1, and Appendix M, Appendix B SREIS Chapter 12, Section 12.5.5 and Appendix 10, Appendix F	The EIS Appendix B of Appendix M, Road Impact Assessment, considers heavy vehicle traffic generation per project activity. The glossary of Appendix M defines a heavy vehicle as 'any vehicle with three or more axles or with dual tyres on the rear axle. Also referred to as commercial vehicles'; this includes drill rigs and trucks. At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. Potential sites for four facilities and a temporary workers accommodation facility have since been identified. As part of the SREIS, pavement impact case studies, which consider impacts from various heavy vehicle types, were conducted on selected road sections in proximity to these locations. This information is provided in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and Appendix F of SREIS Appendix 10, Supplementary Roads and Transport Assessment. Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing this plan, Arrow will undertake a fitness for use investigation where required that will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plans will include measures required to safely accommodate increased volumes of project heavy vehicle traffic (including oversized machinery).
R16014	S015, S099, S135	There are concerns regarding heavy vehicle traffic on roads causing wear and tear and safety issues (specifically Karingal-Apunyal Road and Pirinuan-Apunyal Road near Macalister) and being detrimental to the environment. Karingal-Apunyal Road near Macalister, used by Ostwald Quarry, should be bitumen sealed and maintained by Arrow as a condition of approval.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Localised impacts, such as those on Karingal-Apunyal Road if applicable, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment

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Issue No.	Submission No.	Issue	Reference	Responses
R16014	S015, S099, S135			C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands (including heavy traffic). The road use management plans will include measures required to safely accommodate increased volumes of project heavy vehicle traffic (including oversize machinery) and preserve the safety of road links. Road contributions will be determined during preparation of these plans. Upgrade and maintenance contributions will be calculated in accordance with accepted standards.
R16015	S086	A desktop assessment to determine the current road condition in the project area has been used. The results need to be ground truthed as the condition of the majority of the roads in the area have already deteriorated. This is very apparent along the Warrego Highway which is now a death trap due to the large increase in mining traffic. The government authorities cannot keep up with repairs and maintenance now and their solution albeit temporary is to reduce speed limits along the highway. Assessments need to be made and take in to consideration environmental impacts and soil variability. Costs of maintaining and upgrading of these roads to handle the increase of mining traffic should be born by the proponent, not the rate payers.	EIS Chapter 19, Section 19.6.1 SREIS Chapter 12, and Appendix 10	Following the EIS process, localised impacts, such as those on the Warrego Highway, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When developing these plans, Arrow will undertake a fitness for use (FFU) investigation where required which will consider various road characteristics (such as underlying soil type) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road contributions will be calculated in accordance with accepted standards and be determined during preparation of these plans. Case studies undertaken as part of SREIS Appendix 10, Supplementary Roads and Transport Assessment and described in SREIS Chapter 12, Roads and Transport include FFU investigations, intersection assessments and pavement impact assessments to demonstrate how the above process will be carried out when facility locations are confirmed.
R16016	S011, S015, S024, S026, S081, S129, S130, S135	The proponent should clearly account for any road infrastructure upgrade and maintenance requirements caused by increased traffic from the project. Upgrades should be carried out on floodways, regional roads, council roads, main roads in the Banana Shire, Taroom heavy vehicle bypass, intersections (Dawson and Leichhardt highways) and there should be an increase in rest areas and passing places. Many roads listed in the EIS as expected to experience increased traffic are in dangerous states already. Unless Arrow is able to join with governments in providing good road maintenance, roads will become progressively worse. Is Arrow or the relevant government authority responsible for the financial cost of road upgrades to mitigate	EIS Chapter 19, Section 19.6.1 SREIS Chapter 12, and Appendix 10	As described in EIS Chapter 19, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project, including on council roads, in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). Road contributions will be determined during preparation of these plans following the EIS process and finalisation of project planning. The pavement and maintenance contributions will be calculated in accordance with accepted standards. Case studies undertaken as part of SREIS Appendix 10, Supplementary Roads and Transport Assessment and described in SREIS Chapter 12, Roads and Transport include fitness for use investigations, intersection assessments and pavement impact assessments to demonstrate how the above process will be carried out when facility locations are confirmed.

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R16016	S011, S015, S024, S026, S081, S129, S130, S135	identified road safety issues and the cost of repairs required as a consequence of Arrow's activities and traffic on roads? Arrow should financially contribute to these road upgrades either directly or to State and Federal Governments. Pavement rehabilitation and maintenance contributions should also be provided. Has Arrow conducted an economic assessment of the financial cost to the relevant government departments from increased road repairs and maintenance as a consequence of project activities?		
R16017	S088	Will Arrow be conditioned to upkeep gravel roads at all times due to project related road degradation?	EIS Chapter 19, Section 19.6.1	Following the EIS process, localised impacts such as those on specific gravel roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When developing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established through consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The pavement and maintenance contributions will be determined during preparation of these plans and will be calculated in accordance with contemporary standards.
R16018	S017	On a daily basis there will be landholders and coal seam gas workers requiring access to the same parcel of land at the same time, resulting in conflict.	EIS Chapter 2, Section 2.3	As described in EIS Chapter 2, Project Approvals, Section 2.3, it is a legislative requirement that a conduct and compensation agreement be negotiated before a petroleum authority holder comes onto a landholder's property to undertake 'advanced activities' that are likely to have a significant impact on business or land use. Protocols for land access will be agreed with landholders before development occurs.
R16019	S024, S025, S026, S036, S081, S083, S162	The road impact assessment needs to be redone with upwardly revised heavy vehicle movements relating to the transport of aggregate included.	SREIS Chapter 3, Section 3.4.6 and Chapter 12, Section 12.5.3	SREIS traffic modelling incorporates updated assumptions relating to aggregate volumes, based on aggregate calculations presented in SREIS Chapter 3, Project Description, Section 3.4.6. Updated predictions of project traffic generation are included in SREIS Chapter 12, Section 12.5.3.
R16020	S024, S026, S034, S069, S081	The EIS generalised desktop approach does not account for environmental influences which may impact on the conditions of roads within the project development area, particularly the variation in soil types that roads are constructed on. Arrow must conduct field assessments of the current condition of each road type over all of the various major soil types found within the project development area.	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will address localised impacts in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (such as underlying soil types) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plan will document the current condition of specific roads affected by the project.

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R16021	S024, S026, S081	Count data for road volumes is three years out of date. Arrow should provide more up-to-date count data, undertake modelling to incorporate lower order roads, and provide modelling and assessment data for council-controlled roads. Traffic volumes from other coal seam gas projects since 2009 as well as current 2012 traffic volumes on highways and regional connecting roads within the project development area must be determined.	EIS Chapter 28, Section 28.3.8 SREIS Chapter 12, sections 12.4.1 and 12.5.2	At the time of preparation of the EIS, the latest traffic census data available was from 2009. More recent traffic volume data (DTMR, 2011) pertaining to some roads has been included in traffic modelling undertaken for the SREIS (SREIS Chapter 12, Roads and Transport, Section 12.4.1). Consistent with the methodology used for the EIS road impact assessment, the updated traffic modelling considered all state-controlled and council-controlled roads in the Darling Downs region road network to inform the assessment of significance of impacts. As described in EIS Chapter 28, Cumulative Impacts, Section 28.3.8, the total increase in traffic from all other proponents in the region is expected to be 2% to 8%, equating to approximately 2 to 4 years of historical traffic growth. A reasonable growth rate of 3% has been allowed within the updated traffic modelling to account for project traffic generated by other proponents (SREIS Chapter 12, Roads and Transport, Section 12.5.2).
R16022	S024, S026, S081, S134	If the standard of road construction is a safety aspect and is an environmental value of roads depending on road type, then Table 19.1 must be amended to include standard of road construction under the safety heading, and describe the identified environmental value according to road type.	EIS Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Consistent with a strategic level assessment, a functional hierarchy rather than a construction hierarchy was considered whereby the sensitivity value was not based solely on road construction. Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will undertake a fitness for use (FFU) investigation where required as part of road use management plan preparation that will consider various road characteristics (including existing construction and pavement standard) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The FFU investigation will identify the current condition of specific roads expected to be affected by the project.
R16023	S024, S026, S081	How many of the 50 heavy vehicle movements per production well are accounted for by the cartage of aggregate for construction of the well pad and access track? This is equally applicable to all project activities in the construction and decommissioning phases where aggregate is removed for rehabilitation.	EIS Appendix M, Table B.1 SREIS Chapter 3, Section 3.4.6 and Chapter 12, Section 12.5.3	As discussed in EIS Appendix M, Road Impact Assessment, Table B.1, the EIS considered that 32 tonnes of aggregate was required for the installation of a production well which, based on typical truck capacities, equated to one to two heavy vehicle loads. Since publication of the EIS, there have been a number of changes to the project description and potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Traffic modelling has been undertaken to reflect these changes. Results of updated traffic modelling are included in SREIS Chapter 12, Roads and Transport, Section 12.5.3. The SREIS traffic modelling incorporates updated conservative assumptions relating to aggregate volumes for all phases of the project life, based on aggregate calculations presented in SREIS Chapter 3, Project Description, Section 3.4.6.

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R16024	S024, S026, S081	It is inappropriate for Arrow to compare the project's annual average daily traffic volume with the annual average daily traffic servicing the main townships, which are located at junctions of highways and regional connecting roads with low to moderate sensitivity.	EIS Chapter 19, Section 19.6.1 and Table 19.1	Traffic volume data is sourced from multiple segments per road, rather than from the centre of main townships as a representation of traffic volumes on roads servicing those towns. The project annual average daily traffic volume was also compared to the annual average daily traffic on lower-order roads; rural connecting roads and rural access roads, which display high sensitivity (EIS Chapter 19, Section 19.3.10, Table 19.1). Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road use management plans will include measures such that project impacts on the road use network are appropriately managed.
R16025	S024, S026, S081	If there are 63 heavy vehicle movements and 105 light vehicle movements related to the construction of each well head and its associated gathering infrastructure, and this figure is multiplied by ten for the pod under construction, what percentage increase in volume of traffic on rural connecting roads and rural access roads does this represent?	EIS Chapter 19, Section 19.6.1 SREIS Chapter 12, Section 12.5.3	The updated traffic modelling conducted for the SREIS incorporates updated assumptions underlying traffic generation predictions for each project activity. Updated predictions of project traffic generation are included in SREIS Chapter 12, Section 12.5.3. It is anticipated that 142 heavy vehicle movements and 444 light vehicle movements will be required on average for the construction of a production well (this accounts for a combination of single and multi-well pads). The strategic nature of the traffic modelling means production well locations are indicative. The traffic volumes associated with their construction for rural connecting roads and rural access roads are therefore representative and the exact percentage increase cannot be determined for these roads as traffic volume data could not be sourced for council roads. Localised impacts, such as increases in traffic volumes on these roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16026	S024, S026, S081	Please provide the percentage increase in volume of traffic that will occur on the road types associated with the locations of the parcel numbers in Appendix C of the Road Impact Assessment.	EIS Chapter 19, Section 19.6.1 SREIS Chapter 12, Figure 12.5	The traffic assessment undertaken for the EIS was strategic in nature. Production well locations associated with parcels comprising the development sequence presented in Appendix C (according to development year) were indicative, meaning that associated traffic volumes were representative. The development sequence has since been updated and SREIS Chapter 12, Roads and Transport, Section 12.5.3, Figure 12.5 now shows the anticipated percentage increase in traffic volumes in the peak year of the project on state-controlled roads. Further detail addressing localised impacts will be provided in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16027	S024, S026, S081	If threshold assessments are possible (as stated in	EIS	At the time of publication of the EIS, specific locations of project facilities and

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R16027	S024, S026, S081	[C286]), then why have threshold assessments of the various road types in the project development area not been undertaken? Provide information on the traffic threshold limits for vehicle numbers and/or vehicle weights for each of the road types by regional council area. Arrow must determine whether the threshold is different between locations of differing soil type within the project development area.	Appendix M, Section 9.1	associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Threshold limits will differ for the various roads in the project development area. Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will undertake a fitness for use (FFU) investigation where required which will consider various road characteristics (established in consultation with road authorities, including underlying soil type) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The FFU assessment will contribute to the determination of traffic threshold limits by road authorities.
R16028	S024, S026, S081, S130	Will Arrow impose restrictions on project activities and travel (especially on unsealed roads) when environmental conditions, such as wet and dry, are such that the likelihood of road damage is increased?	EIS Chapter 19, Section 19.6.1	As stated in EIS Chapter 19, Roads and Transport, Section 19.6.1, Arrow has committed to develop journey management plans taking into consideration high-risk roads (Commitment C291). Arrow will also develop project logistics plans to provide safe movement of people and materials, and to minimise traffic (Commitment C290). Arrow's health, safety and environment management system, which is designed to manage hazard and risk through policy, standards and procedural controls, will be implemented for all activities and phases of development (Commitment C417).
R16029	S024, S026, S034, S069, S081	How will the integrity of private roads and tracks be maintained?	EIS Chapter 12, Section 12.6.1 SREIS Attachment 4	Arrow has committed to manage its impacts to private roads and access tracks (Commitment C031). Development and maintenance of project infrastructure on private land will be conducted following the negotiation of conduct and compensation agreements with the relevant landholders. Specific management measures will be determined in consultation with landholders to suit the landform and existing agricultural terrain.
R16030	S025	What are the occupational health and safety requirements on the proponent regarding all-weather access to production wellheads?	EIS Chapter 25, Section 25.6.2	Arrow's health and safety requirements are outlined in their health, safety and environment management system which is designed to manage hazard and risk through policy, standards and procedural controls. This will be implemented for all activities and phases of development (Commitment C417), including the construction of access tracks.
R16031	S026, S079, S081, S134	There is a fundamental error in the modelling undertaken by Arrow with regard to workforce vehicle movements from Toowoomba and Brisbane. The Road Impact Assessment modelling needs to be redone to take into consideration traffic movements to and from the Dalby and Millmerran/Kogan blocks of the project development area along the Toowoomba Cecil Plains Road, which is in very poor condition owing	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 10.2.3, Table 10.4 SREIS Chapter 12, Section 12.5.3, and Appendix 10, Section 7	In the EIS, Toowoomba Cecil Plains Road was not identified by the strategic traffic modelling as likely to be affected by project activities. However, the significance of impacts upon Toowoomba Cecil Plains Road was considered in EIS Appendix M, Section 10.2.3, Table 10.4. Impacts identified on specific roads, including those between Toowoomba and Cecil Plains, were representative. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility and updated traffic modelling identified the potential

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R16031	S026, S079, S081, S134	to the underlying soil type, heavy use of the road by light and heavy vehicles and the floods/ wet weather in recent years. Additionally, the Charlton Wellcamp Employment Area is a developing industrial and transport interchange precinct, set to have potential for the origin/destination of goods and equipment related to the project area. How would Toowoomba Cecil Plains Road deal with this?		for traffic to use the Toowoomba Cecil Plains Road. This information is provided and discussed in SREIS Chapter 12, Roads and Transport, Section 12.5.3 and Appendix 10, Supplementary Roads and Transport Assessment, Section 7. Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (including underlying soil type) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The fitness for use investigation will identify the current condition of specific roads expected to be affected by the project.
R16032	S026, S134	The adopted road hierarchy is too simplistic. Arrow should adopt a more definitive road hierarchy.	EIS Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Consistent with a strategic level assessment, a simple hierarchy was utilised considering readily available information. Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will undertake a fitness for use investigation where required. This will consider various road characteristics (established with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the traffic demands associated with project traffic. The identification of road characteristics will enable a more definitive road hierarchy to be adopted.
R16033	S034, S042, S050, S069, S162	What impacts will the increased traffic volumes resulting from the project (as illustrated in Figure 19.2) have on the future conditions of local roads? Congestion will arise due to project related traffic and existing tourist traffic (in particular towing caravans) and agricultural traffic (in particular oversized farm machinery). Many local roads are single track bitumen and do not allow for easy passing of large vehicles. With non-local staff and heavy machinery involved with the project, shoulders will need to be reinforced to ensure no problems when passing wide loads. Arrow drivers will also have to show patience. What measures does Arrow have in place to ensure that oversized agricultural machinery has right-of-way on existing public roads?	EIS Chapter 19, sections 19.6.1 and 19.6.2	As described in EIS Chapter 19, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road characteristics considered may include existing traffic volumes, existing construction and pavement standard including underlying soil types and structure limits, susceptibility to flooding and safety. Where project activities create road safety issues, Arrow has committed to assess and identify instances where unsealed roads should be sealed or where sealed road should be widened (allowing the safe passing of heavy vehicles) (Commitment C285). Road use management plans will include measures such that project impacts on the road use network are appropriately managed.

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R16034	S069	If the project is approved in its current state, vehicle movements on private land will be unknown, putting at risk both children's safety, and the lifestyle that comes with living on a farm.	EIS Chapter 2, Section 2.3	As described in EIS Chapter 2, Project Approvals, Section 2.3, it is a legislative requirement that a conduct and compensation agreement be negotiated before a petroleum authority holder comes onto a landholder's property to undertake 'advanced activities' that are likely to have a significant impact on business or land use. Protocols for land access will be agreed with landholders before development occurs.
R16035	S034, S069, S079, S088, S134, S155	Section 19.3.7 indicates that school bus routes typically use highways and higher-order local roads, such as regional connecting roads. Local school buses also travel on rural connecting roads and rural access roads. Many of the rural connecting roads are single lane bitumen and rural access roads are unsealed with visibility reduced due to dust and the width of a local road is too narrow to allow buses to pass oncoming heavy vehicles. The safety of the children and pets of landholders who live close to increased traffic is of the utmost importance. One road expected to experience an increase in heavy vehicle traffic is Tipton-Horrane Road and as the road is rated to 100 km/hr; there are concerns that children will be at a higher risk boarding and disembarking the bus. The proponent should not be allowed to proceed with the project in its current form as bus routes have not been correctly identified.	EIS Chapter 19, sections 19.3.7 and 19.6.2, and Appendix M, Section 12.2, Table 12.5	As described in EIS Chapter 19, Roads and Transport, Section 19.3.7, school-bus routes have been considered in the EIS as a descriptor of road condition. Arrow has made several commitments in regards to school-bus safety. These include limiting project traffic on school bus routes during pick-up and drop-off times on school days (Commitment C296) and making workers aware of school bus routes and typical pick-up and drop-off times in the vicinity of the work sites (Commitment C297). EIS Appendix M, Road Impact Assessment, Section 12.2, Table 12.5 outlines Arrow's School Bus Routes Management Strategies. Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will undertake a fitness for use investigation where required. This will consider various road characteristics likely to influence the ability of roads (such as Tipton-Horrane Road) to safely and efficiently accommodate increased traffic demands, Where project activities create road safety issues, Arrow has committed to assess and identify instances where unsealed roads should be sealed or where sealed road should be widened (allowing the safe passing of heavy vehicles) (Commitment C285).
R16036	S042, S119	The increased traffic on local roads will increase the time it takes for oversized machinery, used by local people for their business, to reach their destinations. How does Arrow propose to compensate landholders and local businesses for delays in operations resulting from transport delays due to increased traffic volumes, especially of large vehicles used to transport large and heavy equipment?	EIS Chapter 19, Section 19.6.1	As described in EIS Chapter 19, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use (FFU) investigation where required which will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The FFU assessment will contribute to the determination of traffic threshold limits by road authorities. Road contributions will be calculated during the preparation of these plans in accordance with accepted standards.
R16037	S048	There are concerns regarding impacts to livestock and people from increased traffic and mining equipment movements.	EIS Appendix M, Section 9.1	Noted. The strategic traffic assessment undertaken for the EIS established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Once project locations are determined, localised impacts will be addressed in road use management plans prepared and regularly reviewed in

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R16037	S048			consultation with the relevant council or the DTMR (Commitment C284).
R16038	S050	The condition of the existing roads has not been taken into account. According to Figure 9.4.B (Appendix M) that 30 to 74 annual average daily traffic will move along the Macalister-Pirrinuan Road, and 10 to 29 annual average daily traffic will move along Macalister-Bell Road, Alexanders Road, Jandowae-Macalister Road, Alexander's Road and Tully Road within the Jimbour Flood Plain area east of the Warrego Highway. Out of these; Alexanders Road is a black soil track for two thirds of the distance; Macalister-Pirrinuan Road, Kents Road and Tully Road are gravel roads and the others bitumen. All of these roads are in mostly poor condition.	-	Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will undertake a fitness for use investigation where required as part of road use management plan preparation which will consider various road characteristics (including existing construction and pavement standard) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road characteristics considered may include existing traffic volumes, existing construction and pavement standard including underlying soil types and structure limits, susceptibility to flooding and safety. The road use management plan will document the current condition of specific roads affected by the project.
R16039	S050, S079, S150, S162	Appendix B of Appendix M, Table B.1 has an assumption of 32 t of aggregate for well construction and 17 t of aggregate for access road construction. These assumptions are incorrect. On black cracking clay soils, 32 t may be enough for a 10 m x 10 m pad but it will not hold any heavy loads. This design would leave you with barely enough gravel to cover the production pad to give it all weather access. Likewise, 17 t for an access road will be enough for about 5 m of road base. It is laughable because there it would hardly cover the surface and be mixed into the soil by the first large rainfall, unless it was placed above the topography which would lead to erosion and a change in surface water movement. This shows a thorough lack of understanding of the geology and soil condition of the floodplain. It will take at least 50 t to do a reasonable job of the pad to ensure it is weather proof, and the access road will be extremely large. The aggregate estimates are understated, and should immediately be increased with consideration to the existing quarries. The Road Impact Assessment (Appendix M) will also be inaccurate and not provide a true picture of how the project traffic will impact on the region's resources and communities. There is a lack of floodplain understanding due to no consideration of the extra work involved in getting the road and pad	SREIS Chapter 3, Section 3.4.6 and Chapter 12, Section 12.3.3	Since publication of the EIS, there have been a number of changes to the project description and potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. The SREIS traffic modelling has been undertaken to reflect changes to the project description, including updates to aggregate volumes. The traffic modelling incorporates updated aggregate volumes for all phases of the project life, based on aggregate calculations presented in SREIS Chapter 3, Project Description, Section 3.4.6. Updated predictions of project traffic generation are included in SREIS Chapter 12, Section 12.5.3.

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R16039	S050, S079, S150,	topographically correct. This is a significant design flaw.		
R16040	S050, S162	Chapter 19 shows no traffic volume from the associated quarries. Due to the large amount of gravel needed, especially on the floodplains, an increase on roads used to reach nearby quarries is expected. There is a question as to whether the traffic from the well site to the waste disposal locations has also been included. Without the level of project detail available it is difficult to believe these figures are correct.	EIS Appendix M and Appendix B SREIS Chapter 12, Section 12.5.3 and Appendix 10, Section 6.	Due to the strategic nature of the EIS Road Impact Assessment, depot locations were used as representative locations for landfills and quarries, both of which were assumed to be in proximity to the depots. This did not mean that the materials and waste storage required for wells and other infrastructure would physically be located at the depots, but rather that they would originate from within the area. Trips associated with waste described in Appendix B of EIS Appendix M, Road Impact Assessment were conservative given that the project will minimise waste outputs where possible. SREIS traffic modelling incorporates updated assumptions relating to aggregate volumes, depots and quarry locations and updated predictions of project traffic generation are included in SREIS Chapter 12, Section 12.5.3. Some quarry material is expected to be transported directly to site from suppliers (SREIS Appendix 10, Supplementary Roads and Transport Assessment, Section 6). A study into the availability of existing quarries will be undertaken during the front end engineering design phase (i.e., detailed planning) of the project.
R16041	S011, S050, S162	The EIS does not address the large number of floodways that are susceptible to road surface erosion after rain. These eroded areas can quickly become huge traffic hazards. Due to the nature of the floodplain, road maintenance is an ongoing issue. Damage to these roads will be restored by council, who in turn will have to charge ratepayers more to cover the costs. This is a major concern for the community. Road maintenance for the damage to local roads from increased traffic loads has not been assessed.	EIS Chapter 19, Section 19.6.1	Following the EIS process, localised impacts such as those on floodways will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When developing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established through consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road characteristics considered may include existing traffic volumes, existing construction and pavement standard including underlying soil types and structure limits, susceptibility to flooding and safety. The pavement and maintenance contributions will be determined during preparation of these plans and will be calculated in accordance with accepted standards.
R16042	S050, S162	The existing annual average daily traffic numbers (Figure 4.3, Appendix M) do not include the roads; Macalister-Pirrinuan Road, Alexanders Road, Jandowae-Macalister Road, and Tully Road, but only include Macalister-Bell Road. The traffic at the rail crossing at Macalister will double according to modelling due to the Macalister-Pirrinuan Road joining this road on the eastern side of the crossing before reaching the Warrego Highway. Further analysis needs to take place on local roads to	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5 and Appendix D and E of Appendix 10	Following the EIS process, localised impacts such as those on floodways will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When developing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established through consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road characteristics considered may include existing traffic volumes, existing construction and pavement standard including underlying soil types and structure limits, susceptibility to flooding and safety. The

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Issue No.	Submission No.	Issue	Reference	Responses
R16042	S050, S162	ensure road annual average daily traffic numbers are correct, existing road condition is suitable for heavy traffic (50t drill rigs) and any upgrades or maintenance is planned. No road management plans have been sighted, and there is a limited trust that this will be done publicly.		pavement and maintenance contributions will be determined during preparation of these plans and will be calculated in accordance with accepted standards.
R16043	S011, S062, S072, S135	How can impacts be assessed based on the averaged out total travel over the entire region, when in fact the traffic will be concentrated over a fairly small number of roads, including specific sections of state-controlled roads, that will be used heavily? Appendix M Figure 1.1 uses the entire Darling Downs region which is far larger than the project area and uses a vast number of roads outside of the project area which will not be used by project traffic, in effect 'watering down' the results. A more valid comparison would be vehicle kilometres travelled for the coal seam gas project divided by the vehicle kilometres travelled in 2009 in the area where the coal seam gas project is taking place.	EIS Chapter 19, Section 19.6.1 and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that a large proportion of the traffic associated with the project will result in localised impacts on specific roads (e.g., associated with the location of facilities). This will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR following the EIS process (Commitment C284).
R16044	S079	Traffic modelling has taken into account the potential impact on the percentage increase in volume occurring on individual sections of a road then higher sensitivity must be placed on roads/tracks that only have five vehicles travelling a day compared with the possibility of hundreds of vehicles a day	EIS Chapter 19, Section 19.3.1, and Tables 19.4, 19.5 and 19.6, and Appendix M, Section 9.1	The traffic assessment undertaken for the EIS was strategic in nature and established that road impacts associated with increases in traffic volumes at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Consistent with a strategic level assessment, the adopted sensitivity framework incorporated a functional hierarchy which grouped roads in terms of function, under four road classification types (EIS, Chapter 19, Roads and Transport, Section 19.3.1). Impacts are typically considered in light of average annual daily vehicle numbers, the condition and the design capacity of roads. Lower order roads, which typically have lower daily traffic volumes, were assigned higher sensitivity than highways which typically experience greater daily traffic volumes (EIS, Chapter 19, Roads and Transport, Section 19.4, Table 19.4 to 19.6).
R16045	S086, S119, S136	The state of the Warrego Highway which until the mining boom was in reasonably good condition, is now week by week becoming a death trap due to the vast amounts of heavy mining equipment travelling on the highway. Problems including surface degradation, reduced speeds and risky driver behaviour are being experienced. Arrow should acknowledge that the project will have a	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 10.2.2	As stated in EIS Appendix M, Road Impact Assessment, Section 10.2.2, Arrow acknowledges that the magnitude of impact by project activities on the Warrego Highway in the Chinchilla development region is 'high'. Following the EIS process, localised impacts, such as those on the Warrego Highway, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing road use management plans, Arrow will undertake a fitness for use investigation where required which will consider various road

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R16045	S086, S119, S136	high impact on certain parts of the Warrego Highway at certain times.		characteristics (established with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16046	S088	On some local gravel roads around Cecil Plains, Arrow states that up to 74 vehicles a day will commute during peak development. Given the current average is 10, this should be considered a serious increment above existing levels.	EIS Chapter 19, Section 19.6.1 and Section 19.3.1 Appendix M, Section 9.1	The traffic assessment undertaken for the EIS was strategic in nature and established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Consistent with a strategic level assessment, the adopted sensitivity framework incorporated a functional hierarchy which grouped roads in terms of function, under four road classification types (EIS, Chapter 19, Roads and Transport, Section 19.3.1), meaning that significance of impacts and mitigation measures were not identified for specific locations. Localised impacts, such as those on gravel roads around Cecil Plains, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16047	S088	How accurate is the map of "Maximum project annual average daily traffic" when the map does not show any increase in traffic from Toowoomba to Cecil Plains as a result of project activities?	EIS Appendix M, Section 10.2.3, Table 10.4 SREIS Chapter 12, Section 12.5.3	In the EIS, Toowoomba-Cecil Plains Road was not identified by the strategic traffic modelling as likely to be affected by project activities. However, the significance of impacts upon Toowoomba-Cecil Plains Road was considered in EIS Appendix M, Section 10.2.3, Table 10.4. Impacts identified on specific roads, including those between Toowoomba and Cecil Plains, were representative. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility, which includes the potential for traffic to use the Toowoomba Cecil Plains Road. This information is provided and discussed in SREIS Chapter 12, Roads and Transport, Section 12.5.3.
R16048	S027, S088	Homes close to gravel roads will be inundated with dust. Arrow must be conditioned to provide a bitumen surface 200 m in front of any home where dust is going to make their rural living a nightmare.	EIS Chapter 18, Section 18.6.3, and Chapter 19, Section 19.6.2 SREIS Attachment 4	As stated in EIS Chapter 19, Roads and Transport, Section 19.6.2, Arrow has committed to manage its impacts to private roads and tracks and minimise dust generation, where appropriate, in consultation with relevant landowners and council (Commitment C031). Arrow will implement dust suppression measures on roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012).
R16049	S091	The effect of traffic traversing black soils, especially in wet conditions has not been determined.	EIS Chapter 19, sections 19.6.1 and 19.6.2	Traffic will not travel directly on black soils but will be confined to designated roads and access tracks, where practicable (Commitment C033). Where necessary, existing access roads or new access tracks will be constructed in consultation with the landholder.
R16050	S099	The traffic study is inconsistent with the project description. The traffic study states 14 days for daily maintenance, and fortnightly maintenance thereafter (project description states weekly). Similarly Table 19.2 appears to understate	SREIS Appendix 10, Section 6	SREIS traffic modelling incorporates updated assumptions relating to maintenance and quarry locations. Well maintenance will be conducted in accordance with legislative requirements and manufacturer's recommendations. Some quarry material is expected to be transported directly to site from suppliers (SREIS Appendix 10, Supplementary Roads

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R16050	S099	expected traffic volumes. Figure 19.2 does not provide an indication of existing quarries and expected traffic increase.		and Transport Assessment, Section 6). Quarry locations have been assumed to be east of Toowoomba however it is intended that a study into the availability of existing quarries will be undertaken during the front end engineering phase (i.e., detailed planning) of the project.
R16051	S099	Lack of confidence in the EIS due to inconsistency between Appendix L (Visual) and Appendix M (Traffic) and the EIS. Traffic modelling has been based on placing a facility on the Warrego Highway and the Old Warrego Highway at Macalister. In the visual report, it stated that facilities should be no closer than 1 km from Warrego Highway.	EIS Appendix M, Section 1.2, and Appendix L, Section 8.2.3	Noted. The studies are not inconsistent. At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken based on representative facility locations (EIS Appendix M, Road Impact Assessment, Section 1.2). Although some of the areas of potential facility development in Figure 1.3 are shown as overlapping the highway, the facilities themselves will be located adjacent to a highway. The statement made in EIS Appendix L, Landscape and Visual Amenities, Section 8.2.3, which recommends facilities be located ideally 1 km from view corridors where screening is possible or 3 km otherwise, remains.
R16052	S109	Poor and dangerous road conditions and heavy traffic were experienced between Toowoomba and Roma. There are concerns that the existing infrastructure isn't able to cope with the current traffic levels, and the project should be deferred until planning and funding parameters are better understood.	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will prepare road use management plans in consultation with the relevant council or the DTMR (Commitment C284). Arrow will undertake a fitness for use investigation where required as part of road use management plan preparation which will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plan will document the current condition of specific roads affected by the project.
R16053	S119	Arrow to review traffic and transport impacts based on the five staged development areas, to help focus on the impacts within the region that the project works are concentrating in.	EIS Chapter 5, Section 5.3.1 SREIS Chapter 3, Section 3.2, and Chapter 12, Section 12.5.5	At the time the EIS was published, progressive development of five development regions (Wandoan, Chinchilla, Dalby, Millmerran and Goondiwindi) was proposed (EIS Chapter 5, Project Description, Section 5.3.1). The development sequence has been revised to the progressive development of eleven drainage areas, identified by sequential numbering, that correspond with the gas reserves that will be fed into each central gas processing facility (SREIS Chapter 3, Project Description, Section 3.2). Since the publication of the EIS, the locations for four central gas processing facilities and a temporary workers accommodation facility have also been identified. Findings related to these sites are discussed in SREIS Chapter 12, Roads and Traffic, Section 12.5.5. Following the completion of the EIS process, localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16054	S119, S135	Arrow to consider adding the following additional mitigation measure: 'Utilise rail transport to transport pipes and other equipment to avoid additional road train traffic.'	EIS Chapter 19, Section 19.2.4	As set out in EIS Chapter 19, Roads and Transport, Section 19.2.4, roads have been identified as the key mode of transport for the Surat Gas Project. However, Arrow are contemplating the use of existing rail networks in preliminary logistics plans to reduce traffic. Detailed logistics planning carried out in conjunction with front end engineering and design will further

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R16054	S119, S135			investigate the feasibility of rail as a mode of transport for project materials. Rail use has not been anticipated or assessed in the EIS or SREIS.
R16055	S119	Arrow to consider adding the following additional mitigation measure: 'Upgrade intersections and highway as required in the higher impact areas.'	EIS Chapter 19, Section 19.6.1	As described in EIS Chapter 19, Roads and Transport, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). Upgrade and maintenance contributions will be determined during preparation of these plans. Contributions will be calculated in accordance with accepted standards.
R16056	S121	There are concerns regarding increased road traffic volume. There may be an increase in road traffic crashes due to the increased volumes of traffic.	EIS Appendix M, Section 4.10, Table 4.1 SREIS Chapter 12, Section 12.5	Noted. The existing conditions of the road network reviewed included a road safety assessment of historical crash rates for key rural roads (see EIS Appendix M, Road Impact Assessment, Section 4.10, Table 4.1) which has been updated for the SREIS (SREIS Chapter 12, Roads and Transport, Section 12.5). Following the EIS process and finalisation of project planning, including identification of project infrastructure locations, Arrow will undertake a fitness for use investigation where required. This will consider various road characteristics (including road safety) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plans will include measures required to safety accommodate increased volumes of project traffic.
R16057	S130	The modelling undertaken by Arrow with regard to workforce vehicle movements is flawed and has grossly underestimated the impacts on roads from vehicle movements.	EIS Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.3	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Since the publication of the EIS, there have been a number of changes to the project description. Workforce vehicle movements have been updated in line with revised workforce estimates and updated predictions of project traffic generation are included in SREIS Chapter 12, Section 12.5.3.
R16058	S130	Arrow need to provide more detail on mitigation measures provided, including road construction standards and safety attributes and upgrade requirements.	EIS Chapter 19, Section 19.6.1 and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5 and Appendix D and E of Appendix 10	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be managed through effective mitigation measures (EIS Appendix M, Road Impact Assessment, Section 9.1). Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Specific management strategies, including recommended infrastructure upgrades, have been presented for road sections assessed in proximity to each location. The assessments conducted

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Issue No.	Submission No.	Issue	Reference	Responses
R16058	S130			at these four locations represent example case studies and information is presented in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and SREIS Appendix D and E of Appendix 10, Supplementary Roads and Transport Assessment). Following the EIS process, localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16059	S130	Request vehicle monitoring to all vehicles using the council's network.	EIS Chapter 19, Section 19.6.1	As described in EIS Chapter 19, Roads and Transport, Section 19.6.1, Arrow will implement an in-vehicle monitoring system for all project vehicles (Commitment C288).
R16060	S130	A traffic impact study should be undertaken, particularly on local road networks, prior to the use of any roads.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Following the EIS process and finalisation of project planning, localised impacts such as those on council roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16061	S130	All mitigation and management measures that will minimise the impact on roads should be approved prior to implementation.	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning, localised road impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16062	S130	Arrow should be financially liable for upgrades and maintenance of roads for life of project, road condition assessments prior and at completion of project, all weather access roads to camps (with appropriate main road access constructed), bush fire risk considered for safe access by emergency services.	EIS Chapter 25, Section 25.6.3 and Appendix F, Section 6.5	Upgrade and maintenance contributions will be determined during the preparation of road use management plans. Contributions will be calculated and agreed in accordance with accepted standards. Where required, Arrow is proposing to construct permanent all weather access to significant facilities, such as central gas processing facilities and temporary workers accommodation facility (EIS Appendix F, Agricultural Report, Section 6.5). In regards to bush fire risk, EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3 outlines specific management measures and controls that will be implemented in the design, planning and construction phases of the project to reduce the risk to people and assets from fire.
R16063	S130, S134	Road condition assessments should be undertaken prior to and at the completion of the project. Arrow should provide details regarding how they	EIS Chapter 19, Section 19.6.1, and Chapter 17	Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will address localised impacts in road use management plans prepared and regularly reviewed in

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R16063	S130, S134	will ensure that roads are left in a condition no less than prior to their use for project activities.	SREIS Chapter 12, Section 12.5.5 and Appendix 10	consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plan will document the current condition of specific roads affected by the project. Case studies undertaken as part of SREIS Appendix 10, Supplementary Roads and Transport Assessment and described in SREIS Chapter 12, Roads and Transport, Section 12.5.5, include fitness for use investigations, intersection assessments and pavement impact assessments to demonstrate how the above process will be carried out when facility locations are confirmed.
R16064	S130, S135	The EIS should expand on scheduling rosters to include avoiding school bus operation hours and following guidelines. Arrow should work around school timetables and liaise with all stakeholders to minimise impacts to transport, especially school buses.	EIS Chapter 19, Section 19.6.2	Arrow has made several commitments with regards to school-bus safety including limiting project traffic on school bus routes during pick-up and drop-off times on school days or installing appropriate school bus infrastructure, e.g., signage or pull-over areas where necessary (Commitment C296). Location-specific requirements will be set out in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR.
R16065	S130	Transportation of waste by road may pose a significant risk/hazard to soil and water resources as well as impact roads.	EIS Chapter 12, Section 12.6.3	Arrow recognises the potential for loss of containment of potentially hazardous materials (including forms of waste) during unloading or transfer. As described in EIS Chapter 12, Geology Landform and Soils, Section 12.6.3, Arrow has committed to develop and implement emergency response and spill response procedures to reduce impacts that could occur as a result of releases of hazardous materials or loss of containment of storage equipment (Commitment C036).
R16066	S134	There is concern over potential impacts on Toowoomba Regional Council assets including roads.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Localised road impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16067	S134, S136	Arrow should identify and provide specific traffic generation projections for every local road affected by the project, and enter into an infrastructure agreement for each potentially affected road. Agreed traffic models for each of the regional councils involved should be developed, to underpin the development of an overarching road use management plan with each council and to the	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use

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Issue No.	Submission No.	Issue	Reference	Responses
R16067	S134, S136	associated infrastructure agreements for road upgrading and/or maintenance.		investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road contributions will be determined during preparation of these plans. Upgrade and maintenance contributions will be calculated in accordance with accepted standards.
R16068	S134	EIS underrates the significance of road safety risks.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	The strategic traffic assessment undertaken for the EIS established that road impacts associated with project traffic at a regional level could be effectively managed (EIS, Appendix M, Road Impact Assessment, Section 9.1). Following EIS approval and finalisation of project planning, including the identification of project infrastructure, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16069	S134	Arrow to ensure that gas lines placed within or adjacent to road reserves do not hinder or adversely affect Toowoomba Regional Council's road construction and maintenance practices.	EIS Chapter 5, sections 5.5.2 and 5.5.6	As described in EIS Chapter 5, Project Description, Section 5.5.6, gas pipelines may have to cross roads, pipelines, railway tracks, utilities and/or watercourses. The construction of these crossings will be undertaken in accordance with Australian Standard AS 2885.1 for the design and construction of gas and liquid petroleum pipelines (Australian Standards, 2008a), Australian Pipeline Industry Association's code of environmental practice for onshore pipelines (APIA, 2009), and the requirements of asset owners and/or operators. In addition, the depth of pipeline burial will conform to acceptable industry practices but will ultimately depend on the existing land use (Section 5.5.2).
R16070	S134	Arrow to identify the Local Government Act (and its association to council controlled road networks) as relevant to the legislative context.	EIS Chapter 19, Section 19.1, and Appendix M, Section 3.1	As stated in EIS Appendix M, Road Impact Assessment, Section 3.1, the DTMR and local governments have a role in implementing the legislation, policies and guidelines that are listed in EIS Chapter 19, Roads and Transport, Section 19.1. Both state and local governments utilise these legislative processes and power to assess the impacts of development, specific to roads, in Queensland.
R16071	S134	Only state controlled roads have been considered in the traffic assessment. Arrow to provide further traffic modelling including council controlled roads.	EIS Appendix M, Section 9.2	As described in EIS Appendix M, Road Impact Assessment, Section 9.2, the total number of project vehicle kilometres travelled have been considered for the state controlled road network, council controlled road network and the access networks internal to private land, for the life of the project. Due to the strategic nature of the assessment, all road links were considered however a sample of both state-controlled and council-controlled roads were used to inform the assessment of significance of impacts.
R16072	S134, S135	The level of road categorisation in Section 19.4., Table 6.1 nor Table 19.1 of the traffic assessment	EIS Chapter 19, Section 19.6.1,	As the infrastructure characteristics of the roads vary significantly across the region, it was not feasible to incorporate this information in the EIS and this

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Issue No.	Submission No.	Issue	Reference	Responses
R16072	S134, S135	is not adequate to address pavement strength, width or condition concerns at a local road level and should be more definitive. Arrow to provide further road condition information at a council controlled road level. Arrow should incorporate the effects on / of infrastructure characteristics in this section. There should be a summary of current pavement, speed environments, intersection standards, rail crossings, school bus routes, etc. The EIS recognises that rural roads are highly sensitive to changes in traffic conditions, but does not go on to adequately address the potential impacts of the project to these roads.	and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5 and Appendix 10	data would now be out-dated. Consistent with a strategic level assessment, EIS Appendix M, Road Impact Assessment considered a functional hierarchy rather than a construction hierarchy. Following the EIS process and finalisation of project planning including the identification of specific project locations, Arrow will address localised impacts in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use (FFU) investigation where required which will consider various road characteristics (including pavement strength and width) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plan will document the current condition of specific roads affected by the project. Case studies undertaken as part of SREIS Appendix 10, Supplementary Roads and Transport Assessment and described in SREIS Chapter 12, Roads and Transport, Section 12.5.5 include FFU investigations, intersection assessments and pavement impact assessments to demonstrate how the above process will be carried out when facility locations are confirmed.
R16073	S134	Arrow should review the characterisation of the 'Safety' environmental value to incorporate road formation and pavement factors.	EIS Chapter 19, Section 19.4, Table 19.2	As shown in EIS Chapter 19, Roads and Transport, Section 19.4, Table 19.2, environmental characteristics include the presence of pavement (sealed or unsealed) and road formation factors such as standard of intersection control and rail-way crossing control. Although some of these are not grouped under the 'safety' category, they contribute equally to the overall sensitivity of the values to change for each road type.
R16074	S124	Arrow should provide greater detail on how increased traffic stress from the project will affect existing infrastructure.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that traffic associated with the project will result in localised impacts on roads; however, these will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16075	S134	Arrow should include the potential for flood inundation as a measure for characterising a road's existing environment / environmental value.	–	Arrow will undertake a fitness for use investigation where required which will consider various road characteristics such as the potential for flood inundation likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The road use management plan will document the current condition of specific roads affected by the project.
R16076	S134	Arrow should consider environmental values of highways in an urban environment separately from	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning, localised impacts will be addressed in road use management plans prepared and

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Issue No.	Submission No.	Issue	Reference	Responses
R16076	S134	highways in a rural environment.		regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (such as the surrounding environment) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16077	S134	Neither the Road Impact Assessment nor Table 19.2 in the EIS recognises traffic generation associated with the construction of water gathering infrastructure and associated dams. Arrow to characterise the traffic generation associated with water gathering infrastructure and associated dams.	EIS Chapter 19, Section 19.4, Table 19.2, and Appendix M, Section B.2.4.2, Table B.4	As shown in EIS Chapter 19 Roads and Transport, Section 19.4, Table 19.2, traffic associated with the construction of water gathering infrastructure has been captured under the 'Gathering Infrastructure' category. Dams are co-located with central gas processing facilities and as such, traffic generation associated with dams is captured under this category (as detailed in EIS Appendix M Road Impact Assessment, Section B.2.4.2, Table B.4).
R16078	S134	Why are five development regions identified in Table 19.4, but only three in Table 19.5, and four in Table 19.6. Arrow to provide consistency.	EIS Chapter 19, Section 19.4, Table 19.5	Only the development regions that include that particular road type have been included in these tables. For example, in the development regions of Wandoan and Goondiwindi, no regional connecting roads were identified. They were subsequently omitted from EIS Chapter 19, Roads and Transport, Table 19.5, as this outlines impacts to regional connecting roads only.
R16079	S134	Arrow to characterise the amount of oversize traffic that will be generated by project activities, and compare these forecast volumes with current levels of traffic of this type.	EIS Chapter 19, Section 19.4, and Appendix M	As described in EIS Chapter 19, Roads and Transport, Section 19.4, at its peak, the project is anticipated to increase the extent of heavy-vehicle travel occurring on the region's road network by less than 2% of the existing (2009) levels. SREIS Chapter 12, Roads and Transport, Section 12.5 presents updated information on the extent of heavy vehicle traffic generated by the project. As defined in the glossary of Appendix M, Road Impact Assessment, a heavy vehicle is 'any vehicle with three or more axles or with dual tyres on the rear axle. Also referred to as commercial vehicles', which includes oversize traffic. Specific details regarding the number of oversize loads associated with project activities will be considered during the preparation of road use management plans.
R16080	S134	Figure 19.2 should identify traffic volumes generated by project activities that would utilise the road network outside the project area.	EIS Chapter 19, Section 19.2.3 and Figure 19.2	The strategic traffic modelling undertaken for the EIS considered traffic generation from the project across DTMR's entire Darling Downs region road network, rather than solely roads within the project development area. As described in EIS Chapter 19, Roads and Transport, Section 19.2.3, the Darling Downs regional boundary in the east (Toowoomba) was used as the source location from which equipment and materials were transported (visible in Figure 19.2). Additionally, traffic generated by workforce personnel during the construction phase has been considered for traffic travelling to and from Toowoomba.
R16081	S134	Environmental protection objectives (Section 19.5) for traffic and transport should include infrastructure characteristics that are of concern for the council-	EIS Chapter 19, sections 19.5 and 19.6.1	The environmental protection objective to 'avoid or minimise and manage adverse effects on the efficiency, safety and amenity of existing road networks' includes the council-controlled road network.

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Issue No.	Submission No.	Issue	Reference	Responses
R16081	S134	controlled road network.		Following the EIS process and finalisation of project planning, Arrow will develop road use management plans in consultation with the relevant council or the DTMR (Commitment C284).
R16082	S134	Section 19.6.1 states that Arrow will develop and regularly review road use management plans in consultation with the relevant council and Section 19.6.2 states that the need to upgrade or widen roads will be assessed and also done in consultation with the relevant council. There is concern that this consultation is not occurring with Toowoomba Regional Council. Arrow should be required to develop road use management plans and enter into an associated infrastructure agreement for each potentially affected road.	EIS Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Given the strategic nature of the assessment, Arrow was not in a position to identify mitigation measures for specific locations. The preparation of road use management plans will be undertaken progressively following the EIS process, as facility locations are confirmed. Consultation between Arrow and the relevant councils will be conducted when facility locations and affected roads are confirmed. It is envisaged that these discussions will commence in Q4 2013 or 2014.
R16083	S134	Arrow should be required to develop and implement inspection and monitoring regimes for affected roads.	EIS Chapter 19, Section 19.8	As set out in in EIS Chapter 19, Roads and Transport, Section 19.8, the requirements for inspection or monitoring will be described in specific road use management plans after the location of project infrastructure is confirmed. Inspection and/or monitoring will be carried out in accordance with legislative requirements.
R16084	S134	Arrow should provide details regarding how they will ensure that public road agencies are contacted within the notice period, as per Petroleum and Gas Act.	EIS Chapter 19, Section 19.1	Arrow recognises that under the <i>Petroleum and Gas (Production and Safety) Act 2004</i> , a holder of a petroleum authority must notify the road authority prior to use of a public road for a 'notifiable road use' and that DTMR may give the proponent a 'road use direction' detailing how the petroleum authority holder may use the road for the proposed use (see EIS Chapter 19, Roads and Transport, Section 19.1). This legislative obligation will be addressed when preparing road use management plans in consultation with DTMR or the relevant council.
R16085	S134	The Road Impact Assessment should explicitly identify and consider the project activities associated with the current/pilot field/exploration/pre-production phase of the project. Tables 8.1 and 8.2 in the roads impact assessment should be updated to provide exploration well/pilot well and production well traffic generation data.	–	Arrow is already authorised to conduct exploration activities under the company's existing authorities to prospect and associated environmental authorities. Exploration activities are therefore not considered in the EIS or SREIS.
R16086	S134	Arrow to characterise the effects of project-related road upgrade activities, including traffic generated, on the local road network.	EIS Chapter 19, Section 19.6.1	The effects of project-related upgrades will not be determined until the period following the EIS process and finalisation of project planning (including the identification of specific project locations) when road use management plans are prepared and regularly reviewed in consultation with the relevant council

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R16086	S134			or the DTMR (Commitment C284). Road upgrades and maintenance will be determined through fitness for use investigations where required which will consider various road characteristics. Upgrade requirements, if identified, will serve the purpose of improving the safety of the road network.
R16087	S099, S134, S135, S162	In Chapter 19, 2009 traffic figures have been used when 2010 figures were available and these show a large increase in road use (larger than prescribed by Arrow) on some of the roads. Considering Arrow is predicting a small increase in traffic (1% to 4%), why wouldn't they use the latest available data. Again, more dubious data use.	SREIS Chapter 12, Section 12.4.1	At the time of preparation of the EIS, the latest traffic census data available was from 2009. Where possible, more recent traffic volume data (DTMR, 2011) has been included in traffic modelling undertaken for the SREIS (SREIS Chapter 12, Roads and Transport, Section 12.4.1).
R16088	S134	Heavy vehicles, in relation to multi-combination vehicle routes, are not mentioned in either the EIS or supporting documents. Assessment of multi-combination routes should include council-controlled roads.	EIS Chapter 19, Section 19.2.3, and Appendix M, Section 4.4 and Figure 4.4	Due to the strategic nature of the EIS Road Impact Assessment, travel routes identified were conceptual and based on the shortest travel time (EIS Chapter 19, Roads and Transport, Section 19.2.3). However, in the EIS Appendix M, Road Impact Assessment, Section 4.4, designated multi-combination routes have been identified from data supplied by TMR and are summarised in Figure 4.4. Multi-combination vehicle routes represent those roads on which the use of B-Doubles or Road Trains is approved. Following the EIS process and finalisation of project planning including the identification of specific project locations and definition of routes, a non-conceptual assessment of multi-combination routes will occur.
R16089	S134	Discussion in the roads impact assessment of other projects in the vicinity is of little relevance to Toowoomba Regional Council's road network. The few projects that are within Toowoomba Regional Council's area are not co-located with Arrow's tenements and accordingly will not contribute to background growth on local roads likely to be used by Arrow.	EIS Chapter 28, Section 28.3.8	Noted. As described in EIS Chapter 28, Cumulative Impacts, Section 28.3.8, Arrow expects that most of the traffic generation by other projects will contribute to increased traffic volumes on 'through routes' (i.e., highways and rural connecting roads), such as the Warrego Highway from Toowoomba to Miles, rather than local roads.
R16090	S134	Table 9.1 and Charts 9.1 to 9.3 in the Road Impact Assessment would be more relevant if compared to the background/baseline transport tasks. The use of a global comparison is misleading due to the immense scale of transport on the Warrego Highway by comparison with lower use (by one or two orders of magnitude) of the majority of the council road network involved.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that traffic associated with the project will result in localised impacts, however, these will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).

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Issue No.	Submission No.	Issue	Reference	Responses
R16091	S134	Clarity should be provided on the extent (in kilometres) of the council road network included in the analyses of forecast traffic volumes.	EIS Appendix M, Section 9.2 SREIS Chapter 12, Section 12.5.3	As described in EIS Appendix M, Road Impact Assessment, Section 9.2, the total number of project vehicle kilometres travelled have been considered for the state controlled road network, council controlled road network and the access networks internal to private land, for the life of the project. Due to the strategic nature of the assessment, all road links were considered however a sample of both state-controlled and council-controlled roads were used to inform the assessment of significance of impacts An updated estimate for the extent in kilometres of the council road network (i.e., 16,340 km) was included in traffic modelling undertaken for the SREIS. See SREIS Chapter 12, Roads and Transport, Section 12.5.3 for updated predicted project traffic volumes.
R16092	S134	Figure 9.4 and Section 11.1 of the Roads Impact Assessment is misleading because the greatest safety risk exists at the time of pre-production construction activities. This figure also fails to illustrate peak heavy vehicle issues and volumes which are the critical factor for infrastructure pavement, width and condition concerns.	SREIS Chapter 12, Section 12.5.5, and Appendix D and E of Appendix 10	Localised impacts from heavy vehicles will be addressed in road management plans in consultation with the relevant council or the DTMR following the EIS process. This will include a breakdown of heavy vehicle types and information on vehicle volumes. Pavement impact assessment case studies for four production facility sites and one temporary workers accommodation facility location have been prepared as part of the SREIS. This information is provided in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and SREIS Appendix D and E of Appendix 10, Supplementary Roads and Transport Assessment.
R16093	S134	The Road Impact Assessment report fails to recognise true peak impacts, by averaging these activities across a whole year or longer, when the actual peak activity is confined to a duration of only one or two months.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	As the locations of project infrastructure were unknown, the traffic assessment undertaken for the EIS was strategic and established that road impacts associated with project traffic at a regional level over the project life could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that traffic associated with the project will result in localised impacts over shorter time periods; however, these will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16094	S134	Table 10.4 Road Impact Assessment: • Resolve contradicting statements above and below the table, regarding the magnitude of anticipated impacts on the road network. • Include all identified regional connecting roads (for example Bowenville–Norwin Road and Brookstead–Norwin Roads should be included) in the table, and include reasons for the significance of the identified impact.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1 and Table 10.4	The statements made above and below EIS, Appendix M, Road Impact Assessment, Table 10.4 are consistent. Impacts on the road network are anticipated to be of a low magnitude in providing access to production wells, while impacts of high significance are provided where lower order roads are used to access production facilities (i.e., central gas processing facilities). At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, the roads presented in Table 10.4 were chosen as a representative selection of the type of roads present in each region with the aim to identify at a regional level if the road network could reasonably support the scale and intensity of activity proposed. The strategic traffic assessment established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Section 9.1). Following the EIS process and finalisation of project planning (including the identification of project infrastructure locations),

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Issue No.	Submission No.	Issue	Reference	Responses
R16094	S134			localised impacts, for example on Bowenville–Norwin Road and Brookstead–Norwin Roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16095	S134	Arrow to review intersection analysis methodology used in the Road Impact Assessment, to account for geometrical turning movement requirements for large vehicles. Geometrical turning movement requirements should also be considered where access for these vehicles is required into private property. This section should refer to DTMR's heavy vehicle guidelines.	EIS Chapter 19, Section 19.6.1	Following the EIS process and the finalisation of project planning, including the identification of project infrastructure locations, Arrow will prepare road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (including intersection characteristics) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. DTMR's heavy vehicle guidelines will be considered during preparation of these management plans for all roads affected by project activities.
R16096	S134	Arrow to note that Section 13.2 of the Road Impact Assessment (Impact on Sensitivity Post-Management Strategy) is limited to consideration of only project roads leading to production facilities and accommodation camps.	EIS Appendix M, sections 10.2.3 and 13.2 and Tables 12.1 and 12.2 SREIS Chapter 12, Section 12.5.5, and Appendix D and E of Appendix 10	As described in EIS Appendix M Road Impact Assessment, Section 10.2.3, impacts on the road network are anticipated to be of a low magnitude in providing access to production wells, whereas traffic volumes on roads leading to production facilities and accommodation camps are higher due to greater traffic generation. Therefore, consistent with a strategic assessment, Section 13.2 of EIS Appendix M, Road Impact Assessment considered the impacts on the road networks leading to facilities and camps. However, Table 12.1 and 12.2 identify management strategies for access roads to wells. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Specific management strategies, including recommended infrastructure upgrades, have been presented for road sections assessed in proximity to each location. The assessments conducted at these four locations represent example case studies presented in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and SREIS Appendix D and E of Appendix 10, Supplementary Roads and Transport Assessment.
R16097	S134	The EIS Road Impact Assessment states that consultation will be undertaken with Councils and Transport and Main Roads to identify works at specific locations during the detailed planning phase, and also that local impacts can be managed via consultation with road authorities. This consultation is not happening.	EIS Chapter 19, Section 19.6.1	Front end engineering and design (i.e., detailed planning) for the project had not commenced at the time of preparing the EIS or SREIS. Following the EIS process and finalisation of project planning, including the identification of project infrastructure locations, road use management plans will be prepared and regularly reviewed in consultation with the relevant council or the DTMR to address localised impacts (Commitment C284). Consultations prior to this between Arrow and the relevant councils will be conducted so that council requirements are taken into account prior to the commencement of project activities and the finalisation of traffic management plans.

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Issue No.	Submission No.	Issue	Reference	Responses
R16098	S134	Arrow to note that the "small temporary dams" referred to in the Road Impact Assessment are considered by Toowoomba Regional Council to be far from small, and that the construction and operation of these dams generate large numbers of heavy vehicle movements.	EIS Appendix M, Section B.1.3	As described in Appendix B, Section B.1.3 of EIS Appendix M, Road Impact Assessment, small temporary dams will be constructed at each pilot well exploration site to store produced water (except on intensively famed areas where water will be piped off-site to an existing or new dam). The EIS and SREIS does not consider the exploration phase and these activities are already authorised under existing petroleum tenements and associated environmental authorities for exploration.
R16099	S134	Arrow to note that Appendix B of the Road Impact Assessment mentions the use of "extendable vehicle" to transport gathering pipe. This is critical to road intersection and safety impacts yet this vehicle is not mentioned in any of the preceding discussion.	EIS Chapter 19, Section 19.6.1	A breakdown of heavy vehicle types will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road use management plans will include measures required to safety accommodate increased volumes of project heavy vehicle traffic (including oversize machinery).
R16100	S134	Arrow to note that it would assist in understanding the timelines if the Development Schedule in Appendix C of the Road Impact Assessment was mapped in the spatial sense, to clearly identify which areas were being impacted when by which activities.	EIS Appendix M, Section 9, Figures 9.2 to 9.4C SREIS Chapter 12, Section 12.5.3 and Appendix C of Appendix 10	Noted. EIS Appendix M, Road Impact Assessment, Section 9 shows when the peak transport tasks will occur by displaying the vehicle kilometres travelled per year for light and heavy vehicles. Figures 9.2 to 9.4C show where these traffic movements occur over the full project life, average project life (annual average daily traffic) and peak year of project (maximum project annual average daily traffic). The development schedule has been updated for the SREIS and revised figures are presented in SREIS Chapter 12, Roads and Transport, Section 12.5.3. Annual average daily traffic anticipated to be generated by the project on individual road links for each year of the project life has been presented in SREIS Appendix C of Appendix 10, Supplementary Roads and Transport Assessment.
R16101	S135	If cumulative traffic generation and potential impacts prove significant, this chapter needs to identify that any related impacts on pavement and intersections will be mitigated in accordance with DTMR's Road Planning and Design Manual.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively mitigated (EIS Appendix M, Road Impact Assessment, Section 9.1). Following the EIS process and finalisation of project planning, including the identification of project infrastructure locations, Arrow will address localised impacts from the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).As part of this, Arrow will undertake a fitness for use investigation where required. This will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate increased traffic demands. Arrow recognises that DTMR's Road Planning and Design Manual provides guidance on the road design standards and warrants for various road elements, including intersections, to suit different traffic situations.

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Issue No.	Submission No.	Issue	Reference	Responses
R16102	S130, S135	All findings of studies, assessment and any proposed mitigation works are to be incorporated into a road use management plan. The EIS does not clearly state this. The road use management plans should be approved prior to construction before any road is approved for use.	EIS Chapter 19, Section 19.6.1	As described in EIS Chapter 19, Roads and Transport, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). It is Arrow's intention that road use management plans are approved prior to the start of construction activities.
R16103	S135	EIS must ensure the overall road impact assessment is undertaken in accordance with the Guidelines for Assessment of Road Impacts of Development (GARID). The sensitivity to impact approach taken in the EIS does not follow these guidelines and as such, is not adequate. Arrow Energy cannot identify/mitigate all significant impacts of project traffic and an assessment in accordance with GARID should be conducted prior to identifying possible mitigation measures. Also, EIS should identify the specific location of key project related-infrastructure, assets, accesses and activities, to help determine road link intersections and pavement areas that will experience the greatest development-related pressures, including all temporary and full-time worker trips.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5 and Appendix D and E of Appendix 10	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1. This assessment was consistent with the DTMR's Guidelines for Assessment of Road Impacts of Development (GARID) in terms of road design standards. Arrow acknowledges that traffic associated with the project will result in localised impacts; however, these will be addressed during preparation of road use management plans in consultation with the relevant council or the DTMR (Commitment C284). Plans will be prepared in support of the GARID approach. Since the publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Specific management strategies, including recommended infrastructure upgrades, have been presented for road sections assessed in proximity to each location. The assessments conducted at these four locations represent example case studies and information is presented in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and SREIS Appendix D and E of Appendix 10, Supplementary Roads and Transport Assessment).
R16104	S135	Commitment (C293) 'Where assessed necessary, provide protected turning lanes for entry to permanent facilities to address road safety issues.' – Arrow should outline that requirements when providing turn lanes are to be in accordance with DTMR's Road Planning and Design Manual and relevant policies and guidelines. Turn lanes are to be assessed in accordance with the turn warrant requirements in the manual, and intersections upgraded to address road safety issues as necessary. Temporary facilities may also need upgrade depending on turn warrant requirements.	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning including the identification of project infrastructure locations, localised impacts will be addressed during preparation of road use management plans in consultation with the relevant council or the DTMR (Commitment C284). Arrow recognises that DTMR's Road Planning and Design Manual provides guidance on the road design standards and warrants for various road elements, including auxiliary turn lanes at intersections, to suit different traffic situations. Arrow recognises that the DTMR considers a Road Impact Assessment on specific intersections and roads to be necessary where developments generate an increase in traffic of equal to or greater than 5% on the road section, intersection movements or turning movements. The necessity for infrastructure upgrades, such as protected turning lanes, will be determined in the traffic management plans to be agreed with DTMR and relevant councils.

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Issue No.	Submission No.	Issue	Reference	Responses
R16105	S135	All of the three major LNG proponents were required to prepare a logistics plan.	EIS Chapter 19, Section 19.6.1	As stated in EIS Chapter 19, Roads and Transport, Section 19.6.1, Arrow will develop project logistics plans to provide safe movement of people and materials, as well as to minimise traffic volumes (Commitment C290).
R16106	S135	EIS doesn't state that accesses (driveways) to state-controlled roads must be in accordance with the road planning and design manual. Approval from Department of Transport and Main Roads must also be sought in accordance with s33 and s62 of traffic impact assessment, including permits etc.	EIS Appendix M, Section 3.1	Arrow recognises that DTMR's Road Planning and Design Manual provides guidance on the road design standards and warrants for various road elements, such as access location, layout and sight distance, to suit different traffic situations. A review of legislation has been conducted in the EIS Appendix M, Road Impact Assessment, Section 3.1. This has been based on the advice presented in the DTMR's Guidelines for Assessment of Road Impacts of Development, which provides information about the steps involved in assessing the road impacts of a proposed development project and provides reference to the Road Planning and Design Manual.
R16107	S135	Combine highways and regional connecting roads impact assessment and mitigation in the EIS.	EIS Appendix M, Section 6.1	The traffic assessment undertaken for the EIS considered a functional road hierarchy, which is consistent with a strategic assessment. As described in EIS Appendix M, Road Impact Assessment, Section 6.1, environmental values were defined as a measure of how the public value the environment in which we live and the roads used in the project development area. In this respect, the road types of highways and regional connecting roads were considered separately due to differing characteristics and identified as values within the project development. According to Table 6.1, the sensitivity of these road types are different for the three aspects considered; efficiency, safety and amenity.
R16108	S135	Some key traffic generators are not listed in sufficient detail, and may require further assessment and mitigation.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). A breakdown of vehicle types, including into several heavy vehicle types, will be included the assessment during preparation of road use management plans in consultation with the relevant council or the DTMR following the EIS process (Commitment C284).
R16109	S135	The Road Impact Assessment should assess each road intersection, road link or structure that could be affected should be assessed individually (where annual average daily traffic or environmental sensitive areas increases by 5%), not as overall network.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Arrow acknowledges that traffic associated with the project will result in localised impacts; however, these will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). Arrow recognises that the DTMR considers a Road Impact Assessment on specific intersections and roads to

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Issue No.	Submission No.	Issue	Reference	Responses
R16109	S135			be necessary where developments generate an increase in traffic of equal or greater than 5%.
R16110	S135	Consider and assess the use of buses to transport workers associated with the work/accommodation camps.	EIS Appendix M, Section B.2.4, Tables B.4, B.5, B.15 and B.16 SREIS Chapter 12, Section 12.5.3	The strategic traffic assessment undertaken for the EIS considered the use of buses to transport workers between accommodation camps and work sites during the construction and decommissioning of central gas processing facilities and field compression facilities (see EIS Appendix M, Road Impact Assessment, Section B.2.4, Tables B.4, B.5, B.15 and B.16). The updated traffic modelling also considers the use of buses to transport workers. Updated predictions of project traffic generation, including bus movements, are included in SREIS Chapter 12, Section 12.5.3.
R16111	S135	The upgrade intervention levels are as per turn warrants in road planning and design manual. The 5% guideline is not a consideration.	–	Arrow recognises that DTMR's Road Planning and Design Manual provides guidance on the road design standards and warrants for various road elements, including intersections, to suit different traffic situations.
R16112	S135	The Darling Downs Region should be contacted to obtain specific width standards, rather than utilizing the Rural Road Design manual. These values should also be used for impact assessment and mitigation.	EIS Chapter 19, Section 19.6.1	Noted. Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or DTMR (Commitment C284). The road construction standard that is used in these plans will be in-line with contemporary research and that which is already constructed in the region. In conjunction, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16113	S135	The Road Impact Assessment does not outline traffic generation/background information for the project in an easily interpreted format, to allow identification and comparison with current data and Transport and Main Roads planning purposes.	EIS Chapter 19, Section 19.4, Table 19.2, and Section 19.6.1 SREIS Chapter 12, Section 12.5	As specific locations of project facilities and associated infrastructure were unknown at the time of publication of the EIS, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). The traffic generation for each project activity in each project phase has been summarised in EIS Chapter 19, Roads and Transport, Section 19.4, Table 19.2. Further traffic generation information, including a breakdown of heavy vehicle types, will be established during preparation of road use management plans in consultation with the relevant council or the DTMR following the EIS process (Commitment C284). SREIS Chapter 12, Section 12.5 provides updated information on predicted traffic generation.
R16114	S135	The EIS needs to include potential impacts on open level crossings as an associated impact. The assessment of rail crossings needs to be in accordance with Australia Level Crossing Assessment Model to determine whether upgrading of rail crossings is warranted in response to project related traffic.	EIS Chapter 19, Section 19.6.1	Localised impacts, including those on open level/rail crossings, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). As part of this, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.

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Issue No.	Submission No.	Issue	Reference	Responses
R16115	S135	Provide more detail on the magnitude of the transport task for the delivery of construction and operational inputs and outputs for the project.	EIS Chapter 19, Section 19.4, Table 19.2, and Appendix M, sections B.2 and B.3 and Figures 9.2 to 9.4C SREIS Chapter 12, Section 12.5.3	The traffic generation for each project activity in each project phase, including construction and operations, has been estimated in EIS Chapter 19, Roads and Transport, Section 19.4, Table 19.2. A detailed breakdown of the traffic generation for construction and operations phases per infrastructure type (i.e. production wells, gathering infrastructure, central gas processing facility, field compression facility and temporary workers accommodation facility) can be found Appendix B, sections B.2 and B.3 of the EIS Appendix M, Road Impact Assessment. Figures 9.2 to Figure 9.4C show the transport task for the project across the Darling Downs region road network across the project life. Estimates have been updated for the SREIS (see SREIS Chapter 12, Roads and Transport, Section 12.5.3) and will continue to be refined as project planning continues.
R16116	S136	There is concern for additional traffic on minor rural roads. These roads will require significant upgrades to carry additional traffic.	EIS Chapter 19, Section 19.6.1	Localised impacts, including those on minor rural roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). Road upgrades and maintenance requirements will be determined through a fitness for use investigation where required which will consider various road characteristics (established in consultation with road authorities) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16117	S136	Impact classification for the regional and rural connecting roads is low considering the additional traffic movements on these roads will be heavy vehicles, buses and work vehicles.	EIS Chapter 7, Section 7.2.3, and Chapter 19, sections 19.4 and 19.6.1	The significance of potential impacts has been assessed using the sensitivity of the value for each functional road type and the magnitude of the potential impact (as described in EIS Chapter 7, Impact Assessment Method, Section 7.2.3). Highways in the project development area are built and operated at a standard that is likely to accommodate changed traffic conditions and therefore exhibit low sensitivity, meaning that the significance of impacts on these roads is low (see EIS Chapter 19, Roads and Transport, Section 19.4). Similarly, regional connecting roads exhibit moderate sensitivity; however the magnitude of impacts for these roads is higher than for highways. Localised impacts, including those on highways and regional connecting roads, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16118	S136	Develop project logistics plans to provide safe movement of people and materials, as well as to minimise traffic volumes. Suggestion that private vehicles are discouraged in preference for company-related transport to and from camps.	EIS Chapter 19, Section 19.6.1 SREIS Chapter 12, Section 12.5.3	Arrow has committed to develop journey management plans taking into consideration high-risk roads (Commitment C291). Arrow will also develop project logistics plans to provide safe movement of people and materials, as well as to minimise traffic volumes (Commitment C290). The updated traffic modelling considers the use of buses to transport workers and updated predictions of project traffic generation, including bus movements, are included in SREIS Chapter 12, Section 12.5.3.
R16119	S136	Monitor compliance with the project's road safety	EIS	Arrow will implement an in-vehicle monitoring system for all project vehicles

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R16119	S136	requirements through regular review of reports generated by the in-vehicle monitoring system. Life-threatening breaches of the project's road safety requirements should be referred to the Queensland Police Service for investigation.	Chapter 19, Section 19.6.1, and Chapter 25, Section 25.6.2	(Commitment C288). This is a part of Arrow's health, safety and environment management system which is designed to manage hazard and risk through policy, standards and procedural controls. Compliance with this system is mandatory for all employees and contractors engaged by Arrow and disciplinary action is applicable for non-compliance (see EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2).
R16120	S136	Arrow should advise of all traffic disruptions and road closures.	–	Processes for advising of traffic disruptions and road closures will be set out in road use management plans developed in consultation with the relevant council and DTMR.
R16121	S136	Rural and regional roads in the gas fields south of Chinchilla are already carrying significant traffic.	–	Noted.
R16122	S136	The drive-in drive-out workforce will impact heavily on traffic particularly on the Warrego Highway between Toowoomba and Chinchilla.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	Noted. The strategic traffic assessment undertaken for the EIS considered traffic generated by workforce personnel during the construction phase travelling to and from Toowoomba or Brisbane and traffic travelling to and from production facilities and wells to the temporary workers accommodation facility (EIS, Chapter 19, Roads and Transport, Section 19.2.3). The assessment established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Following the EIS process, localised impacts, such as those on the Warrego Highway, will be addressed in more detail in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16123	S139	Will restrictions be placed on access times/speeds/traffic flow along access tracks?	–	Arrow's land access rules limit speeds within private properties to 40 km/h unless otherwise agreed with landholders. Access times will be determined in consultation with the landholder.
R16124	S153	The EIS does not adequately address mitigation measures relating to increased demands on infrastructure.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5 and Appendix D and E of Appendix 10	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Given the strategic nature of the assessment, location-specific mitigation measures were not identified. Proposed locations for four facilities and a temporary workers accommodation facility have since been determined. Specific management strategies, including recommended infrastructure upgrades, have been presented for road sections assessed in proximity to each location. The assessments conducted at these four locations represent example case studies and information is presented in SREIS Chapter 12, Roads and Transport, Section 12.5.5 and SREIS Appendix D and E of Appendix 10, Supplementary Roads and Transport Assessment). Impacts on specific roads will be assessed in greater detail as facility

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R16124	S153			locations are selected. Localised impacts will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16125	S161	Traffic modelling in the EIS is inaccurate and inadequate, and needs to encompass a wider geographic range. It does not account for return trips post-delivery of materials, nor does it look further afield than the Darling Downs traffic management region, when in reality many people and materials will be coming from Brisbane.	EIS Chapter 19, Section 19.4, Table 19.2	As shown in EIS Chapter 19, Roads and Transport, Section 19.4, Table 19.2, two-way trips were considered when determining the traffic generation of the project. The Darling Downs region road network was used to include roads that lie outside of the project development area and provide a more accurate depiction of the transport tasks associated with the project. As stated in 19.2.3, traffic generated by workforce personnel during the construction phase and the source of all equipment and materials has been considered from Toowoomba, which lies on the eastern boundary of the Darling Downs region road network. Travel from Brisbane will be addressed with DTMR when developing road use management plans for the project.
R16126	S162	Appendix M does not indicate that Alexanders Road will be gravelled or that Macalister-Pirrinuan Road will be paved despite the large traffic increases. Macalister-Pirrinuan Road is also very flood-prone, so further work would be needed before construction to allow access to the sites along this road.	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1). Localised impacts, such as those that might be experienced on Alexanders Road and Macalister-Pirrinuan Road, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). When preparing these plans, Arrow will undertake a fitness for use investigation where required which will consider various road characteristics (such as susceptibility to flooding) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands.
R16127	S024, S026, S079, S081	What are the strategies to minimise dust generation? Does this refer to wetting unsealed roads with produced coal seam water? If so, in what instances is the minimisation of dust generation appropriate? In which instances is it not appropriate?	EIS Chapter 9, Section 9.6, and Chapter 15, Section 15.6.4 SREIS Attachment 4	Arrow has committed to implement dust suppression measures for roads and construction sites where there is a potential for dust to cause nuisance effects (Commitment C012). Appropriate measures will be determined on a case-by-case basis and will be implemented where dust may cause environmental nuisance or harm. When used for dust suppression on roads or for construction and operations activities, coal seam gas water quality will be in accordance with relevant permits and/or consents (Commitment C176).
R16128	S024, S026, S081, S135	What are the actual traffic generation data from the other major coal seam gas proponents within the project development area and wider region?	EIS Chapter 28, Section 28.3.8 SREIS Chapter 12, Section 12.5.2	Actual traffic generation data is not in the public domain and therefore not available to Arrow. Estimates as set out in EIS Chapter 28, Cumulative Impacts, Section 28.3.8 indicate a total increase in traffic from all developments in the region of between 2% and 8%, equating to approximately 2 to 4 years of historical traffic growth. Further modelling has been undertaken for the SREIS. A reasonable growth rate of 3% has been allowed within the updated traffic modelling to account

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R16128	S024, S026, S081,			for project traffic generated by other proponents (SREIS Chapter 12, Roads and Transport, Section 12.5.2).
R16129	S099	Concern that the sensitivity ranking of highways (specifically the Warrego Highway) in the project development area (low) is incorrect. Reassess the sensitivity using more recent data and cumulative impacts from other pending and approved projects in the region.	EIS Chapter 19, sections 19.4 and 19.6.1 SREIS Chapter 12, Section 12.5.4	Highways in the project development area are built and operated at a standard that is likely to accommodate changed traffic conditions and therefore exhibit low sensitivity, meaning that the significance of impacts on these roads is low (see EIS Chapter 19, Roads and Transport, Section 19.4). Further assessment and modelling has been undertaken for the SREIS which validates the sensitivity rankings of roads presented in the EIS (SREIS Chapter 12, Roads and Transport, Section 12.5.4). Impacts specifically pertaining to the Warrego Highway will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16130	S120	More information is required on the cumulative impacts of heavy transport activity.	EIS Chapter 28, Section 28.3.8 SREIS Chapter 12, sections 12.5.2 and 12.5.5 and Appendix F of Appendix 10	As described in EIS Chapter 28, Cumulative Impacts, Section 28.3.8, the total increase in traffic, including heavy vehicles, from all developments in the region is expected to be between 2% and 8%, equating to approximately 2 to 4 years of historical traffic growth. Further modelling has been undertaken for the SREIS, including pavement impact assessment case studies to ascertain the potential impact of heavy vehicles (SREIS Chapter 12, Roads and Transport, Section 12.5.5 and Appendix F of Appendix 10, Supplementary Roads and Transport). A reasonable growth rate of 3% has been allowed within the updated traffic modelling to account for project traffic generated by other proponents (SREIS Chapter 12, Section 12.5.2).
R16131	S135	Provide trip numbers of pipeline construction traffic (despite being assessed as negligible), as it contributes to cumulative traffic impacts.	EIS Chapter 19, Section 19.4, Table 19.2	Short sections of high-pressure gas pipelines may be required to connect central gas processing facilities to the Arrow Surat Pipeline. SREIS traffic modelling has considered the construction of high-pressure gas pipelines in vehicle movements for gathering infrastructure construction. However, the high-pressure gas pipeline was deemed to be an insignificant component in terms of vehicle movements.
R16132	S024, S026, S079, S081	What coal seam water qualities will be used for dust suppression on soils in the project development area with clay content of greater than 30%?	EIS Chapter 15, Section 15.6.4 SREIS Attachment 4	When used for dust suppression on roads or for construction and operations activities, coal seam gas water quality will be in accordance with relevant permits and/or consents (Commitment C176).
R16133	S136	Requests that the District Officers of Roma and Dalby be invited to participate or nominate a liaison officer to attend regular briefings to assist with operational planning (e.g. traffic and disaster management). To then develop traffic management plans.	EIS Chapter 19, Section 19.6.1	Following the EIS process and finalisation of project planning, including the identification of project infrastructure locations, road use management plans will be prepared and regularly reviewed in consultation with the relevant council or the DTMR to address localised impacts (Commitment C284). Consultation prior to this between Arrow and the relevant councils will be conducted so that council requirements are considered prior to the commencement of project activities and the finalisation of traffic management plans.

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Issue No.	Submission No.	Issue	Reference	Responses
R16134	S133	The EIS does not include impacts associated with increased traffic including the potential increase in road trauma experienced by these communities.	EIS Appendix M, Section 4.10, Table 4.1	The existing conditions of the road network reviewed included a road safety assessment of historical crash rates for key rural roads (see EIS Appendix M, Section 4.10, Table 4.1). Following the EIS process and finalisation of project planning, including identification of project infrastructure locations, Arrow will undertake a fitness for use investigation where required. This will consider various road characteristics (including road safety) likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. Road use management plans will include measures such that project impacts on the road use network are appropriately managed.
R16135	S135	Requires information stating pavement and maintenance contributions may be necessary in accordance with Fitzroy methodology, specifically Table 4.3 in the EMP of the EIS.	EIS Chapter 19, Section 19.6.1	As described in EIS Chapter 19, Section 19.6.1, Arrow will assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). Road contributions will be determined during preparation of these plans. Upgrade and maintenance contributions will be calculated in accordance with accepted standards.
R16136	S135	Insufficient reference to the need for approvals for access to/from state-controlled roads.	EIS Chapter 19, sections 19.1 and 19.6.1	Arrow recognises that under the Petroleum and Gas (Production and Safety) Act 2004, a holder of a petroleum authority must notify the road authority prior to use of a public road for a 'notifiable road use' and that DTMR may give the proponent a 'road use direction' detailing how the petroleum authority holder may use the road for the proposed use (see EIS Chapter 19, Roads and Transport, Section 19.1). Where applicable, this 'road use direction' will be given after the preparation of road use management plans in consultation with the relevant council or the DTMR (Commitment C284).
R16137	S135	The EIS should include a section on seeking approvals from the relevant Railway Manager, Queensland Rail.	SREIS Chapter 2, and Attachment 7	Approval requirements for the project are described in SREIS Chapter 2, Project Approvals and SREIS Attachment 7, Legislation and Policy.
R16138	S135	The "railway reserves" should be updated to be "railway corridors" throughout the EIS, to allow consistency with the Transport Infrastructure Act 1994. Amend the overview of the role of the Transport Infrastructure Act 1994 to include the powers with respect to protection of rail corridors.	SREIS Attachment 7	Noted. Attachment 7, Legislation and Policy, provides an update to acts of relevance to the project.
R16139	S024, S026, S034, S069, S079, S081	Commitment (C031) 'Maintain the integrity of private roads and tracks and minimise dust generation, where appropriate, in consultation with relevant landholders and council.' – What does 'maintain the integrity' mean, with respect to private	EIS Chapter 19, Section 19.8	Maintaining the integrity refers to the condition and safe operation of the private road or track. As described in EIS Chapter 19, Section 19.8, the integrity and amenity of project-related roads and tracks will be maintained through routine monitoring (Commitment C308) and will be in accordance with Arrow's standard operating procedures. Detailed information on the

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Issue No.	Submission No.	Issue	Reference	Responses
R16139	S024, S026, S034, S069, S079, S081	roads and tracks?		mitigation measures for Arrow to manage its impacts to private roads and tracks will be included as applicable in accordance with statutory requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". Consultation with landholders will also occur to determine the mitigation measures ultimately implemented.
R16140	S021	Commitment (C032) 'Use existing roads and tracks, where practicable.' – Under what circumstances will this be practicable or impracticable?	EIS Chapter 12, Section 12.6.1	The practicability of using existing roads will be determined through a fitness for use investigation undertaken where required following the EIS process and finalisation of project planning. This investigation will consider various road characteristics likely to influence the ability of roads to safely and efficiently accommodate the increased traffic demands. The practicability of using access tracks on private properties will be determined through consultation with the landholder, with consideration to existing condition, width, etc.
R16141	S021	Commitment (C033) 'Confine project traffic to designated roads and access tracks, where practicable.' – Under what circumstances will this be practicable or impracticable?	EIS Chapter 19, Section 19.6.2, and Chapter 25, Section 25.6.2	The practicability of confining project traffic to designated roads and access tracks will be determined on a case-by-case basis through use of Arrow's health, safety and environment management system which is designed to manage hazard and risk through policy, standards and procedural controls. This will be implemented for all activities and phases of development (Commitment C417). The practicability of using access tracks on private properties will be determined through consultation with the landholder, based on such factors as existing condition, width, etc.
R16142	S079	Commitment (C294) 'Ensure access driveways to project facilities and infrastructure have appropriate sight distances.' – What does "appropriate sight distances" mean?	EIS Chapter 19, Section 19.6.2	Appropriate sight distances are determined through the use of DTMR's Guidelines for Assessment of Road Impacts, which provides reference to DTMR's Road Planning and Design Manual. This manual provides guidance on the road design standards and warrants for various road elements, such as access location, layout and sight distance, to suit different traffic situations. Sight distances will be assessed during the preparation of road use management plans in consultation with DTMR or the relevant council (Commitment C284).
R16143	S135	Commitment (C285) 'Assess and identify the need to upgrade unsealed roads or widen sealed roads where project activities and traffic will create road safety issues. Such works will be done in consultation with the relevant council (if a local government road) or DTMR (if a state road).' – Insufficient wording, needs to outline the trigger of DTMR's policies, guidelines and vision width standards.	EIS Chapter 19, sections 19.1 and 19.6.1 SREIS Chapter 12, Section 12.4, Figure 12.1	Arrow recognises that under the Petroleum and Gas (Production and Safety) Act 2004, a holder of a petroleum authority must notify the road authority prior to use of a public road for a 'notifiable road use' and that DTMR may give the proponent a 'road use direction' detailing how the petroleum authority holder may use the road for the proposed use (see EIS Chapter 19, Roads and Transport, Section 19.1). The DTMR considers a road impact assessment on specific intersections and roads to be necessary where developments generate an increase in traffic of equal to or greater than 5% on the road section, intersection movements or turning movements. These assessments involve the use of DTMR guidelines on the road design standards and warrants for various road elements, including vision width, and form the basis of road use management plans

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Issue No.	Submission No.	Issue	Reference	Responses
R16143	S135			prepared in consultation with the relevant council or the DTMR (Commitment C284). Road contributions for road upgrades will be determined during preparation of these plans. SREIS Chapter 12, Roads and Transport, Section 12.4, Figure 12.1 outlines this process.
R16144	S135	Commitment (C298) 'Coordinate with local law enforcement for movement of heavy or oversized loads.' – Add further wording in commitment that Local Government and DTMR need to be included in co-ordination of movement of heavy or oversized loads.	EIS Chapter 19, section 19.6.1 SREIS Attachment 4	The wording of Commitment 298 has been amended to read: "Coordinate with relevant authorities (e.g., Queensland Police, Department of Transport and Main Roads and council) for movement of heavy or oversized loads." Coordination will be further outlined in road use management plans prepared following the EIS process, once the locations for project activities have been determined.
R16145	S134	Arrow to provide a clear perspective regarding cumulative impacts on local/council controlled roads.	EIS Chapter 28, Section 28.3.8 SREIS Chapter 12, Section 12.5.2	A reasonable growth rate was allowed within the traffic modelling undertaken for the EIS, which included council-controlled roads, to account for project traffic generated by other proponents. The total increase in traffic from all developments in the region is expected to be between 2% and 8%, equating to approximately 2 to 4 years of historical traffic growth (EIS Chapter 28, Cumulative Impacts, Section 28.3.8). Traffic modelling has been updated for the SREIS and also includes a reasonable growth rate of 3% to account for project traffic generated by other proponents (SREIS Chapter 12, Roads and Transport, Section 12.5.2).
R16146	S135	The list of cumulatively affected roads is incomplete.	EIS Chapter 28, Section 28.3.8	As described in Chapter 28, Cumulative Impacts, Section 28.3.8, with respect to the roads within the region, most of the traffic generation by other projects will contribute to increased traffic volumes on 'through routes' (i.e., highways and rural connecting roads). This section highlighted routes that would potentially be impacted by other significant projects in the area and so does not include a full list of roads in the project area. It is stated that there would be negligible cumulative impact on rural connecting roads and rural access roads in the project development area, as these are not typically anticipated to service facilities associated with other projects.
R16147	S136	The reduced efficiency and safety of higher order roads such as highways and regional connecting roads due to cumulative impacts from the three major gas projects is a significant risk. The cumulative impact of the projected traffic movements associated with the three gas projects will have a profound impact on the Warrego Highway.	EIS Chapter 19, Section 19.6.1, and Chapter 28, Section 28.3.8	Noted. As described in Chapter 28, Cumulative Impacts, Section 28.3.8, the Warrego Highway between Toowoomba and Miles is identified as a road that may experience reduced efficiency and safety cumulative impacts. Following the EIS process, localised impacts, such as those on the Warrego Highway, will be addressed in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).
R16148	S011	Does not fulfil terms of reference, section 4.3.1 as the Roads and Transport report has been constructed entirely on the basis of modelling, with facilities being theoretically placed at roughly evenly spaced intervals within the development	EIS Chapter 19, Section 19.6.1, and Appendix M, Section 9.1 SREIS Chapter 12, Section 12.5.5	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. The Terms of Reference states that, where it is not possible to provide specific details relating to timing and specific routes, the EIS should provide an indication of the types of transport infrastructure and activity that could reasonably be expected for various

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Issue No.	Submission No.	Issue	Reference	Responses
R16148	S011	<p>regions of the project areas, and traffic generation occurring within the model between these locations. Arrow has not used its knowledge of where facilities are likely to be positioned in the report.</p> <p>As such, there is limited information about the impact on specific roads or sections of road that will be heavily used by the project. The proponent should redo traffic modelling with likely locations of project infrastructure and traffic generation calculations should be scrutinised and corrected. This information, should be submitted before project activities are approved.</p>	and Appendix F of Appendix 10	<p>petroleum activities. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (EIS Appendix M, Road Impact Assessment, Section 9.1).</p> <p>Since publication of the EIS, potential locations have been identified for four central gas processing facilities and a temporary workers accommodation facility. Traffic modelling has been updated accordingly and this information is included in SREIS Chapter 12, Roads and Transport. The SREIS also presents case studies incorporating pavement impact assessments whereby management strategies have been applied to potential locations (SREIS Chapter 12, Roads and Transport, Section 12.5.5 and Appendix F of Appendix 10, Supplementary Roads and Transport Assessment). Following the EIS process and finalisation of project planning, impacts on specific locations will be addressed in detail during development of road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284).</p>
R16149	S011	Information provided in Appendix M, Road Impact Assessment, on consultation does not fulfil the Terms of Reference Section 4.3.2, as details have not been provided of any consultation with the transport authorities. Has such consultation taken place?	EIS Chapter 6, Section 6.3	The DTMR has been included in the list of identified stakeholders as described in EIS Chapter 6, Public and Stakeholder Consultation, Section 6.3. Prior to the commencement of project activities and the finalisation of traffic management plans, consultation between Arrow and the relevant councils will be conducted so that council requirements are taken into account.
R16150	S108	The roads and traffic chapter details the number of vehicle movements associated with the drilling of a production well. Vehicle wash-down and quarantine procedures must be able to handle such high numbers of vehicle movements, but no details are provided regarding how this will be achieved. How will contractors be monitored to ensure these procedures are being followed?	EIS Chapter 13, Section 13.6.3, and Chapter 19, Section 19.6.1	Arrow will wash down vehicles and equipment that have potentially been in contact with weeds before entering new work sites (Commitment C099). Vehicle movements to and from washdown facilities will be monitored, as Arrow will implement an in-vehicle monitoring system for project vehicles, including contractor vehicles (Commitment C288). Facilities provide certificates upon completion of washdowns.

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Issue No.	Submission No.	Issue	Reference	Responses
R17001	S079	What is classed as an "acoustic environment" in Section 20.2 in the EIS?	EIS Chapter 20, Section 20.2	Schedule 2 of the Environmental Protection (Noise) Policy (EPP (Noise)) defines acoustic environment as 'the part of the environment of an area or place characterised by the total amount of noise that may be experienced there.'
R17002	S024, S026, S081	What is the definition of a commercial place, as the Environmental Protection (Noise) Policy considered them to be sensitive receptors? Why has the proponent not included commercial places in their list of sensitive receptors in Section 20.2 (Assessment Methods) of the EIS?	EIS Chapter 20, Section 20.2	A commercial place is not defined in the relevant noise legislation. For the purpose of the EIS, a sensitive receptor was categorised as a dwelling in order to model worst-case noise impacts on the receiving environment. Dwellings possess the most stringent noise criteria under the Environmental Protection (Noise) Policy (EPP (Noise)), as the environmental values of health and wellbeing in relation to the ability to sleep need to be met. Site specific modelling will be conducted for the environmental authority (EA) or EA amendment application process. Potential dwellings within the project development area are shown on figures contained within SREIS Attachment 2, Strategic Environmental Management Plan.
R17003	S160	Arrow has not addressed the impact of vibration at varying levels on piggeries and other intensive livestock operations. Arrow should consult with owners and operators of intensive livestock operations in the project area and prepare and publish an independent report which assesses the impact of noise and vibration on intensive livestock operations, with sufficient detail for owners and operators to be able to consider the impacts on their operations.	EIS Chapter 13, Section 13.6.5 and Chapter 20, Section 20.4.8	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Where infrastructure is proposed on occupied lands, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084). As set out in EIS Chapter 20, Noise and Vibration, Section 20.4.8, vibration levels were found to be well below the level of detection at 100m from the facility. A site specific noise and vibration impact assessment in accordance with best practice background noise monitoring, i.e., Australian Standard and EPP (Noise) compliant, will be conducted for the environmental authority (EA) or EA amendment application for identified sensitive receptors, once facility locations are selected.
R17004	S157	Noise and vibration impacts are biased towards humans, and the social impact assessment suggests that noise will be a compensation matter for its impacts on humans, however that has no regard for the potential impacts on intensive livestock industries.	EIS Chapter 13, Section 13.6.5	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076).
R17005	S157	Does the EIS address the effect of vibration (from heavy vehicles, earthmoving equipment etc.) on flock performance and efficiency?	EIS Appendix N, Section 14	The EIS has considered the potential impacts of noise and vibration on livestock. The expected vibration levels produced from typical construction activities were found to be below the level of detection at distances greater than 100 m from the facility. Based on the vibration impact assessment, the vibration level experienced by livestock outside the site boundaries of the

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Issue No.	Submission No.	Issue	Reference	Responses
R17005	S157			production facilities will be similar to grazing adjacent to roads or rail (EIS Appendix N, Noise and Vibration Impact Assessment, Section 14).
R17006	S011, S157	The EIS does not contain an assessment of potential noise impacts on free range poultry and other intensive livestock industries etc. Chickens are sensitive to noise disturbance. There is concern with intermittent noises expected during construction, road works, land clearing, drilling and flaring; these activities could trigger flight response which could lead to birds piling up in corners and suffocating, problems with feed use efficiency and egg production, and stress, which adversely affects immune system development and expression. Noise disturbance can cause egg laying problems such as malformed eggs and retained eggs leading to egg peritonitis and death. As long term effects are not well understood, does the EIS assess long term impacts of noise on barn and range birds?	EIS Chapter 13, sections 13.6.1 and 13.6.5	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Where infrastructure is proposed on private property, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084). Where required undertake site specific noise and vibration impact assessment with best practice background noise monitoring, for identified sensitive receptors, once facility locations are selected.
R17007	S160	Noise and vibration interference of a level that disturbs the pigs could be considered a breach of the duty of care provided by the person in charge of the pigs, subjecting them to potential criminal charges.	EIS Chapter 13, sections 13.6.1 and 13.6.5, and Appendix N, Section 14	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Based on the vibration impact assessment, the vibration level experienced by livestock outside the site boundaries of the production facilities will be similar to grazing adjacent to roads or rail (EIS Appendix N, Noise and Vibration Impact Assessment, Section 14). Where infrastructure is proposed on private property, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084).
R17008	S011	The 200 m minimum separation from animal enclosures and production wells does not meet biosecurity standards and is insufficient to mitigate animal welfare impacts caused by light/noise and hazards from coal seam gas production.	EIS Chapter 13, sections 13.6.1 and 13.6.5	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Where infrastructure is proposed on private property, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084), with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing land uses, including special requirements around animals. Arrow will be flexible in the location of wells and infrastructure and will address impacts through compensation.

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Issue No.	Submission No.	Issue	Reference	Responses
R17009	S160	Arrow should be precluded from operating within two kilometres of piggeries until the impacts of noise and vibration have been the subject of an independent study.	EIS Appendix N, Section 14	The EIS has considered the potential impacts of noise and vibration on livestock (Appendix N, Noise and Vibration, Section 14). The expected vibration levels produced from typical construction activities were found to be below the level of detection at distances greater than 100 m from the facility. Based on the vibration impact assessment in the EIS, the vibration level experienced by livestock outside the site boundaries of the production facilities will be similar to grazing adjacent to roads or rail.
R17010	S157	There should be a review of the proposed infrastructure separation distances and the definition/identification of sensitive receptors after appropriate identification of the intensive livestock production areas through the project development area.	EIS Chapter 13, Section 13.6.5	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Where infrastructure is proposed on private property, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084). Where required, Arrow will undertake site-specific, detailed noise modelling of production facilities and the application of acoustic treatments where the modelled noise from facilities exceeds the established noise criteria at one or more sensitive receptors (Commitment C310).
R17011	S011, S157	The EIS does not fulfil the terms of reference in Section 4.7.1 (Noise and Vibration - description of environmental values) as only four monitoring points for baseline measurements were used, all within 50 km of each other and, roughly in the centre of the project development area (no baseline measurements were undertaken in the northern or southern areas). No measurements were taken for seasonal variation.	EIS Appendix N, Section 5.2 and Attachment 1, Section 4.7.1	Environmental values for noise are outlined in the EPP (Noise) and the Coal Seam Gas Industry Procedural Guide. The modelling undertaken for the EIS has been undertaken in accordance with these policies, with the aim of protecting the environmental values of health and wellbeing in relation to noise. The location of production facilities and infrastructure is currently unknown. Monitoring locations for the existing environment were selected such that measurements at the respective locations provide indicative background noise levels at a variety of sensitive receptors across the project development area. The existing acoustic environment at the majority of sensitive receptors in the project development area is dominated by a low acoustic environment with natural sounds such as wind in trees and birds. Other sites are influenced by existing production facilities (EIS Appendix N, Noise and Vibration, Section 5.2). Where required, a site specific noise and vibration impact assessment with best practice background noise modelling, i.e., Australian Standard and EPP (Noise) compliant, will be conducted for the environmental authority (EA) or EA amendment application for identified sensitive receptors, when the locations for facilities are selected.
R17012	S079	Why was the noise level during monitoring not taken at the minimum distance of 200m from a production well (considering the monitoring data was taken at 1,700m to 2,200m instead)?	EIS Appendix N, Section 5.2	The minimum distance of 200 m has been adopted to address a range of issues including community concerns over proximity of infrastructure to people's homes. Background noise monitoring was undertaken at Measurement Location (ML) 4 and ML 1 which are located approximately 800 m to 1,500 m and 1,700 m

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Issue No.	Submission No.	Issue	Reference	Responses
R17012	S079			to 2,200 m from existing production wells. These locations provide an indication of the background noise level at sensitive receptors in proximity to existing wells and production facilities and an approximate level of noise contribution from wells to the background environment. Where required, site specific noise and vibration modelling will be conducted for the environmental authority (EA) or EA amendment application for identified sensitive receptors, once the locations of facilities are known.
R17013	S079	How many wells were in operation at the time of monitoring?	EIS Chapter 20, Section 20.2.2 and Figure 20.1	Monitoring undertaken at Measurement Location (ML) 1 and ML 4 was in proximity to existing processing facilities and production wells. ML 1 is situated approximately 1,700 m to 2,200 m from four existing production wells, which are at the edge of a production field containing numerous wells. ML 4 is situated approximately 3.8 km from Tipton West Central Gas Processing Facility and approximately 800 m to 1,500 m from several existing production wells; see Chapter 20, Noise and Vibration, Section 20.2.2, Figure 20.1.
R17014	S160	Proposed monitoring only refers to structural damage, but fails to address monitoring of sensitive receptors to comply with Australian Standard 2670.2-1990.	EIS Chapter 20, Section 20.6.2 and Appendix N, Section 10	Vibration levels are expected to be below the threshold of human detection and to not cause structural damage at sensitive receptors that are located at distances greater than 100 m from the activity. The vibration assessment was undertaken with reference to Australian Standard AS 2670.2-1990 and German Standard DIN 4150.3-1999 and based on the vibration levels produced from typical construction activities in relation to the modelled sensitive receptors (EIS Appendix N, Noise and Vibration Impact Assessment, Section 10). Notwithstanding this, Arrow has committed to undertake a risk-based assessment or potential vibration monitoring during any construction activity that occurs within 100 m of a sensitive receptor that might be subject to vibration (Commitment C306).
R17015	S160	After Arrow drilled pilot wells in the vicinity of Tong Park, employees could feel vibrations from the motors on the well sites as far as 3 km from the wells. Given the level of vibration felt at 3 km, vibration monitoring at 100 m from a sensitive receptor for structural damage is inadequate.	EIS Appendix N, Section 10	Modelling conducted for the EIS concluded that vibration levels are expected to be below the threshold of human detection and to not cause structural damage at sensitive receptors that are located at distances greater than 100 m from the activity. The vibration assessment was undertaken with reference to Australian Standard AS 2670.2-1990 and German Standard DIN 4150.3-1999 and based on the vibration levels produced from typical construction activities in relation to the modelled sensitive receptors (EIS Appendix N, Noise and Vibration Impact Assessment, Section 10). Site selection will include consideration of separation distances to sensitive receptors based on the assessment of the distance at which vibration levels meet the applicable guidelines. Arrow has committed to conduct risk-based assessment or potential vibration monitoring during any construction activity that occurs within 100 m of a sensitive receptor that might be subject to vibration (Commitment C306).

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Issue No.	Submission No.	Issue	Reference	Responses
R17016	S011	Further baseline monitoring around noise and vibration should be undertaken to ensure a representative sampling covering the whole project area.	EIS Chapter 20, Section 20.1	Noise monitoring for the EIS was undertaken in accordance with the Department of Environmental Heritage Protection (EHP) Noise Measurement Manual (DERM, 2000). Where required, a site specific noise and vibration impact assessment with best practice background noise monitoring, i.e., Australian Standard and EPP (Noise) compliant, will be conducted for the environmental authority (EA) or EA amendment application, once specific facility locations are selected.
R17017	S011	The "flawed" 1-2% modelled traffic increase has been used for the basis of the 'Noise and Vibration' impact assessment which has led to an inadequate assessment of the impact made by traffic on noise levels and dust experienced by sensitive receptors.	EIS Appendix M and Appendix N, Section 12.2 SREIS Chapter 13, Section 13.4.3, Appendix 10 and Appendix 11	EIS Appendix M, Road Impact Assessment found that at its peak, the project is expected to increase the extent of heavy-vehicle traffic occurring on the district's road network by less than 2% of the existing (2009) levels, and the extent of light-vehicle travel by less than 1% of existing (2009) levels. Based on this, the noise levels at sensitive receptors from road traffic was estimated to increase by no greater than 0.1 dB(A) above the current level (EIS Appendix N, Noise and Vibration Impact Assessment, Section 12.2). This assessment has been revised SREIS Appendix 11, Supplementary Noise and Vibration Assessment in line with updates to the traffic data presented in SREIS Appendix 10, Supplementary Roads and Transport Assessment. The supplementary noise assessment predicted that project traffic would produce an increase of less than 1 dB(A) above current noise levels, and a cumulative increase generated by all project activity in the region of approximately 1 dB(A). Consequently, no change in noise impact on sensitive receptors is expected. In stating the above, Arrow acknowledges that the degree to which sensitive receptors may be affected will vary depending on the volume of traffic on a particular road, and the duration of which project traffic uses the road. For example, installation of wells and gathering lines may see an increase in traffic for the 10 to 14 day construction period for each well, following which traffic will drop back to operational levels necessary to conduct well maintenance and well workovers. However, the construction and operation of a facility on a rural road may see traffic volumes increase by more than 2% in a particular location over an extended period.
R17018	S048	There is concern over the impacts from noise pollution, including impacts to livestock and people from increased traffic noise.	EIS Appendix N, Section 12.2 SREIS Chapter 13, Section 13.4.3, Appendix 10 and Appendix 11	Noise levels associated with traffic generated by the project were discussed in EIS Appendix N, Noise and Vibration Impact Assessment, Section 12.2. This assessment has been revised SREIS Appendix 11, Supplementary Noise and Vibration Assessment in line with updates to the traffic data presented in SREIS Appendix 10, Supplementary Roads and Transport Assessment. The supplementary roads and transport assessment found that, based on revised traffic data, the project could potentially result in increases to the existing (2011) heavy vehicle traffic by 4.2% across the region in the peak year of the project. Overall, total travel has been estimated to increase by 1.5% above existing traffic volumes across the region in the peak year of the

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Issue No.	Submission No.	Issue	Reference	Responses
R17018	S048			project. As set out in SREIS Chapter 13, Noise and Vibration, these traffic increases are predicted to produce an increase of less than 1 dB(A) above current noise levels, and a cumulative increase generated by all activity in the region of approximately 1 dB(A). Consequently, no change in noise impact arising from additional project vehicles is expected.
R17019	S024, S026, S081	Has Arrow considered the noise impact of reverse beepers fitted to light and heavy vehicles in the Noise and Vibration Impact Assessment? Considering project activities can occur over a 24 hour period, they may affect sensitive receptors.	EIS Chapter 20, sections 20.2.3 and 20.6	In the case of reversing beepers, vehicles will be fitted with appropriate reversing alarms which may include white sound reversing alarms, which are quieter than tonal beepers. Noise levels were modelled based upon known sounds levels of typical construction and operational equipment throughout a 24-hour period (EIS Chapter 20, Noise and Vibration, Section 20.2.3). This equipment included vehicles (light and heavy) and earthmoving machinery, see Table 20.5. Arrow has committed to managing noise in accordance with the relevant permits and/or consents conditions. Where night-time activities are planned (10.00 p.m. to 6.00 a.m.) and are likely to exceed the prescribed noise criteria, Arrow will conduct prior consultation with affected parties (Commitment C304). This consultation will occur prior to the commencement of the activity and would explore ways to reduce the impact on the landholder (e.g., accommodating the landholder's family in alternative accommodation while the activity was undertaken).
R17020	S011	The noise and vibration report fails to consider converging traffic in proposed depots that will impact a large number of sensitive receptors.	–	Noted. Once depot locations and specific facility locations are selected and traffic routes to sites determined and outlined in the road use management plan, Arrow will develop mitigation measures as required.
R17021	S099	Impacts and mitigation measures relating to traffic noise on unsealed roads has not been properly assessed. There seem to be inconsistencies with how the overall noise levels will increase (e.g., the expected increase of only 0.1 dB(A) seems low when compared to approximate traffic volumes). Mitigation measures such as double glazing of windows, installation of air conditioners, electricity subsidies, bitumen seal roads etc., should be considered.	EIS Appendix M and Appendix N, Section 12.2. SREIS Chapter 13, Section 13.4.3 and Appendix 11	EIS Appendix M, Road Impact Assessment found that at its peak, the project is expected to increase the extent of heavy-vehicle traffic occurring on the district's road network by less than 2% of the existing (2009) levels, and the extent of light-vehicle travel by less than 1% of existing (2009) levels. Based on this, the noise levels at sensitive receptors from road traffic was estimated to increase by no greater than 0.1 dB(A) above the current level (EIS Appendix N, Noise and Vibration Impact Assessment, Section 12.2). This assessment has been revised SREIS Appendix 11, Supplementary Noise and Vibration Assessment in line with updates to the traffic data presented in SREIS Appendix 10, Supplementary Roads and Transport Assessment. The supplementary noise assessment predicted that project traffic would produce an increase of less than 1 dB(A) above current noise levels, and a cumulative increase generated by all project activity in the region of approximately 1 dB(A). Consequently, no change in noise impact on sensitive receptors is expected. In stating the above, Arrow acknowledges that the degree to which sensitive receptors may be affected will vary depending on the volume of traffic on a particular road, and the duration of which project traffic uses the road. For

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R17021	S099			example, installation of wells and gathering lines may see an increase in traffic for the 10 to 14 day construction period for each well, following which traffic will drop back to operational levels necessary to conduct well maintenance and well workovers. However, the construction and operation of a facility on a rural road may see traffic volumes increase by more than 2% in a particular location over an extended period, in which case, appropriate mitigations will be determined.
R17022	S011	Appendix P, pg. 131 of the EIS - air quality, noise and vibration impacts have been assessed as low due to the fact that, although on an individual level to individual landholders, such impacts can be experienced as high level impacts, these impacts will be dealt with through negotiated processes between Arrow and the landholder, outside of the EIS. This insinuates that if Arrow can't meet the required criteria, they will try to negotiate a payout.	EIS Chapter 9, Section 9.6.1, Chapter 20, Section 20.6.1 and Appendix P	Arrow has committed to complying with established air quality (EIS Chapter 9, Air Quality, Section 9.6) and noise (EIS Chapter 20, Noise and Vibration, Section 20.6.1) criteria. Surat Gas Project infrastructure will be designed to meet air quality criteria. In the case of noise, where infrastructure exceeds the established noise criteria at one or more sensitive receptors, the application of acoustic treatments will be used (Commitment C310). Arrow will seek to acquire land on which to place production facilities, or enter into long term lease arrangements for the use of land. Arrow has a preference to select facility sites in sparsely populated areas (Commitment C309).
R17023	S014, S024, S044, S081	Section 20.6.2 (Construction and Decommissioning, Avoidance, Mitigation and Management Measures) states: "Consult with those who may be affected by increased noise levels due to construction activities with particular reference to the type and timing of work" (C035). How will this reduce noise levels at a sensitive receptor? And will the consultation happen before or after the sensitive receptor is affected? Describe the nature of community liaison and communication in the event that noise criteria at sensitive receptors cannot be achieved.	EIS Chapter 20, sections 20.6.1 and 20.6.2	Arrow has committed to managing noise in accordance with the relevant permits and/or consents conditions. Where night-time activities are planned (10.00 p.m. to 6.00 a.m.) and are likely to exceed the prescribed noise criteria, Arrow will conduct prior consultation with affected parties (Commitment C304). This consultation will occur prior to the commencement of the activity and would explore ways to reduce the impact on the landholder (e.g., accommodating the landholder's family in alternative accommodation while the activity was undertaken).
R17024	S025	Given the proponent has identified how integral the identification of sensitive receptors are to the assessment of environmental and social aspects of the project, all sensitive receptors within the entire project development area must be ground truthed prior to undertaking specialist environmental impact assessments.	EIS Attachment 10, Figures A10.2 to A10.10 SREIS Attachment 8	Subject to property accessibility, the location of houses and other sensitive receptors (i.e., businesses, schools, churches) has been ground-truthed in the area of Arrow's Dalby Expansion Project. Beyond this area, the other potential housing and sensitive receptors locations (shown in EIS Attachment 10, Preliminary Constraints Maps, Figures A10.2 to A10.10) was determined through analysis of publicly available, 2004 aerial imagery. Arrow has acquired and reviewed new, high resolution aerial imagery over the project development area and updated figures are presented in SREIS Attachment 8, Constraints Mapping Update. Where required, a site specific noise and vibration impact assessment with best practice noise monitoring, i.e., Australian Standard and EPP (Noise) compliant, will be conducted for the environmental authority (EA) or EA amendment application.

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R17025	S160	Workplaces have not been classed as sensitive receptors.	EIS Chapter 7, Figures 7.2a, 7.2b and 7.2c	For the purpose of the EIS, a sensitive receptor was categorised as a dwelling in order to model worst case noise impacts on the receiving environment. Where required, site specific modelling will be conducted for the environmental authority (EA) or EA amendment application process. Workplaces will be categorised on a case by case basis with regard to their purpose of use at the time, and modelled accordingly.
R17026	S160	Piggeries are not classed as sensitive receptors, despite being both workplaces and animal housing, so would not be subjected to vibration monitoring.	EIS Chapter 13, Section 13.6.5	For the purpose of the EIS, a sensitive receptor was categorised as a dwelling in order to model worst case noise impacts on the receiving environment. Where required, site specific modelling will be conducted for the EA application process once facility locations are selected. Workplaces will be categorised on a case by case basis with regard to their purpose of use at this time, and modelled accordingly. Noting this, Arrow has also committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076).
R17027	S118	There is concern for wells, field compression facilities and integrated processing facilities impacting on neighbours. It is argued that although noise impacts will fall within the limits and guidelines, noise impacts can be highly subjective, meaning the tolerance levels of a particular individual are different.	–	Schedule 1 of the Environmental Protection (Noise) Policy 2008 identifies acoustic quality objectives for specific sensitive receptors. More vulnerable sensitive receptors such as hospitals and childcare centres have more stringent noise criteria than typical dwellings and commercial facilities. Arrow is required to meet noise criteria which are aimed at protecting health and wellbeing including the prevention of sleep disturbance.
R17028	S130	It is requested that all wells and infrastructure must not be located within 300m of sensitive receptors.	EIS Chapter 20, Section 20.6.1	Arrow has committed to locating equipment associated with production wells and wellhead infrastructure at a distance of 200 m or more from a sensitive receptor (Commitment C311). Where infrastructure is proposed on private property, Arrow will negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure and will address impacts through compensation.
R17029	S060	People are not prepared to accept any development on their land within 500m of a residence due to noise impact.	EIS Chapter 20, Section 20.6.1	Arrow has committed to complying with established noise criteria by reducing project impacts on the acoustic environment of sensitive receptors through site selection and applying appropriate acoustic treatments. Arrow has committed to locating equipment associated with production wells and wellhead infrastructure at a distance of 200 m or more from a sensitive receptor (Commitment C311). Where infrastructure is proposed on private property, Arrow will negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's

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Issue No.	Submission No.	Issue	Reference	Responses
R17029	S060			requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure and will address impacts through compensation.
R17030	S014, S044	If noise modelling demonstrates a sensitive receptor will be impacted, what is the management plan to address this?	–	Arrow has committed to managing noise in accordance with the relevant environmental authority conditions. A site-specific noise management plan will be developed where detailed noise modelling identifies an exceedance of the established noise criteria at one or more sensitive receptors. The plan will identify appropriate acoustic treatments that will need to be applied in order to meet noise criteria. Examples include intrinsically quieter equipment or the design of acoustic treatments such as hospital-grade exhaust systems and mufflers, or barriers and equipment housing. Where appropriate, Arrow will explore ways to reduce potential impacts in consultation with landholders.
R17031	S033	Arrow has not addressed potential impacts of noise on wild fauna species. A ban is requested on: drilling, blasting and heavy diesel machinery as studies have not been undertaken on impacts to native flora and fauna, particularly in relation to the impact infra-sound (<20Hz) and ultrasound (>20,000 Hz) emissions (i.e., the levels at which most people do not 'hear' noise) on flora and fauna.	EIS Chapter 17, Section 17.4.5	Potential impacts of noise on fauna species have been discussed in EIS Chapter 17, Terrestrial Ecology, Section 17.4.5. The impacts of noise on avian fauna is not well studied, but current research suggests that excessive noise has the potential to stress birds through masking predator arrival and associated alarm calls and interfering with acoustic signals of territory defence and breeding communications (Forman and Alexander, 1998; Andrews et al., 2006; Slabbekoom and Ripmeester, 2008). While impact severity is dependent on environmental variables (e.g., temperature, wind speed, and humidity; Martin and Marler, 1977), it is possible that the increased noise levels could lead to a reduction in avian species richness, potentially causing consequences for the overall community structure (Francis et al, 2009). Research has also shown that traffic noise can affect frog mating, interfering with male calling behaviour and female detection of male advertisement calls (Sun and Narrins, 2005; Bee and Swanson, 2007). It seems feasible that excessive noise generated by non-electric generators could also affect frog mating, and therefore the distribution of frogs in proximity to noise generating infrastructure (see e.g., Hoskin and Goosem 2010; Eigenbrod et al, 2009 for the impact of road noise on frog distribution). Arrow will aim to avoid areas of high sensitivity when siting infrastructure including but not limited to 'critically endangered' EPBC Act communities, national and state listed communities and essential and core habitat (Commitment C217 and C218). Arrow has committed to conducting preconstruction clearance surveys to identify any additional areas that may need to be avoided (Commitment C220). Arrow is currently designing out noise generation through the use of centrifugal compressors at central gas processing facilities and electric motors at wellheads. When developing in proximity to confirmed habitat for amphibians and bird endangered, vulnerable and near threatened species, Arrow will implement

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Issue No.	Submission No.	Issue	Reference	Responses
R17031	S033			noise control techniques in accordance with the projects noise and vibration commitments and standard industry noise suppression techniques (Commitment C254). Where a high risk of disturbance or displacement is identified, Arrow will investigate the location and distribution of species within the affected habitat as part of its preclearance survey (Commitment C232) to determine the appropriate management measures, e.g., habitat protection, further attenuation of plant and equipment. Such measures would be addressed in species specific management plans.
R17032	S011	The EIS does not fulfil terms of reference in Section 4.7.2 (Noise and Vibration - description of environmental values) as there is no information or consideration of possible impacts of noise on protected areas, terrestrial animals (apart from grazing livestock) and birds. The report also does not consider potential impacts on farm/domestic animals and birds beyond the statement that noise levels would be similar to those experienced by animals grazing beside a road. This inadequate for intensive livestock operations such as poultry and pig farming.	EIS Chapter 13, Section 13.6, and Chapter 17, Section 17.6.1	Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Potential impacts of noise to flora and fauna species have been addressed in EIS Chapter 17, Terrestrial Ecology, Section 17.4.5. Where noise impacts to fauna are identified, Arrow will implement noise control techniques in accordance with the noise and vibration commitments and standard industry noise suppression techniques (Commitment C254).
R17033	S157	The proposed noise mitigation measures detailed in Appendix N, Section 8.1.8 of the EIS are unlikely to reduce noise impacts to within the established criteria, particularly at night, unless there is considerable separation between the construction, in particular drilling, and intensive animal enclosures.	EIS Chapter 13, Section 13.6	Arrow has committed to comply with current legislation by reducing project impacts on the acoustic environment of sensitive receptors through site selection and the incorporation of acoustic treatments. Arrow has committed to avoiding existing infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). Where infrastructure and access routes are proposed on private property, Arrow will negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure and address impacts through compensation.
R17034	S014, S026, S044, S081	The EIS states specific mitigation measures will be confirmed once the actual construction processes are known and modelling or measurements have been conducted. Arrow has an established gasfield, producing gas since 2006. It is not feasible that there would be no known construction processes to use for appropriate modelling of construction noise relating to production wells and pipelines. Considering that there are no tables	EIS Appendix N, Section 8.18 and Tables 8.10 to 8.15 SREIS Chapter 13, Section 13.4 and Appendix 11, Section 5	The noise and vibration impact assessment (EIS Appendix N) was undertaken with consideration of Arrow's current construction techniques, including the known sound levels of typical construction equipment. However, given the scale of the Surat Gas Project, more streamlined construction processes may be implemented to improve efficiency and reduce waste. EIS Appendix N, Tables 8.10, 8.11 and 8.12 present modelled noise reduction levels from the application of acoustic treatments. Tables 8.13, 8.14 and 8.15 present modelled noise levels at the sensitive receptor noise locations with additional acoustic treatment measures.

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Issue No.	Submission No.	Issue	Reference	Responses
R17034	S014, S026, S044, S081	demonstrating the reduction of construction noise following mitigation measures, the conclusion must be that there are no management and mitigation measures that reduce the impact and avoiding areas within 1 km of a sensitive receptor must be adhered to.		Modelling based on the revised project description has been undertaken for the SREIS; see SREIS Chapter 13, Noise and Vibration, Section 13.4 and SREIS Appendix 11, Noise and Vibration, Section 5. Arrow has committed to locating equipment associated with production wells and wellhead infrastructure at a distance of 200 m or more from a sensitive receptor (Commitment C311). Where infrastructure is proposed on private property, Arrow will negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Arrow will comply with the prescribed coal seam gas noise criteria and where possible, be flexible in the location of infrastructure.
R17035	S024, S026, S081	When will specific mitigation measures and actual construction processes be known?	–	Specific mitigation measures and more detailed construction processes will be set out in the statutory information requirements to accompany the application for an environmental authority (EA) or EA amendment.
R17036	S024, S026, S081	Will Arrow employ the principal mechanism of site selection for avoiding impacts on the acoustic environment of sensitive receptors from the construction of production wells, pipelines and production facilities, given the other mechanisms are unlikely to significantly reduce the impacts?	EIS Chapter 13, Section 13.6.1 and Chapter 20, Section 20.6.1.	Arrow has identified a number of mitigation and management measures that will be used to reduce noise impacts to sensitive receptors including site selection and the use of acoustic treatments EIS Chapter 20, Noise and Vibration, Section 20.6.1. Arrow has committed to consulting and agreeing with landholders on the appropriate location for infrastructure and access routes (Commitment C084). Arrow aims to accommodate the landholder's requirements and where possible, will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation. This will help to limit potential impact to the acoustic environment of sensitive receptors; in stating this, Arrow will comply with the prescribed coal seam gas noise criteria.
R17037	S014, S024, S026, S044, S081	Describe the acoustic treatment that would be applied for production facility construction activities to meet noise criteria within a 3 km radius of a sensitive receptor and well and pipeline construction activities to meet noise criteria within a 1 km radius of a sensitive receptor.	EIS Appendix N, Section 8.1.8	EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.9 presents feasible acoustic treatments for construction techniques, construction equipment, and operational facilities. Acoustic treatments will be considered on a case by case basis in relation to their applicability to noise impact management.
R17038	S014, S044	The supplementary report to the EIS should include a table showing the reduced noise levels following acoustic treatment that can be understood by someone who isn't a noise expert.	EIS Appendix N, Section 8.1.8 and Tables 8.9, 8.11, 8.12, 8.13, 8.14 and 8.15 SREIS Chapter 13, Section 13.4.4.	Feasible acoustic treatment packages are presented in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.9. These packages have been applied to typical gas construction and production activities. Table 8.11 (central gas processing facility) and Table 8.12 (integrated processing facility) in Appendix N presents the modelled noise reduction levels (dB(A)) acoustic treatment packages will have on construction and production activities for different noise frequencies. Tables 8.13, 8.14, 8.15 in Appendix N show the reduced noise levels to sensitive receptors following acoustic treatment. Updated noise levels modelled with the incorporation of noise reduction

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Issue No.	Submission No.	Issue	Reference	Responses
R17038	S014, S044			packages are presented to SREIS Chapter 13, Section 13.4.4 to reflect the changes to the production facilities and associated noise impacts.
R17039	S133	The proponent should undertake further assessment in relation to a noise management / monitoring strategy that includes proactive as well as reactive management strategies. Noise attenuation at sensitive receptors has not been discussed as a mitigation measure and an effective complaints management system is considered essential in managing noise issues.	EIS Chapter 20, Section 20.6.2	Arrow will use a number of methods including site selection and the use of acoustic treatments to avoid noise impacts on sensitive receptors. Noise impacts will be addressed at the source wherever possible, to reduce influences on the ambient environment and avoid background creep. Applying acoustic treatment at the source provides the most effective means of mitigation. Such actions will be defined later during front end engineering design (FEED). Arrow has committed to implementing a grievance management system that responds to noise complaints and if necessary, undertake noise monitoring of construction activities to facilitate a response to the grievance (Commitment C307).
R17040	S024, S026, S081	Evaluation is requested to address how the use of structures and elevations to reduce noise at sensitive receptors impacts on other environmental values such as soils, agriculture, surface water and visual amenity.	EIS Appendix N, Section 8.8.1	The use of elevations and structures are just two examples of noise attenuation methods. Other methods include the use of noise reduction devices such as mufflers, low-noise fans and possibly enclosures (EIS Appendix N, Noise and Vibration Impact Assessment, Section 8.8.1). Noise attenuation measures will be evaluated on a case-by-case basis and structures and elevations would not be used where this was expected to have an adverse impact on other environmental values.
R17041	S014, S044	At a distance of 200 m the modelled “worst-case” scenario for well and pipeline construction has quite significantly exceeded the noise criteria for medium and long term events at all times. When noise levels for machines are considered on an individual basis, though somewhat reduced from the total, each one still exceeds all noise criteria for long and medium term events.	EIS Chapter 20, Section 20.6.1 SREIS Chapter 13 and Appendix 11.	The modelled noise levels of individual machine/equipment are based on the machine operating continuously with direct line of sight to the sensitive receptor. Where noise levels exceed the prescribed criteria, Arrow has committed to manage noise in accordance with the relevant environmental authority conditions through detailed site selection and the incorporation of appropriate acoustic treatments to meet noise criteria at sensitive receptor locations (EIS Chapter 20, Noise and Vibration, Section 20.6.1). Updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17042	S014, S044	The only construction mitigation measures proposed that would actually reduce well or pipeline construction noise, all relate to the operation and maintenance of machinery; <ul style="list-style-type: none"> • “Where noise reduction devices are deemed necessary, ensure devices (such as mufflers, low noise fans and possibly enclosures) are fitted and work correctly. (C301)” or • “Operate equipment and handle materials in a manner that does not cause unnecessary noise (e.g. excessive revving or dropping materials). 	EIS Appendix N, Section 8.1.8 and Table 8.9.	Noted. Construction equipment and techniques have not been finalised. Sound levels of typical construction equipment were modelled in the EIS. Feasible acoustic treatment packages for typical construction equipment and techniques are presented in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.9. Acoustic treatments will be considered on a case by case basis in relation to their applicability to noise impact management.

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R17042	S014, S044	(C302).		
R17043	S024, S026, S081	The minimisation of noise is not an appropriate mitigation of its own, unless the noise minimisation achieves a resulting noise level at sensitive receptors in accordance with the relevant noise criteria for the type of noise event.	EIS Chapter 20, Section 20.6	Arrow has committed to manage noise in accordance with the relevant environmental authority conditions through detailed site selection and the incorporation of acoustic treatments to meet noise criteria at sensitive receptor locations (EIS Chapter 20, Noise and Vibration, Section 20.6).
R17044	S024, S026, S081	Provide evidence of the extent of noise reduction achieved by acoustic treatment to the plant and equipment used for production wells, pipelines and the construction of the production facility?	EIS Appendix N, Section 8.1.8 and Tables 8.11 to 8.15	EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.11 (central gas processing facility) and Table 8.12 (integrated processing facilities) presents the modelled noise level reductions (dB(A)) provided by acoustic treatments in relation to typical gas construction and production noise sources. Tables 8.13, 8.14 and 8.15 illustrate the modelled noise levels at the project reference locations with acoustic treatment applied. Where required, the performance of specific acoustic treatments applied to the project will be confirmed by noise measurements during construction.
R17045	S024, S026, S081	Are there any other forms of acoustic treatments that may be used, for example structures or elevations, to provide noise reduction at sensitive receptors?	–	Best practice and preferred management is to apply treatment directly at the noise source, as treatments to facades will not be as effective in reducing noise to outdoor areas. Noise barriers at dwellings may be considered on a case-by-case basis in discussions with landholders if treatment at the noise source is less practical.
R17046	S024, S026, S081	Arrow should provide evidence of the extent of noise reduction at sensitive receptors achieved by structures or elevations.	EIS Appendix N, Section 8.1.8 SREIS Chapter 13 and Appendix 11	Structures or elevations would only be used in combination with other acoustic treatment measures. Modelled noise levels for production facilities with additional treatments applied are shown in EIS Appendix N, Noise and Vibration Impact Assessment, Tables 8.13, 8.14 and 8.15. The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17047	S024, S026, S081	When they are known, will specific mitigation measures be modelled prior to construction of production wells, pipelines and production facilities?	EIS Appendix N, Table 8.19	Where required, site specific noise and vibration modelling of production facilities will be conducted for the environmental authority (EA) or EA amendment application when specific locations are known. In regard to production wells and gathering infrastructure, typical construction activities were modelled with results presented in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.19. Feasible acoustic treatments will be applied by Arrow on a case by case basis to meet the prescribed noise criteria.
R17048	S079	What is the application of acoustic treatment for the development, operational, decommissioning and rehabilitation stages of all infrastructure?	EIS Appendix N, Section 8.1.8 and Table 8.9	Acoustic treatments will be considered on a case-by-case basis in relation to their appropriateness to noise impact management at specific sites. Feasible acoustic treatment packages are identified in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.9. The application of treatment packages is discussed in Appendix N, Section 8.1.8.

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Issue No.	Submission No.	Issue	Reference	Responses
R17049	S081	Evidence is requested to support the statement that 'residual impacts are expected to be negligible as the impact assessment determined that relevant criteria can be achieved at sensitive receptors through the use of appropriate mitigation measures, where necessary' for construction activities.	EIS Chapter 20, Section 20.7	Impacts resulting from project noise are expected to be negligible as the noise and vibration impact assessment (EIS Chapter 20, Noise and Vibration, Section 20.7) determined that established noise criteria can be achieved at sensitive receptors through the use of appropriate mitigation measures, where necessary. Arrow will use a number of methods including site selection and the use of acoustic treatments to avoid noise impacts to sensitive receptors.
R17050	S079	If they use electricity to run motors/generators, further adverse impacts will be created with regards to more infrastructure placed on GQAL strategic cropping land. How can the proponent reduce noise to the required noise levels set by DERM if they cannot use electric motors/generators?	EIS Chapter 20, Section 20.4.5 SREIS Chapter 3, Section 3.4.5, Chapter 13 and Appendix 11.	As described in SREIS Chapter 3, Project Description, Section 3.4.5, electric power sourced from the Queensland electricity grid is now Arrow's preferred power supply option. However, onsite power generation may be temporarily required in the initial phase of operation until production facilities, production wells and associated infrastructure are connected to the electricity transmission grid. Electricity supplied to facility substations will then be distributed to production wells, production facilities and associated infrastructure via a network of overhead power lines and underground cables. Typically, production facilities (central gas processing facilities, water treatment facilities and brine treatment facilities) will be electrically powered. However, Arrow will seek to place facilities within sparsely populated areas on less productive land; facilities will not be constructed on intensively farmed land. By exception, production wells remote from production facilities will be powered by gas-engine generators or with power from a distribution network service provider or third party electricity grid. Both wellhead electric motors and gas engine generators were modelled as part of the EIS noise and vibration impact assessment (Appendix N) with and without noise attenuation. Production wells with gas generators were shown to meet established noise criteria at 300 m from the well without attenuation; attenuated wells meet guidelines within 80 m of the well (EIS Chapter 20, Noise and Vibration, Section 20.4.5). The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17051	S014, S044	It is understood that it is Arrow's intention to amend the Dalby Expansion Project Environmental Authority if the project is approved, rather than apply for a new Environmental Authority. The conditions in this existing Environmental Authority (Condition E2 and E3) are appropriate for planning but still allow infrastructure to be put in place without the noise management plan or mitigation measures being applied. Arrow can conduct activities exceeding the noise criteria until a valid	EIS Chapter 20, Section 20.6.2	As part of the environmental authority (EA) amendment process, the conditions of Arrow's existing EA (including conditions E2 and E3) may be amended. This will take into consideration the results of site specific monitoring for identified sensitive receptors. Arrow has committed to comply with the relevant permits and/or consents conditions. Where night-time activities are planned (10.00 p.m. to 6.00 a.m.) and are likely to exceed the prescribed noise criteria, Arrow will conduct prior consultation with affected parties (Commitment C304). Notwithstanding this, a grievance management system that responds to noise complaints will be implemented and if necessary, noise monitoring of

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R17051	S014, S044	complaint is made. This poses a difficult situation if the nuisance noise is only a short or medium term noise event. It is quite possible that activities which create nuisance noise will be very difficult to monitor either resulting in a lengthy resolution process or the complainant being dismissed as vexatious. It would be appropriate from the perspective of those living at sensitive receptors that have been identified as impacted by modelling, prior to commencement of activities, that the noise management measures were put in place when the activities commenced.		construction activities will be undertaken to facilitate a response to the grievance (Commitment C307).
R17052	S014, S044	If noise modelling demonstrates that the location of these facilities will be affecting a sensitive receptor for a minimum period of 25 years it would be prudent to ensure that the noise management plan or acoustic treatment was applied during the construction phase rather than wait until a complaint is made.	–	A site-specific noise management plan will be developed where detailed noise modelling exceeds the established noise criteria at one or more sensitive receptors. The plan will identify appropriate acoustic treatments that will need to be applied in order to meet noise criteria. Examples include intrinsically quieter equipment or the design of acoustic treatments such as hospital-grade exhaust systems and mufflers, or barriers and equipment housing.
R17053	S024, S026, S081	Restricting noisy construction work or equipment to the hours of 7.00 a.m. to 6.00 p.m. or commencing noisy work after 9.00 a.m. is not an appropriate mitigation of its own, unless the noise level at these times at sensitive receptors is in accordance with the relevant noise criteria for the type of noise event.	EIS Chapter 20, Section 20.2.8.	Restricting noisy construction work or equipment to the hours of 7.00 a.m. to 6.00 p.m. or commencing noisy work after 9.00 a.m. is not an appropriate mitigation of its own, unless the noise level at these times at sensitive receptors is in accordance with the relevant noise criteria for the type of noise event.
R17054	S011, S014, S044, S050, S060, S099, S157, S160	Modelling of noise levels reveals that during construction and abandonment of production wells, noise criteria will be exceeded night and day, even if the sensitive receptor is up to one kilometre away. Arrow has only committed to 200 m buffer distances from sensitive receptors.	EIS Chapter 20, Section 20.6.1 SREIS Chapter 13 and Appendix 11	The minimum distance of 200 m has been adopted to address a range of issues including community concerns over proximity of infrastructure to people's homes. EIS Chapter 20, Noise and Vibration, Section 20.4.4 notes that modelling predictions for the construction of production wells and pipelines indicate that if activities are undertaken at a distance of less than 1 km from a sensitive receiver, acoustic treatment would need to be applied in order to meet the criteria. The updated modelling results for the SREIS are provided in SREIS Chapter 13 Noise and Vibration and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17055	S079	How can the proponent limit noise at 300m when their monitoring data shows that the noise exceeds the required limits at 1,700m to 2,200m?	EIS Chapter 20, Section 20.7	The conclusion of the noise and vibration impact assessment (EIS Chapter 20, Noise and Vibration, Section 20.7) was that relevant criteria could be achieved at sensitive receptors through the use of appropriate mitigation measures, where necessary. The primary mitigation measure will be the avoidance of project development

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Issue No.	Submission No.	Issue	Reference	Responses
R17055	S079			near sensitive receptors. The relatively sparse pattern of population throughout the project development area provides opportunities to site the infrastructure with adequate separation, thus minimising the need for acoustic treatment. Once locations are finalised, infrastructure will be designed to meet noise and vibration objectives at sensitive receptors.
R17056	S014, S044	While the operation of pipeline infrastructure may not have an impact on the sensitive receptor, the construction of the pipeline will. It must also be considered that sensitive receptors are family homes. Constructing pipelines or conducting any other activities within a 200m radius of a family home is completely inappropriate and considered an unacceptable safety risk.	EIS Chapter 20, Section 20.6.1	Arrow has committed to locate equipment associated with production wells and associated wellhead infrastructure at a distance of 200 m or more from a sensitive receptor (Commitment C311). This minimum distance of 200 m has been developed to address a range of issues including community concerns over proximity of infrastructure to people's homes. There may however be instances where (by agreement) Arrow seeks to conduct construction activities in closer proximity than 200 m. Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084) and negotiate conduct and compensation agreements with affected landholders. Arrow aims to accommodate the landholder's requirements and undertake activities considering existing land uses. Where possible, Arrow will be flexible in the location of wells and infrastructure and will address impacts through compensation.
R17057	S067	Noise will create an impact on the location that a landowner chooses to build a new residence. For example, a landowner owns land on three titles and it may be likely that sometime in the future they will want to construct a residence on one of the other titles.	–	Noted. Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084) and negotiate conduct and compensation agreements with affected landholders. Arrow aims to understand and accommodate the landholder's requirements and undertake activities considering the landholder's future plans for their properties.
R17058	S014, S044	Considering the close proximity of sensitive receptors on the floodplain, the limited construction noise modelling concluding that daytime noise criteria will be met at 3 km, the length of time to complete construction and noisy work will only be restricted to daytime where practicable, the assumption would be there are very few locations in the area that a field compression facility could be constructed where noise criteria would be met.	–	Arrow will seek to place production facilities on less productive and sparsely populated land, not intensively farmed land on or in the vicinity of the floodplain.
R17059	S014, S044	Arrow has made a commitment to "Locate equipment associated with production wells and associated wellhead infrastructure at a distance of 200 m or more from a sensitive receptor." Will there be any production facilities placed between 200 m and 1 km from a sensitive receptor? It is requested	EIS Chapter 20, Section 20.6	The specific location of production facilities is not yet known. However, Arrow will seek to acquire land on which to place production facilities, water treatment and power generation facilities, or enter into long term lease arrangements for the use of land. Consequently, it is unlikely that production facilities would be located within 1 km of a sensitive receptor.

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R17059	S014, S044	that the administering authority impose conditions that prevent this from happening.		Arrow has a preference to select facility sites in sparsely populated areas (Commitment C309).
R17060	S014, S044	An explanation of how the conclusion is reached should be provided in the SREIS; noise criteria will be met at 1 km from the noise source when all the information provided appears to be showing that is incorrect?	EIS Chapter 20, Section 20.7	The conclusions of the noise and vibration impact assessment (EIS Chapter 20, Noise and Vibration, Section 20.7) was that relevant criteria could be achieved at sensitive receptors through the use of appropriate mitigation measures, where necessary. The primary mitigation measure will be the avoidance of project development near sensitive receptors. The relatively sparse pattern of population throughout the project development area provides opportunities to site the infrastructure with adequate separation, thus minimising the need for acoustic treatment. Once locations are finalised, infrastructure will be designed to meet noise and vibration objectives at sensitive receptors.
R17061	S014, S044	What is the exact distance from the source where the noise criteria are met, prior to mitigation measures being put in place?	EIS Appendix N, Section 8.1.8. SREIS Chapter 13	As the exact site locations of the facilities were yet to be determined at the time of preparing the EIS, random positions with various distances from a facility were considered, which were representative of separation distances between facilities and sensitive receptors. 'Reference locations' considered were located 1, 2, 3 and 5 km from hypothetical facilities. Modelling indicates that without mitigation measures, an impractical separation distance (5 km) from sensitive receptors would be required for an operating production facility. However, modelling also demonstrates that with the application of acoustic treatment packages, the long term night-time noise criterion of 28 dB(A) could be achieved at all reference locations (EIS Appendix N, Noise and Vibration Impact Assessment, Section 8.1.8). The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17062	S027	There is concern that even with the implementation of the buffer distances, the cumulative effect of several well heads along the grid patterns will result in noise disturbance, especially with the quiet rural environment.	EIS Chapter 20 Appendix N, Section 8.2 SREIS Chapter 13 and Appendix 11	The spacing between well pads will vary according to the coal depth and permeability. The EIS conceptualised that single-well pads would be sited with a separation distance averaging a minimum of 800 m across the project development area. Production wells may be drilled in stages to take into account monitoring results and the performance of the first wells to be drilled. These initial wells may have a wide spacing, and the remaining wells would then be drilled to complete the grid of production wells (a process known as infilling). Infilling does not mean that well pads will be sited at a spacing less than the stated average (i.e., a minimum 800 m grid spacing). An assessment of noise levels associated with the construction and operations of production wells is provided for single wells in EIS, Chapter 20, Noise and Vibration; and multi-wells in SREIS Chapter 13, Noise and Vibration. Noise modelling for production wells in the EIS and SREIS was based on the

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Issue No.	Submission No.	Issue	Reference	Responses
R17062	S027			conceptual 800 m grid spacing, with the associated gas and water gathering systems linking the production wells to production facilities. Modelling assumed worst-case meteorological conditions. Compliance with the long-term night-time noise criterion of 28 dB(A) will be achieved through site selection and the application of different levels of acoustic treatment, where necessary.
R17063	S162	Commitment (C311) 'Locate equipment associated with production wells and associated wellhead infrastructure at a distance of 200m or more from a sensitive receptor.' For noise reasons at 28 dB(A) no wells should be built within 300m of a sensitive receptor, yet section 20.6.1 it is clearly portrayed that Arrow will build wells no closer than 200m.	EIS Chapter 20, Section 20.6.1 SREIS Chapter 13, Section 13.4	Production well operational noise modelling predicted that, without any acoustic treatment, the long-term night-time noise criterion of 28 dB(A) can be met at a distance of 300 m from a production well. This distance decreases by 200 m for a scenario where a 5.7-L gas generator is replaced by the use of electricity from the power grid, and to 80 m with the incorporation of acoustic treatments (e.g., barriers and equipment housing) into well design (EIS Chapter 20, Noise and Vibration, Section 20.6.1). Noise modelling of multi-well pads was undertaken for the SREIS, with the results presented in SREIS Chapter 13, Noise and Vibration, Section 13.4. This minimum distance of 200 m (Commitment C311) has been adopted to address a range of issues including community concerns over proximity of infrastructure to people's homes.
R17064	S024, S026, S081	What percentage of the background noise levels for location 4 are attributed to the production wells and the production facility?	EIS Appendix N, Section 5.2	Based on approximations under worse-case meteorological conditions, the influence of existing production wells and other facilities at Measurement Location (ML) 4 was estimated to be 40 dB(A) under worst-case meteorological conditions (EIS Appendix N, Noise and Vibration Impact Assessment, Section 5.2). It is noted however that hydraulic wellheads were fitted at this location. Hydraulic wellheads are an older design, which produce significantly more noise than modern wellheads. It is not anticipated that Arrow will use hydraulic wellheads for the Surat Gas Project.
R17065	S079	How was the background noise level calculated when production is already operational?	EIS Appendix N, Section 5.2.	The background noise level is the noise level calculated in the absence of intermittent noise sources. For this project, background noise monitoring over a six-to-eight day period was undertaken to measure the noise levels without the influence of existing production facilities (at Measured Location (ML) 2 and ML 3) and with the influence of existing production facilities (ML 1 and ML 4). From these measurements, the estimated influence of the project facilities on the existing environment was modelled (EIS Appendix N, Noise and Vibration Impact Assessment, Section 5.2).
R17066	S079	What are the actual measured noise levels used for modelling assumptions (seen in Section 20.2.3 of the EIS) i.e., site preparation, surface equipment installation, and drilling and site rehabilitation?	EIS Appendix N, Tables 8.3, 8.4 and 8.6	Measured noise levels of typical construction equipment and techniques associated with these activities can be found in the EIS, Appendix N, Noise and Vibration Impact Assessment, Tables 8.3, 8.4 and 8.6.

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Issue No.	Submission No.	Issue	Reference	Responses
R17067	S014, S044	The EIS states in Appendix N, Table 8.3 that modelling has been based on six compressors being located at a field compression facility. Yet Chapter 25 of the EIS says a field compression facility could include a maximum of eight compressors (section 25.4.1). If eight compressors is the worst case scenario for field compression facilities then this is the number that should have been used for modelling purposes. It is requested that the supplementary report to the EIS includes noise modelling for field compression facilities based on the worst case scenario of eight compressors at each site.	EIS Appendix N, Table 8.3	EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.3 shows that field compression facility modelling included six screw compressors and two reciprocating compressors (i.e., eight compressors).
R17068	S014, S044	The supplementary report to the EIS should provide the following information – Under the heading "Noise Level Reduction (dB)", do the numbers; 63, 125, 250, 50, 10, 20, 40 represent the different power levels of the machinery during operation? As shown in Appendix N, Table 8.10 of the EIS: Attenuation from acoustic treatment for field compression facilities.	EIS Appendix N, Section 7.1.4, Table 8.10	The numbers under the heading 'Noise Level Reduction d(B)' in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.10 refer to octave band centre frequencies. For each octave band, a different level of noise reduction may be required, that is a higher or lower frequency sound attenuation. Section 7.1.4 presents the application of Low Frequency Noise (Draft) Guidelines and how they are applied in Queensland.
R17069	S014, S044	The noise impact assessment has not correctly modelled the noise generated by the construction and operation of the project and is misleading regarding the impacts it will have on sensitive receptors. The supplementary report to the EIS should include the social impacts of noise generated by the project based on more specific noise modelling.	EIS Chapter 20, Section 20.1	Noise modelling has been conducted in accordance with Coal Seam Gas Industry Procedural Guide – Control of Noise from Gasfield Activities which has been developed with the aim to assist authorities with the regulation of noise emissions from the coal seam gas industry in Queensland, and deals specifically with environmental noise from gasfield activities. Reference was also made to the EPP (Noise), World Health Organisation (WHO) Guidelines, and the DERM "Assessment of Low Frequency Noise" Draft Guideline in the assessment of potential impacts to noise from the project. The EPP (Noise) identifies acoustic quality objectives to protection the health and well-being (social impacts) of human being at different sensitive receptors (EIS Chapter 20, Noise and Vibration, Section 20.1). Where required, site specific noise and vibration modelling of production facilities will be conducted for the environmental authority (EA) or EA amendment application when specific locations for facilities are known.
R17070	S024, S026, S081, S130	Arrow must measure the noise levels from existing production facility infrastructure within the project development area to compare with noise levels predicted through modelling. This information will inform as the accuracy and relevance of the modelled limits.	EIS Appendix N, Section 5.2	Background noise monitoring was undertaken at Measure Location (ML) 4 and ML 1 which are located approximately 800 m to 1,500 m and 1,700 m to 2,200 m from existing production wells. These locations provide an indication of the background noise level at sensitive receptors in proximity to existing wells and production facilities and an approximate level of noise contribution from wells to the background environment (EIS Appendix N, Noise and Vibration Impact Assessment, Section 5.2).

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Issue No.	Submission No.	Issue	Reference	Responses
R17070	S024, S026, S081, S130			Based on approximations under worse-case meteorological conditions, the influence of existing production wells and other facilities at ML 4 was estimated to be 40 dB(A) under worst-case meteorological conditions. It is noted however that hydraulic wellheads were fitted at this location. Hydraulic drive heads are an older design, which produce significantly more noise than modern drive heads. It is not anticipated that Arrow will use hydraulic drive heads for the Surat Gas Project, instead electric drive heads will be used.
R17071	S024, S026, S081	Is there noise measurement data (for the construction and operation of production facilities and wells within the project development area) to compare with modelled predicted levels in Appendix N of the EIS?	EIS Chapter 20, Section 20.2.3 and Table 20.5	Construction noise levels were modelled based upon known sound levels of typical construction and operational equipment throughout a 24-hour period (EIS Chapter 20, Noise and Vibration, Section 20.2.3). This equipment included vehicles (light and heavy) and earthmoving machinery, see Table 20.5. For operating plant, background noise monitoring was undertaken at Measured Location (ML) 1 and ML 4. ML 4 is situated approximately 3.8 km from Tipton West central gas processing facility and 800 m to 1,500 m from existing production wells with hydraulic wellheads, while ML1 is situated approximately 1,700 m to 2,200 m from existing production facilities.
R17072	S079	What was the distance from the sensitive receptors, used to model the assumptions found in Section 20.2.3 of the EIS?	EIS Appendix N, Section 8.1.1, 8.2.1	The assumed distances from the “reference locations” (i.e., hypothetical sensitive receptors) considered in the noise modelling are provided in EIS Appendix N, Noise and Vibration Impact Assessment, Section 8.1.1. Distances included 1 km, 2 km, 3 km and 5 km.
R17073	S081	Arrow has not identified all the environmental values within the project development area to be enhanced or protected.	EIS Chapter 20, Section 20.3.3 and Appendix N, Section 4.4, 5.1	The Environmental Protection (Noise) Policy prescribes environmental values to be protected for noise in Queensland. The noise and vibration impact assessment was undertaken in accordance with this policy and identified all relevant environmental values to be protected and enhanced in relation to noise (EIS Chapter 20, Noise and Vibration, Section 20.3.3 and EIS Appendix N, Noise and Vibration Impact Assessment, Section 4.4 and 5.1).
R17074	S079	Arrow should supply current actual noise levels for each part of the coal seam gas infrastructure. Real data should be used for this assessment not conceptual data.	EIS Chapter 20, Section 20.2.3	Existing known sound levels of typical construction equipment and coal seam gas infrastructure were used to model impacts in the EIS, Chapter 20, Noise and Vibration, Section 20.2.3. Site specific noise and vibration modelling of production facilities will be conducted for the environmental authority (EA) or EA amendment application when specific locations for facilities are known.
R17075	S014, S044	The supplementary report to the EIS should provide a table showing the modelled noise levels post mitigation measures for well and pipeline construction?	EIS Appendix N, Section 8.1.8	Reasonable and practical mitigation measures to reduce construction noise are given in EIS Appendix N, Noise and Vibration Impact Assessment, Section 8.1.8.

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Issue No.	Submission No.	Issue	Reference	Responses
R17076	S014, S044, S050, S081, S086, S099, S162	The studies and assessments have not been conducted on a natural treeless plain like Jimbour Plain. The assessment should be carried out to establish there are no increased impacts before the project is allowed to continue.	SREIS Chapter 3, Figure 3.1	Since the preparation of the EIS, further knowledge of the gas reserves has been gained and the portion of the project development area encompassing the Jimbour Plain has been reduced. See SREIS Chapter 3, Project Description, Figure 3.1. The noise assessment undertaken for the EIS has been based on worst-case modelling where no trees or natural barriers were situated between the noise sources and sensitive receptors. Trees and vegetation are considered natural barriers to noise which will result in lower noise levels than those modelled in the EIS. Where required, a site specific noise and vibration impact assessment will be conducted for the environmental authority (EA) or EA application for identified sensitive receptors, when facility locations are selected.
R17077	S079	What is the noise level of the flaring event?	EIS Appendix N, Table 8.8 SREIS Chapter 13, Section 13.4 and Appendix 11, Section 5.7.4	Modelled noise levels from flaring events are provided in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.8. The modelled noise levels from flaring events due to the updated project description are provided in SREIS Appendix 11, Supplementary Noise and Vibration Impact Assessment, Section 5.7.4, and are summarised in SREIS Chapter 13, Noise and Vibration, Section 13.4.
R17078	S041	Due to being a low noise environment, there is concern regarding the impact of noise.	–	Noted.
R17079	S162	Noise ratings listed in Table 20.3 (of Chapter 20 in the EIS), are above the DERM guidelines listed in Appendix N, Table 7.2 and significantly above the ML 2 and ML 3 noise levels in Table 20.4. Arrow are seeking a 9 to 15 dB(A) increase in background noise in a rural area. A 10dB(A) increase in noise level is equivalent to doubling the volume. So Arrow are essentially doubling the background noise in a rural landscape. This is unacceptable.	EIS Chapter 20, Section 20.5	The project will at times produce noise of up to 15 dB(A) above measured background levels, however, this will be within the EHP (previously DERM) noise criteria. It is important to note that Arrow is not seeking to increase background noise levels by up to 15 dB(A). EIS Appendix N, Noise and Vibration Impact Assessment, explains how the noise criteria are calculated using the following tables: <ul style="list-style-type: none"> • Table 5.2 (EIS Chapter 20, Noise and Vibration, Table 20.4) presents the measured background noise levels (existing environment), which were calculated from monitoring data. • Table 7.2 displays the minimum background noise levels as per the DERM Coal Seam Gas Procedural Guide. • Table 7.3 contains the Procedural Guide formula for calculating the noise criteria. • Table 7.4 (EIS Chapter 20, Table 20.3) shows the noise criteria, which were calculated based on the measured background noise levels, the minimum background noise levels and the Procedural Guide formula. Background noise levels are determined by applying the LA90 parameter, which means excluding the highest 90% of noise recorded during the measurement period. Background noise levels therefore represent the lulls in noise by omitting intermittent noise from sources such as birds, vehicles and gusts of wind. Conversely, the predicted noise from the proposed development includes all short-term and long-term noise sources that may be emitted by the project,

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R17079	S162			<p>rather than just lulls in noise, with predictions based on worst-case meteorological conditions. Noise criteria (Table 7.4) set limits on emissions of these short-term and long-term noise sources.</p> <p>It is important to note that because of these differences, background noise levels and project noise emissions cannot be directly compared. Under worst-case meteorological conditions, the project may on occasions produce noise of up to 15 dB(A) above the background levels, which is acceptable under the Procedural Guide (Table 7.4). This does not mean that the noise will be constantly 15 dB(A) above the background levels.</p> <p>Noise levels presented in Table 7.2 are the deemed minimum background levels determined by the Procedural Guide. The deemed minimum background noise levels are background noise levels that are applied as a standard for calculating noise emissions limits in Queensland.</p> <p>The Procedural Guide, like most statutory Australian noise guidelines, sets appropriate noise criteria (best practice limits to noise emissions as determined by the relevant government authority) based on the combination of deemed minimum background noise levels and maximum noise levels that occur within the environment. The Procedural Guide specifies that where the measured background noise levels (Table 5.2) are less than the minimum background noise levels in the Procedural Guide (Table 7.2), the noise criteria will be calculated using the minimum background noise levels in the Procedural Guide.</p> <p>Of the four background monitoring locations, two (ML2 and ML3) had recorded background noise levels below the Procedural Guide deemed minimum background levels, while the other two monitoring locations (ML1 and ML4, which lie in proximity to existing facilities) had higher recorded background noise levels than those set out in the Procedural Guide.</p> <p>Consequently, to ensure the most stringent criteria were applied, minimum background noise levels were used in conjunction with the Procedural Guide formula (Table 7.3) to calculate the noise criteria for the project (Table 7.4). The requirements under the Procedural Guide represent the most stringent environmental noise criteria of any state in Australia.</p>
R17080	S060	There is concern that the noise from coal seam gas wells may lead to sleep deprivation and more accidents causing injury and possible death. Arrow will be part of the chain of responsibility and held liable.	EIS Appendix N, Section 7	The project infrastructure will be designed and operated in a manner that achieves prescribed noise criteria which are well below the recommendation of the World Health Organisation to protect against sleep disturbance (EIS Appendix N, Noise and Vibration Impact Assessment, Section 7). In areas where existing facilities influence the ambient environment, Arrow have committed to construct and operate infrastructure in a manner that noise in the existing acoustic environment will meet EHP (previously DERM) noise criteria.
R17081	S014, S044	The EIS states that ML4 measured noise levels which exceeded the noise criteria in the current	–	A Noise Management Plan has been prepared in response to condition E4 of the Dalby Expansion Project Environmental Authority (EA).

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R17081	S014, S044	environmental authority that covers the Tipton West Gas Processing Facility and sensitive receptor location ML4. Condition E3 from the Dalby Expansion Project Environmental Authority requires a "Noise Management Plan by the 18th October 2011" for any existing activities that indicate noise levels are being exceeded. It is requested that the supplementary report to the EIS include the following information; <ul style="list-style-type: none"> • Has the Noise Management Plan been completed? • A copy of the Noise Management Plan to demonstrate how the noise limits will be achieved. 		Condition E4 specifies that for any petroleum activities existing at the time of issue of the environmental authority (EA), if noise modelling or the calculations indicate that petroleum activities are likely to exceed the noise levels specified in Schedule E, Table 1 - Noise limits at sensitive receptors, the holder of the EA must prepare a Noise Management Plan which demonstrates how the noise limits specified in Schedule E, Table 1 - Noise limits at sensitive receptors will be achieved in the event of a valid noise complaint. The submitter may contact Arrow to be supplied with a copy of the Noise Management Plan.
R17082	S067	Even with the regulation in place regarding the distance from a residence to a production well, there will be a degree of noise pollution. Noise will be evident 24/7 which is a huge disruption to the quiet that is expected in a country environment.	EIS Chapter 20, sections 20.6.1 and 20.7	Although Arrow has made a commitment that no production wells and associated wellhead infrastructure will be located within 200 m of a residence (Commitment C311), Arrow aims to accommodate the landholder's requirements and where possible, will be flexible in the location of wells and infrastructure. Impacts will be addressed through compensation. The primary mitigation measure will be the avoidance of project development near sensitive receptors. Noting this, the conclusions of the noise and vibration impact assessment included that established noise criteria could be achieved at sensitive receptors through the use of appropriate mitigation measures, where necessary (EIS Chapter 20, Noise and Vibration, Section 20.7).
R17083	S079	Noise levels were modelled based upon known sound levels, however, it is not stated what those current levels are.	SREIS Appendix 10, Table 8.3, 8.4, 8.18 and 8.19	The modelling has been based on sound power levels of the noise sources provided SREIS Appendix 10, Noise and Vibration Impact Assessment, Table 8.3, 8.4, 8.18 and 8.19. This included typical facility equipment, typical construction equipment and wellhead engines.
R17084	S079	Arrow has been operational for 10 years and should be able to give the existing measured noise levels.	EIS Chapter 20, Section 20.3.2 and Appendix N, Section 5	Background noise monitoring was undertaken at Measure Location (ML) 4 and ML 1 which are located approximately 800 m to 1,500 m and 1,700 m to 2,200 m from existing production wells. These locations provide an indication of the background noise level at sensitive receptors in proximity to existing wells and production facilities and an approximate level of noise contribution from wells to the background environment (EIS Appendix N, Noise and Vibration Impact Assessment, Section 5.2).
R17085	S014, S044	The supplementary report to the EIS should provide the following information – Is the table showing that the 28dB(A) is only achieved at certain power levels? e.g., at locations RF1 and RF5 28dB(A) is only achieved when operating at	–	The noise modelling is based on the assumption that the production facilities are operating full load at maximum capacity continuously to account for worst-case noise levels. Compressors operate continuously under various loads and are periodically taken out of service for maintenance and major overhauls. Loading is managed to avoid large variations over short periods of

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Issue No.	Submission No.	Issue	Reference	Responses
R17085	S014, S044	50, 10, 20 (Hz). If this is the case, what portion of the time is the equipment at facilities, operating at this level or will there be fluctuating noise levels based on the different power levels? Will this fluctuation create an impulsive type of noise? Will the fan or compressor be continuously starting and stopping?		time that might be conducive to impulsive noise.
R17086	S024, S026, S081	For the plant and equipment that are constructed with mufflers attached, confirmation is requested as to whether the maximum overall sound power level provided in Table 8.4 and 8.19 of Appendix N (Noise and Vibration Impact Assessment of the EIS) is for the plant and equipment with the muffler attached.	EIS Appendix N, Table 8.4 and 8.19	The maximum sound power levels provided in EIS Appendix N, Noise and Vibration Impact Assessment, Tables 8.4 and 8.19 are based on typical construction equipment which may include standard mufflers.
R17087	S133	The EIS has not assessed against the requirements of the Environmental Protection Policy (Noise), specifically the health and well-being criteria identified for sleep disturbance for residential/sensitive receptors (including accommodation/workers camps).	EIS Chapter 20, Section 20.6.1 and Appendix N, Section 7 SREIS Chapter 13 and Appendix 11	Noise modelling has been conducted in accordance with Coal Seam Gas Industry Procedural Guide – Control of Noise from Gasfield Activities (Procedural Guide). The Procedural Guide has been developed in accordance with the EPP (Noise), with the aim to assist authorities with the regulation of noise emissions from the coal seam gas industry in Queensland, and deals specifically with environmental noise from gasfield activities. The prescribed noise levels in the Procedural Guide are more stringent than those defined in the EPP (Noise) for health and well-being in relation to the ability to sleep. Arrow has committed to comply with current noise legislation (Coal Seam Gas Industry Procedural Guide, EPP (Noise), World Health Organisation (WHO) Guidelines, DERM Assessment of Low Frequency Noise Draft Guideline), see EIS Chapter 20, Noise and Vibration, Section 20.6.1. Where modelled noise from project facilities exceeds the established noise criteria at one or more sensitive receptors, the application of acoustic treatments will be used (Commitment C310). The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17088	S081	Arrow does not comply with the applicable environmental protection policies (EPP (Noise) 6a, 6b and 6c).	EIS Appendix N, Section 5.1, 7.1.4 and 8	The EIS has identified the environmental values to be protected in EIS Appendix N, Noise and Vibration Impact Assessment, Section 5.1, as required by EPP (Noise)(Section 6a). The acoustic quality objectives for protecting the environmental values as required by EPP (Noise) (Section 6b) are stated in Section 7.1.4, Noise criteria, and provided the framework for the assessment and consideration of the acoustic environment, as required by EPP (Noise) (sections 6c and 8).
R17089	S079	The conceptual grid pattern for production wells is 800m, how can they limit noise to the regulated	EIS Chapter 20	The spacing between well pads will vary according to the coal depth and permeability. The EIS conceptualised that single-well pads would be sited

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Issue No.	Submission No.	Issue	Reference	Responses
R17089	S079	requirements? And if they have in-fill wells in between their conceptual wells, how will that affect the noise level?	SREIS Chapter 13	with a separation distance averaging a minimum of 800 m across the project development area. Production wells may be drilled in stages to take into account monitoring results and the performance of the first wells to be drilled. These initial wells may have a wide spacing, and the remaining wells would then be drilled to complete the grid of production wells (a process known as infilling). Infilling does not mean that well pads will be sited at a spacing less than the stated average (i.e., minimum 800 m grid spacing). An assessment of noise levels associated with the construction and operations of production wells is provided for single wells in EIS, Chapter 20, Noise and Vibration; and multi-wells in SREIS Chapter 13, Noise and Vibration. Noise modelling for production wells in the EIS and SREIS was based on the conceptual 800 m grid spacing, with the associated gas and water gathering systems linking the production wells to production facilities. Modelling assumed worst-case meteorological conditions. Compliance with the long-term night-time noise criterion of 28 dB(A) will be achieved through site selection and the application of different levels of acoustic treatment, where necessary.
R17090	S014, S044	The supplementary report to the EIS should provide evidence that the noise criteria has been met, prior to mitigation measures being put in place.	EIS Chapter 20, Figure 20.3	EIS Chapter 20, Noise and Vibration, Figure 20.3 presents modelled distances of noise emissions prior to mitigation measures being put in place. The application of acoustic treatment is necessary to achieve established noise criteria, except in circumstances where sensitive receptors are located at a distance of greater than 5 km from the facility.
R17091	S050, S162	Strongly disagree with the noise standards that Arrow wish to implement and as an absolute maximum utilise the published EHP (formerly DERM) guidelines in EIS Appendix N, Table 7.2. It is our preference that only a 3 dB(A) rise in existing levels be granted to keep the local amenity.	EIS Chapter 20, Section 20.6.1	The noise criteria in EIS Chapter 20, Noise and Vibration, Table 20.3 fully comply with the recommendations of Coal Seam Gas Industry Procedural Guide. The Procedural Guide, like most guidelines around Australia, set appropriate criteria based on a combination of background noise levels and absolute noise levels, which are considered to be acceptable by the relevant authority. The requirements of the Procedural Guide represent the most stringent environmental noise criteria of any state in Australia.
R17092	S162	If noise barriers are erected, which according to Chapter 20 of the EIS due to noise guidelines they should, how high are these going to be? Chapter 20 suggested 3.5m high barriers, but rightly questions their visual amenity. (Appendix N, page 64 of the EIS).	–	Acoustic treatments will be considered on a case by case basis in relation to their applicability to noise impact management and visual amenity.
R17093	S014, S044	The supplementary report to the EIS should assess the compatibility of the acoustic treatment with activities that occur on intensively farmed land, i.e., a 3.5 m high barrier would interfere with large machinery used for cropping purposes e.g., ground	–	Permanent barriers are not compatible with intensively farmed land, and would not be used. Acoustic treatments will be considered on a case by case basis in relation to their applicability to noise impact management.

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Issue No.	Submission No.	Issue	Reference	Responses
R17093	S014, S044	spraying equipment. It would also reflect sound in the opposite direction and on the floodplain this may create a nuisance for other sensitive receptors nearby.		
R17094	S014, S044	The supplementary report to the EIS should include the following information; <ul style="list-style-type: none"> • A clarification of how the conclusion is reached (chapter 20, 20.2.4 of the EIS) that south and east represent Category 4, west and north represent Category 6 meteorological conditions? • What is the minimum percentage of time that indicates a Meteorological Condition Category is a “feature” as opposed to a “significant feature”? • Noise modelling using a Category 5 scenario, as it is the most prevalent meteorological condition. 	EIS Appendix N, Section 6 SREIS Chapter 13 and Appendix 11	The assessment of the occurrence of meteorological conditions in the project development area presented in EIS Appendix N, Noise and Vibration Impact Assessment, Section 6, presents the modelling capabilities of the CONCAWE system. For the purposes of the assessment, worst case meteorological conditions (Category 6) have been used for all directions. Modelling of other meteorological categories would result in a reduction in the predicted noise levels as these categories are considered neutral and best case weather conditions. The noise assessment therefore predicts impacts under worst case conditions. The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17095	S014, S044	The assumption that ambient noise levels (from wind in trees) would mask the noise from sites at times of wind speed greater than 5 m/s cannot be made in relation to the Condamine Floodplain because there are no trees for the wind to blow through and mask the noise. It is requested that the supplementary report to the EIS reanalyse the meteorological data and take this fact into account. As this affects the modelling input data we also request noise modelling for the Condamine Floodplain landscape be included in the supplementary report to the EIS.	EIS Chapter 20, Section 6.3 SREIS Chapter 13 and Appendix 11	As set out in EIS Appendix N, Noise and Vibration Impact Assessment, Section 6.3, the assessment has been based on worst-case modelling where no trees or natural barriers were situated between the noise sources and sensitive receptors. Trees and vegetation are considered natural barriers to noise which will result in lower noise levels than those modelled in the EIS. Arrow will seek to place production facilities on less productive and sparsely populated land, not intensively farmed land on or in a floodplain. Notwithstanding this, a site specific noise and vibration impact assessment with best practice background noise monitoring, will be conducted for the environmental authority (EA) or EA amendment application for identified sensitive receptors, when facilities locations are selected. The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.
R17096	S060	Audible noise at residences will not be completely suppressed under weather conditions, especially during winter.	–	Noted. Noise criteria have been established with the aim of protecting the environmental values of health and wellbeing. However, it is acknowledged that weather conditions may result in noise being audible (though not necessarily above established noise criteria).
R17097	S014, S044, S160	The supplementary report to the EIS should provide the following information – Modelled construction noise and vibration based on actual construction processes of wells and pipelines, access tracks.	EIS Chapter 20, Section 20.4.4 SREIS Chapter 13 and Appendix 11	The noise and vibration impact assessment (EIS Appendix N) was undertaken with consideration of Arrow’s current construction techniques, including the known sound levels of typical construction equipment. However, given the scale of the Surat Gas Project, more streamlined construction processes may be implemented to improve efficiency and reduce waste. EIS Chapter 20, Noise and Vibration, Section 20.4.4 notes that modelling predictions for the construction of production wells and pipelines indicate that

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Issue No.	Submission No.	Issue	Reference	Responses
R17097	S014, S044, S160			<p>if activities are undertaken at a distance of less than 1 km from a sensitive receiver, acoustic treatment would need to be applied in order to meet the criteria.</p> <p>Acoustic treatments will be applied by Arrow on a case by case basis to meet the prescribed noise criteria.</p> <p>The updated modelling results for the SREIS are provided in SREIS Chapter 13, Noise and Vibration, and SREIS Appendix 11, Supplementary Noise and Vibration Assessment.</p>
R17098	S034	Can Arrow assure that rural areas will remain silent at night?	EIS Chapter 20, Section 20.6.1	<p>The Coal Seam Gas Procedural Guide provides stringent noise criteria for night-time (10.00 p.m. to 6.00 a.m.) activities. These criteria are based on the background noise level of 25 dB(A) plus 3 dB(A) for short, medium and long term noise events. These noise levels are considered typical of rural areas.</p> <p>Arrow has committed to manage noise in accordance with the relevant environmental authority conditions through detailed site selection and the incorporation of acoustic treatments to meet noise criteria sensitive receptor locations (see EIS Chapter 20, Noise and Vibration, Section 20.6.1).</p>
R17099	S027, S133	There is concern that sleep disturbance will result from living near facilities. The proponent should undertake further assessment in relation to a maximum sound pressure level (LA1, adj, 1hr) impact within habitable dwellings, ensuring sleep is not disturbed.	EIS Appendix N, Section 7	<p>The project infrastructure will be designed and operated in a manner that achieves prescribed noise criteria which are well below the recommendation of the World Health Organisation to protect against sleep disturbance (EIS Appendix N, Noise and Vibration Impact Assessment, Section 7). In areas where existing facilities influence the ambient environment, Arrow have committed to construct and operate infrastructure in a manner that noise in the existing acoustic environment will meet EHP (previously DERM) noise criteria.</p>
R17100	S014, S044	The supplementary report to the EIS should provide details of acoustic treatments that would be used to ensure operational noise of production wells meet the night time noise criteria.	EIS Appendix N, Section 8.1.8 and Table 8.9	<p>Acoustic treatment packages applicable to production wells are presented in EIS Appendix N, Noise and Vibration Impact Assessment, Table 8.9.</p>
R17101	S014, S044	<p>If the project is approved we request the administering authority impose Environmental Nuisance- Noise Conditions – As per the Dalby Expansion Project Environmental Authority:</p> <ul style="list-style-type: none"> • Prior to undertaking petroleum activities that will result in short-term, medium-term or long-term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity and determine if noise emissions are likely to exceed the noise levels specified in Schedule E, Table 1 – Noise limits at Sensitive Receptors. 	–	<p>Noted. Following the EIS process, Arrow will apply for an environmental authority (EA) or amendment to its existing EA to include Surat Gas Project activities. Arrow expects this noise condition will be retained in the EA or amended EA.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R17101	S014, S044	<p>• If noise modelling or the calculations indicates that petroleum activities are likely to exceed the noise levels specified in Schedule E, Table 1 – Noise limits at sensitive receptors, the holder of this environmental authority must prepare a Noise Management Plan prior to undertaking petroleum activities, which demonstrates how the noise limits specified in Schedule E, Table 1 – Noise limits at sensitive receptors will be achieved in the event of a valid noise complaint.</p>		
R17102	S014, S044	<p>If the project is approved we request the administering authority impose conditions that require Arrow to implement the Noise Management Plan at the commencement of activities that will exceed noise limits at sensitive receptors that have been identified as impacted.</p>	–	<p>Noted. Following the EIS process, Arrow will apply for an environmental authority (EA) or EA amendment to include Surat Gas Project activities. Arrow expects the existing noise conditions pertaining to noise management plans will be retained in the amended EA, or included in a new EA.</p>
R17103	S014, S044	<p>If the project is approved we request the administering authority restrict all petroleum activities to outside a 2km radius of all sensitive receptors within the project area, at minimum.</p>	–	<p>A range of state, national and international legislation and policies prescribe criteria aimed at protecting human health and other environmental values. Arrow will use a number of methods including site selection and the application of appropriate distances to meet its legislative requirements and protect environmental values.</p>
R17104	S011	<p>What is the legal framework that will allow the proponent to deal with noise impacts outside of the EIS?</p>	–	<p>Noise conditions will be set out in the project environmental authority (EA), issued under the <i>Environmental Protection Act 1994</i> (Qld). It is a legal requirement for Arrow in conducting the project to comply with the conditions of its EA.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R18001	S160	Arrow's commercial venture could cause unacceptable economic damage to Tong Park piggery and other commercial livestock operations which would be unlikely to be compensated by Arrow.	EIS Chapter 13, Section 13.4.6 and Chapter 21, Section 21.4.7	Arrow acknowledges the issues associated with the development of the project and potential impacts on intensive livestock operations (EIS Chapter 13, Agriculture, Section 13.4.6). Arrow is committed to avoiding infrastructure and associated farm management areas of intensive farming operations, including piggeries, feedlots, vineyards, orchards, horticultural enterprises, poultry farms and small-lot plantations (Commitment C076). EIS Chapter 21, Economics, Section 21.4.7 states that Arrow is required to compensate landowners for any impacts on productivity. Such compensation will be through direct negotiation with impacted agricultural producers. Arrow will develop and implement a compensation framework (Commitment C081). Consequently, any lost productivity is likely to be offset or negated in financial terms. Impacts are expected to be temporary given the limited life of the project's production facilities and the ability to rehabilitate land to a standard agreed with the agricultural producer. EIS Chapter 13, Agriculture, Section 13.6 outlines Arrow's proposed performance objectives to minimise impacts on agricultural land and enterprise.
R18002	S150	A fully explained business case which includes a cost analysis around the gas management practices should be provided by Arrow. The EIS needs to address fully the impacts of field development variables on the potential for surplus gas to be produced. That is, energy market demand, commercial sales contracts and exploration information will all determine the rate of development and project phasing. Is there the potential for too much gas to be produced, resulting in the need for re-injection?	EIS Chapter 3, Section 3.1	The business case for the project is commercially sensitive and confidential. However, the EIS presents the case for the project and the current understanding of the energy market and demand forecast for the life of the project. In particular, EIS Chapter 3, Project Need, Section 3.1 describes the international and Australian demand for gas and energy. Worldwide LNG sales are expected to rise from 165 Mt in 2007 to between 245 and 340 Mt per year by 2015 (IEA, 2009). By 2035, a global increase in the gas trade of around 80% is predicted, more than half of which will take the form of LNG (IEA, 2010). In Australia, the Australian Energy Market Operator expects that gas consumption will continue to grow during the period 2011 to 2030, at a rate of between 3.0% and 4.8%. Gas-fired power generation in Queensland, Victoria and New South Wales are expected to be key drivers of this demand (AEMO, 2010). As a consequence, the potential for the project to produce surplus gas that would require reinjection is considered to be very low.
R18003	S146	Has Arrow considered the likely implications of changing environmental authority conditioning to the economics of the Surat Gas Project?	EIS Appendix O, Section 3.2	Arrow has developed estimates of operating expenditure for the project based on their experience of similar energy and gas projects in Australia and worldwide, and the specific requirements for developing the Surat gas field. This information is commercially sensitive, is confidential and cannot be publically released.
R18004	S074	If there are production costs associated with the	EIS	Arrow has developed estimates of operating expenditure for the project based

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R18004	S074	GLNG project that are publically available, then there should also be data on Arrow's estimated production costs available to the authors of Appendix O.	Appendix O, Section 3.2	on their experience of similar energy and gas projects in Australia and worldwide, and the specific requirements for developing the Surat gas field. This information is commercially sensitive, is confidential and cannot be publically released.
R18005	S075, S077, S089, S141, S144	Agricultural producers will not benefit from the income increase, being at the mercy of commodity prices and increasingly erratic weather patterns and thus will be faced with an increase in the cost of living and increased costs of running their business, e.g., servicing machinery, buying agricultural products and accessing services. The reduction in productivity/ profitability for farmers may accumulate to have commodity and sector wide ramifications which haven't been assessed in the EIS.	EIS Chapter 21, Section 21.4.7 and Appendix O, Table 5.1	Arrow has identified and investigated the potential for economic impacts on agriculture resulting from this project at either an industry or commodity level. The results showed Arrow's impact is not considered sufficiently large to cause a material change in the longer term viability of the agriculture sector. Table 5.1 of Appendix O (Economic Impact Assessment) shows the Darling Downs agriculture industry is estimated to record a decline in output (compared to what would be expected to occur without the project) of 0.2% to 0.3%. This reduction in agricultural output is not sufficient to affect the long term viability of the industry. Arrow is required to compensate landowners for any impacts of the project on productivity (EIS Chapter 21, Economics, Section 21.4.7). Such compensation will be through direct negotiation with landholders and any lost productivity as a result of the project is expected to be offset or negated in financial terms.
R18006	S024, S026, S027, S081	The major advantages of the project for Australians are royalties and taxes paid to our governments. A large percentage of this money should go back to the road network for local roads as well as the relevant highways, but past experience (e.g., Bowen Basin west of Mackay) proves this won't happen. There are serious errors in the assessments and predicted outcomes in the Roads Impact Assessment and the cost to the state government for road repairs that occur as a consequence of project development. Such costs would bite heavily into the annual payroll tax and royalty revenue expected to result from the project. Arrow must calculate the dollar amount that the state government (local/federal if applicable) will spend per annum on road repairs that are related to project activities. Arrow must redo the cost benefit analysis to include the infrastructure costs to the state.	EIS Chapter 19, Section 19.6.2 and Appendix M, Section 9.1 SREIS Chapter 12	At the time of publication of the EIS, specific locations of project facilities and associated infrastructure were unknown. As such, a strategic traffic assessment was undertaken which established that road impacts associated with project traffic at a regional level (determined from traffic volume forecasts and vehicle kilometres travelled) could be effectively managed (see EIS, Appendix M, Road Impact Assessment, Section 9.1). EIS Chapter 19, Roads and Transport, summarises the findings of this assessment and details the commitments Arrow has made to manage potential impacts on local roads (Section 19.6.2). Actions include further assessment and identification of the need to upgrade roads (Commitment C285) and maintain the integrity of private roads and tracks (Commitment C031). Road use management plans will also be prepared and regularly reviewed in consultation with the relevant council or the DTMR (Commitment C284). The pavement and road maintenance contributions will be calculated in accordance with relevant standards. Arrow will enter into relevant and reasonable infrastructure agreements with DTMR and council. SREIS Chapter 12, Roads and Transport presents the findings of the updated traffic modelling and assessment. The findings of this assessment will be used to inform the discussion with DTMR.
R18007	S074, S081, S108, S117, S138, S142	Section 5.2.1 of Appendix O does not discuss the economic impacts of changed employment profiles	EIS Appendix O, Section 5.2.1	Computable general equilibrium (CGE) modelling undertaken as a part of EIS Appendix O, Economic Impact Assessment presents the net effect inclusive

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R18007	S074, S081, S108, S117, S138, S142	in other industry sectors. Please discuss the project's impact on job creation/depletion in a holistic fashion, and discuss jobs potentially depleted in other non-energy industry sectors as a result of the labour/skills drain to the energy sector. The results of the computable general equilibrium model are aggregated such as to not show direct and indirect employment and therefore defeat any cross check of the analysis. It is also impossible to check that the computable general equilibrium and cost benefit analysis models include the indirect unemployment that would result from the jobs lost from other industries, such as the 746 full time equivalent jobs annually in agriculture and manufacturing.	and tables 5.1 and 5.2 SREIS Attachment 3, Section 2.5	of both direct and indirect impacts. It does not provide impacts disaggregated between direct and indirect impacts. CGE modelling includes consideration of a draw of activity and labour from one sector to another. This is highlighted in Tables 5.1 and 5.2 of the economic impact assessment. The net result on economic activity thereby incorporates the 'loss' of labour from some industries (both direct and indirect in aggregate). Table 5.2 in Section 5.2.1 outlines the change in employment across a range of industries as a result of the Surat Gas Project. The 746 jobs 'lost' in the agriculture and manufacturing sector does not represent a loss of 746 existing jobs, only that there would be 746 fewer jobs in the future in these sectors combined if the Surat Gas Project proceeds. As detailed in SREIS Attachment 3, Social Impact Management Plan, Section 2.5, Arrow has made a commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556).
R18008	S108	Computable general equilibrium models are commonly sensitive to assumptions and the input parameters chosen. These are not described in sufficient detail to permit an assessment of the validity of the modelling assessment undertaken.	EIS Appendix C to Appendix O	Noted. Appendix C to EIS Appendix O, Economic Impact Assessment presents the assumptions used in the computable general equilibrium (CGE) modelling.
R18009	S081, S108	In most economic analysis of expansion of mining, general equilibrium effects on the rest of the economy, arising through exchange rates and factor markets, are typically negative, partially offsetting the expansion in mining. With the exception of employment losses, no such effects are apparent in Figure 5.1. This raises concerns about the appropriateness of the choice of closure assumption.	–	The draw down effect on other sectors is captured within the computable general equilibrium (CGE) modelling. The increase in gross domestic product (GDP) and industry output resulting from the project is a factor of the high gross value add of coal seam gas extraction relative to other industries.
R18010	S081, S108, S117, S138, S142	The outputs of the computable general equilibrium and cost benefit analysis black box models show that the jobs and income generated by the project are largely at the expense of other sectors as shown in Tables 5.1 and 5.2. As the impacts on manufacturing and tourism are largely due to the upward pressure on the Australian dollar, these negative impacts would be expected to be national. However, these results are not reported at a national level in the EIS. It is likely that by including national impacts the project would lead to an even smaller net gain or even a net loss of jobs in	EIS Appendix O	Modelled impacts to employment at the national level, compared to the baseline scenario, are not significant due to the fixed domestic labour assumption used (i.e., total domestic labour availability does not change as a result of the project). Under this assumption, labour mobility between states is motivated by real wage differences. This assumption was used EIS Appendix O, Economic Impact Assessment following discussion with the Queensland Government and is in line with modelling undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government.

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R18010	S081, S108, S117, S138, S142	Australia and that additions to New National Income and Net State Income will be similarly modest.		
R18011	S011	Has the impact on house/property values of landholders affected by noise impacts been assessed as a cost of the project in the cost benefit analysis?	EIS Chapter 20 and Appendix H of Appendix O	Appendix H of EIS Appendix O, Economic Impact Assessment acknowledges noise impacts as a potential impact of the project. These impacts have not been quantified and valued for inclusion in the cost benefit analysis due to data limitations. However, inclusion of these impacts is not anticipated to have a significant bearing on the findings of the cost benefit analysis. EIS Chapter 20, Noise and Vibration examines the noise impacts of the project in further detail.
R18012	S048, S062, S071, S078	There are reports from land owners in the area that they are unable to sell their property and retire due to reduced property values. Devaluation of property values is an unsolvable problem. There is concern over depreciation in value of properties in the gas field area. The possible lowering in land values due to land becoming unsuitable or through operations being more difficult and costly (and the associated problems with selling of land) has not been accounted for in the Economic Impact Assessment. The government must ensure that affected properties actually become more valuable with the arrival of the coal seam gas industry, and do not depreciate. Adequate compensation is required to compensate for the lifestyle and financial burdens of having coal seam gas infrastructure on your property.	EIS Chapter 13, Section 13.6 Chapter 21, Section 21.4.4 and Appendix O, Section 5.3	Noted. EIS Chapter 21, Economics, Section 21.4.4 summarises potential project impacts on property values. Further details are provided in EIS Appendix O, Economic Impact Assessment, Section 5.3. In relation to rural property values, EIS Chapter 21, Section 21.4.4 states that the potential for reduced productive capacity in some landholdings may result in a decline in the value of these properties. However, the impact of the resources sector on rural property values as a whole is very difficult to isolate (as opposed to other factors such as falling commodity values). Arrow is aware of the potential issues that landowners may face with the introduction of coal seam gas infrastructure on their properties and recognises it responsibilities under the Petroleum and Gas (Production and Safety) Act 2004 (Qld) to compensate the landholder for damage and losses arising from coal seam gas activities carried out on the land. EIS Chapter 13, Agriculture, Section 13.6 detailed the actions Arrow will take to reduce and manage these impacts. Arrow is committed to providing appropriate compensation to affected landholders through the conduct and compensation agreement process. The location of infrastructure will be agreed with landholders under the terms of the agreement prior to the commencement of works (Commitment C075) and Arrow will consult with landholders on the most appropriate methods to minimise disruption to cultivation paddocks (Commitment C088).
R18013	S051, S088, S108, S110	Impacts on the operating costs of agricultural businesses need to account for the potential depreciation of the value of the land on which the coal seam gas operations are occurring. This impacts on negotiations with banks, and also farm operations well beyond the areas containing coal seam gas infrastructure. Farmers have to deal with bank managers during	EIS Chapter 13, Section 13.6 and Chapter 21 Section 21.8	Noted. Arrow is aware of the potential issues that landowners may face with the introduction of coal seam gas infrastructure on their properties and recognises it responsibilities under the Petroleum and Gas (Production and Safety) Act 2004 (Qld) to compensate the landholder for damage and losses arising from coal seam gas activities carried out on the land. Arrow is committed to providing appropriate compensation to affected landholders through the conduct and compensation agreement process. EIS Chapter 13, Agriculture, Section 13.6 details the actions Arrow will take to

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R18013	S051, S088, S108, S110	<p>the productive period, when the assets (land), will have been decreased very considerably the minute a drilling rig drives onto the place. Not only will the land have been devalued it will have become unsaleable.</p> <p>The EIS should address the impact on farms and land values with and without coal seam gas tenure over them. There is sensitivity with financial arrangements with banks if coal seam gas tenure exists over farming properties.</p>		<p>reduce and manage these impacts. Importantly, the compensation framework will aim to 'add value' rather than just compensate for impacts (Commitment C081). The location of infrastructure will be agreed with landholders under the terms of a conduct and compensation agreement prior to the commencement of works (Commitment C075) and Arrow will consult with landholders on the most appropriate methods to minimise disruption to cultivation paddocks (Commitment C088).</p>
R18014	S015	<p>The EIS states housing is relatively affordable, however the ABC 7.30 report on May 22 showed that in central Queensland coal mining towns, housing costs have risen greatly in relation to their true value. This appears to be the pattern in any mining towns/settlements near to mining ventures and it could be expected to be the case with coal seam gas enterprises in towns of the Surat Basin area.</p>	<p>EIS Chapter 21, sections 21.3.4, 21.8 and Chapter 22</p> <p>SREIS Attachment 3</p>	<p>While the EIS notes that housing is relatively affordable, it also acknowledges that the Darling Downs has experienced increases in average weekly rents and median house prices in recent years. These increases have been driven largely by increased demand for accommodation from mining and gas companies and their employees (EIS Chapter 21, Economics, Section 21.3.4). Consequently, Arrow will undertake a range of initiatives to assist in managing project impacts on housing affordability in the region. These issues are also discussed in EIS Chapter 22, Social. Arrow will consult with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548).</p> <p>Arrow will develop a Construction Workforce Strategy and an Operations Accommodation Strategy (see Commitment C378 and Commitment C381), accommodate workers required to construct TWAFs in temporary accommodation wherever practicable (Commitment C322) and continue to collaborate with other proponents in the region to identify opportunities to share temporary accommodation for the construction and operations workforces (Commitment C380). As part of these strategies, Arrow will consider continued participation in initiatives set out in the Major Resource Projects Housing Policy and the Western Downs Regional Council Affordability Strategy.</p> <p>The social impact management plan prepared for the EIS which includes these commitments has been updated as part of the SREIS process and is included in SREIS Attachment 3, Social Impact Management Plan.</p>
R18015	S130	<p>Western Downs Regional Council suggests Arrow should:</p> <ul style="list-style-type: none"> • Contribute \$9,565 per full-time worker housed in camps should be made, in accordance with its adopted infrastructure charges. • Enter into an infrastructure agreement with Council to financially contribute to the upgrading of 	<p>SREIS Attachment 3</p>	<p>Noted. Arrow acknowledges it has a shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. Arrow is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contribute to the social and economic wealth of the communities in which it operates, through its social investment program. Arrow will deliver social investment in the areas in which it operates to meet its obligations under</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R18015	S130	telecommunications infrastructure in the Western Downs region. • Contribute to a community fund in collaboration with the Council. • Provide funding for affordable housing to the Western Downs Housing Trust. • Provide an annual financial contribution towards the establishment of an Agriculture and Mining Partnership Development Unit within the Western Downs Regional Council for the purpose of identifying and developing projects and services delivering mutual benefits to both industries.		relevant approvals, and make appropriate infrastructure charges and upgrade contributions. Arrow will work with the Western Downs Regional Council to establish appropriate mechanisms for providing funding to address a range of potential impacts of the project, including on housing availability and community initiatives. Arrow will focus on the key action areas identified in the update of the social impact management plan presented in SREIS Attachment 3, Social Impact Management Plan. Examples include developing a Construction Workforce Strategy and an Operations Accommodation Strategy (see Commitment C378 and Commitment C381) and consulting with state and local government and community stakeholders to deliver the most appropriate program for affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). Arrow will continue to liaise with all coal seam gas proponents to identify opportunities to collaborate on initiatives and actions.
R18016	S027, S042, S130, S153	EIS does not adequately address mitigation measures relating to increased demand for, and cost of, accommodation in the local area. Higher costs for housing and rent further alienate those who are not directly involved in the industry. What is Arrow's strategy to ensure there is minimal effect on housing availability and rental prices in the area? Funding for affordable housing should be provided to the Western Downs Housing Trust.	EIS Chapter 21, Section 21.8 SREIS Attachment 3, Section 2.1	EIS Chapter 21, Economics, Section 21.8 and SREIS Attachment 3, Social Impact Management Plan, Section 2.1 detail Arrow commitments to assist in managing project impacts on housing availability and affordability in the region. These actions include initiatives such as developing a Construction Workforce Strategy and an Operations Accommodation Strategy (see Commitment C378 and Commitment C381) and consult with state and local government and community stakeholders to deliver the most appropriate program for affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). As part of these strategies, Arrow will consider continued support to government reviews on housing availability and affordability, and impacts on low income groups, providing high quality temporary workers accommodation facilities for all non-resident members of the construction workforce and continuing to collaborate with other proponents in the region to identify opportunities to share temporary accommodation where possible for the construction and operations workforces (SREIS Attachment 3, Social Impact Management Plan, Section 2.1).
R18017	S024, S026, S036, S038, S057, S069, S081, S083	What are the financial implications to landowners of having land placed on the Environmental Management Register and Contaminated Land Register and will landowners be compensated by the proponent to offset the devaluing of their land from these listings?	EIS Chapter 12, Box 12.1	Arrow activities with the potential to be classified as notifiable, and therefore require the land parcel to be listed on the Environmental Management Register, are not proposed on private property. Arrow will seek to acquire land on which to place production facilities and water treatment facilities, or enter into long term lease arrangements for the use of land. Schedule 3 to the Environmental Protection Act 1994 defines notifiable activities (also see EIS Chapter 12, Geology, Landform and Soils, Box 12.1). Under the Environmental Protection Act, Arrow is legally required to remediate any contamination caused by project activities wherever it occurs.

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R18017	S024, S026, S036, S038, S057, S069, S081, S083			Remediation goals include identifying proposed future land uses and will be determined as part of a Remediation Action Plan (RAP) which would be developed should land contamination occur. A validation sampling program will be conducted to confirm the site has been successfully remediated according to the objectives identified in the RAP.
R18018	S099	Economic and social impacts relating to the agricultural industry at cessation of the project have not been assessed.	EIS Chapter 5, Section 5.7 and Appendix P, Section 6.10	EIS Chapter 5, Project Description, Section 5.7 describes the decommissioning and rehabilitation strategy for the project and notes that a goal of decommissioning and rehabilitation is that the project development area is safe to humans and wildlife, non-polluting, stable (landforms) and able to sustain a useful land use project. The project infrastructure has a design life ranging between 15 and 35 years and decommissioning and rehabilitation will progressively occur throughout this period. Final decommissioning and rehabilitation will occur at the end of individual infrastructure life and will be carried out in accordance with the relevant approvals and regulatory requirements of the day. Prior to decommissioning, detailed objectives, criteria and performance indicators will be developed for each of the goals in consultation with the appropriate regulatory agency and landowners. The final rehabilitation will be determined in conjunction with the landowner. Land impacted by project infrastructure and activities will be rehabilitated to a pre-development standard. Consequently, the impacts on agricultural productivity will be temporary and agricultural practices are expected to be able to continue as they did prior to the project. Residual social impacts have been assessed in EIS Appendix P, Social Impact Assessment, Section 6.10. Impacts are likely to be minimal and will be considered through the ongoing social impact management plan management process closer to the time of decommissioning.
R18019	S024	In the event of commodity downturn to the point where drilling may cease, what obligations does the proponent have to partially drilled wells?	–	Arrow will be required to comply with the conditions of the environmental authority(s) for the project, which will set out decommissioning and rehabilitation requirements project infrastructure. In addition, the administering authority requires financial assurance to be lodged as a condition of an environmental authority (chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). Financial assurance is held as security so that adequate progressive rehabilitation is undertaken by proponents and that funds are available to government to rehabilitate the site if a company goes into liquidation.
R18020	S089	The smaller agricultural communities will stagnate while the larger ones will prosper. Although the EIS suggests that the increase in higher-earning community members will be beneficial for	EIS Chapter 21, Section 21.8 and Chapter 22, Section 22.8.7	Arrow recognises that the project will affect different communities throughout the project development area in different ways. Arrow is also aware of the experiences of communities with other resource projects in the area and has identified a number of actions that take this experience into account, including

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R18020	S089	townships, the Millmerran experience with coal shows that this is not a major impact. Mining companies tend to bypass smaller local businesses who generally find it difficult to cope with the demands of large heavy industry. As a result, the larger centres that stand to prosper, such as Toowoomba, are unlikely to voice concern at coal seam gas developments, and since local governance for outlying agricultural communities such as Millmerran is now based in the Toowoomba business centre, people from smaller communities who are aware of the scale and nature of the Surat Gas Project feel they are both powerless and voiceless.	SREIS Attachment 3	the need to foster opportunities for local businesses and to provide local communities with mechanisms to be involved in the project and to voice their concerns if needed. EIS Chapter 21, Economics, Section 21.8 outlines a range of commitments Arrow has made to manage project impacts on local businesses. These include for example, continuing to use the Industry Capability Network database for potential suppliers in the area (Commitment C359), organising local supplier information sessions to inform businesses of Arrow's development plans, tender opportunities for local business and how to complete tender requirements (Commitment C361) and providing industry support organisations with the information they require to assist local businesses improve their skills base and respond to project needs (Commitment C362). EIS Chapter 22, Social, Section 22.8.7 identifies the commitments to the community that Arrow has made, including to regularly providing information and also to provide an avenue for suggestions, comments and issues to be raised and addressed by Arrow. Arrow has already established a grievance process for addressing complaints from community members or groups (Commitment C077). Arrow will also have on hand Land Liaison and Community Officers to discuss landowner and residents concerns (Commitment C393). The updated social impact management plan (SREIS Attachment 3, Social Impact Management Plan) provides a full list of the actions Arrow will take to manage potential impacts with different communities and landholders in the area.
R18021	S024, S026, S081	Would Arrow consider that a diverse economy is also one of the most important values of the economic environment in the project description area? How is the proponent fostering this?	EIS Chapter 21, sections 21.5 and 21.8	The mining and gas industry provides a benefit to the regional economy in terms of economic diversification that can assist in mitigating impacts associated with instability in agricultural production due to fluctuations in climatic and weather conditions. The development of coal seam gas reserves for the Surat Gas Project also provides an opportunity to develop skills and expertise in Australia and has the potential to result in a new export industry for Queensland (EIS Chapter 21, Economics, Section 21.5). Arrow has committed to a range of actions at a local level that foster this economic diversification, in particular through encouraging the input of local businesses. Section 21.8 outlines these commitments which include for example, continuing to use the Industry Capability Network database for potential suppliers in the area (Commitment C359), organising local supplier information sessions to inform businesses of Arrow's development plans, tender opportunities for local business and how to complete tender requirements (Commitment C361) and providing industry support organisations with the information they require to assist local businesses improve their skills base and respond to project needs (Commitment C362).

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R18022	S024, S026, S081, S143	What is the economic impact of transient mining and gas populations on the Darling Downs? Local communities gain little economic benefit from petroleum companies and their contractors due to the fly in/ fly out and drive in/ drive out workforce.	EIS Chapter 21, Chapter 22, Section 22.5 and Appendix O, Section 5	The economic impact assessment (EIS Appendix O, Economic Impact Assessment) incorporated the potential economic effects of a transient workforce on local communities and takes into account the economic impacts of a transient mining and gas populations on the Darling Downs (Section 5). Specific impacts of the transient workforce have not been isolated from the results presented in EIS Chapter 21, Economics as the assessment has examined the overall project impacts, not individual components of the project in isolation. As the majority of the construction workforce will be housed in temporary workers accommodation facilities during their roster days, and will return to homes outside of the study area when not on shift, they will have a negligible impact on factors such as local housing prices and accommodation. However, other economic benefits will flow from other aspects of the construction workforce, for example, an increased demand for hotel and motel accommodation during the early stages of the project and accommodation for visitors. EIS Chapter 22, Social describes in detail the planned make-up of the construction and operations workforces (Section 22.5). For the operations phase of the project, Arrow has no plans to establish fly-in, fly-out or drive-in, drive-out operations. As such, there will be no transient workforce. An estimated 50% of the operations workforce is expected to be sourced from the local area and 50% from outside the area. Workers sourced from outside the local area are expected to move to, and rent or purchase housing in the local area, bringing with them associated economic benefits for the region. This workforce may help to sustain services and lifestyle businesses, and training and long-term employment prospects offered by the project may mean that younger local residents will stay in the area. In addition, as set out in SREIS Attachment 3, Social Impact Management Plan, Arrow is committed to significant social investment spend in the areas of Housing and Accommodation, Community Investment and Wellbeing, Indigenous Community, Workforce and Training, Local Content and Community Health and Safety.
R18023	S024, S026, S081	Provide the analysis to show that the net impact to regional councils will be neutral.	EIS Appendix O, Section 5.6.3.1	EIS Appendix O, Economic Impact Assessment, Section 5.6.3.1, outlines the net impact to regional councils is expected to be neutral assuming fees and charges (e.g., headworks charges, developer contributions) are appropriately levied. Arrow will work with regional councils to meet its obligations under relevant approvals, and to making appropriate infrastructure charges and upgrade contributions. Arrow will work with the regional councils to establish appropriate mechanisms for providing funding to address a range of potential impacts of the project, including on housing availability and community initiatives.
R18024	S024, S026, S081	What are the positive and negative economic	EIS	EIS Chapter 21, Economics, Section 21.4.2 summarises the findings of EIS

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R18024	S024, S026, S081	impacts of workers camps on local governments, including potential revenue from rates?	Chapter 21, Section 21.4.2	Appendix O, Economic Impact Assessment, including potential project impacts on local councils. These include impacts on local government revenue, services and infrastructure. The net impact on each regional council is expected to be neutral in the long run, with additional revenues used to fund additional capital or operating expenditure so that the marginal cost to users remains unchanged.
R18025	S011, S024, S026, S081	There are concerns with the terms of reference, Section 4.12.2, as the economic impact report does not quantify costs to government at various levels for infrastructure maintenance and/or improvements; e.g. roads, waste facilities, emergency services, law enforcement and health services. The limited discussion in Section 5.7 is general and incomplete. The discussion on roads only considers a few state controlled roads; impacts on Regional council roads and private roads are not considered. Arrow must provide information about all additional costs (e.g., telecommunications, health and administration) to local, state and federal governments resulting from the Surat Gas Project.	EIS Chapter 19, Section 19.6.2, Chapter 21, Section 21.8, Chapter 22, sections 22.8.4, 22.8.5 and Appendix O, Section 5.7 SREIS Attachment 3	Noted. Quantification of costs is not a requirement of the EIS Terms of Reference. However, EIS Appendix O, Economic Impact Assessment, Section 5.7 does outline the potential costs to government of additional infrastructure provision as a result of the project. Arrow recognises that some infrastructure upgrades will be required as a result of the project and that there will be pressure on community facilities including health and recreation facilities. Arrow is committed to supporting and expanding its social investment in the areas in which it operates to meet its obligations under relevant approvals, and to making appropriate infrastructure and upgrade contributions. Further details on Arrow's commitments are provided in EIS Chapter 19, Roads and Transport which identifies the key impacts on the regional and rural (local) road infrastructure (Section 19.6.2). EIS Chapter 21, Economics, Section 21.8 and EIS Chapter 22, Social, sections 22.8.4 and 22.8.5 also detail the commitments Arrow has made in response to potential impacts on communities, infrastructure and services. Arrow will work with the relevant local, state and federal authorities to establish appropriate mechanisms for providing funding to address a range of potential economic and social impacts of the project. This will include a focus on the key action areas identified in the update of the social impact management plan presented in SREIS Attachment 3, Social Impact Management Plan.
R18026	S081	Arrow has not fully accounted for the cost of operation, i.e., underestimating the amount of aggregate required for the project, underestimating vehicle movements on roads, underestimating greenhouse gas emissions. It is therefore not possible at this time to conclude that the proposed development activities are compatible with the financial implications criteria.	SREIS Chapter 6 and Chapter 12	Noted. Economic modelling was undertaken based on the best available information at the time of writing. Detailed financial information of the nature requested is commercial in confidence and is not presented in the EIS. Further modelling and technical studies of some aspects of the project have been completed to support the SREIS. These include additional traffic modelling and greenhouse gas assessments. The findings of the assessments are included in SEIS Chapter 6, Greenhouse gas Emissions and SREIS Chapter 12, Roads and Transport and will be available to inform discussions with relevant authorities on the appropriate level of financial contributions.
R18027	S011, S040, S081	A properly performed cost benefit analysis should capture in dollar terms every single dimension of the proposed project – the key dimensions are all the direct costs and benefits (private and social)	EIS Chapter 21, Section 21.6, Appendix O of Appendix H	Noted. The cost benefit analysis presented in EIS Chapter 21, Economics, was undertaken for a period of 25 years (the project life). However, it also includes rehabilitation expenditure and impacts to agriculture beyond this period (as salvage values), as appropriate. This method is consistent with

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R18027	S011, S040, S081	over the full life of the project and should account for quantified and further risks, The life of the project does not end until the “without project” option has been restored. If the “with project” risks material damage to the environment and that takes 100 years to correct then that is the life of the project, even if coal seam gas extractions cease after 20 years. No modelling of long term effects (post shut down) is included as per Section 4.12.2 of the terms of reference.		Queensland and Australian government approaches to cost benefit analysis. Modelling has been undertaken using the project scenario described in Appendix H to EIS Appendix O, Economic Impact Assessment.
R18028	S011	The economic impact report does not consider the loss of population and associated economic activity from the area when the project is over. The value assigned to these reversing benefits should be calculated to account for the longer-term change in value (i.e. should be the net effect of the boom and the decline).	EIS Appendix O	The analysis considers the economic changes expected from a 'without project' scenario, including the implications and costs of rehabilitation (EIS Appendix O, Economic Impact Assessment). The region will benefit from the project over the life of the project. At project closure, these benefits will cease to be delivered, but this does not constitute a net cost or loss to the region (as in the alternative scenario, the benefits would not be delivered).
R18029	S074	Please explain the logic behind only conducting economic modelling for the first 13 years (2014 to 2027/2028) of a 35 year project.	–	Economic impacts beyond 2027/28 were not modelled using computable general equilibrium (CGE) modelling as: • There is increasing uncertainty regarding the base case assumptions used over time. That is, the underlying assumptions regarding regional, Queensland, national and global economic and population growth and activity become increasingly uncertain the further into the future the modelling period extends. As such, the reliability of project related economic impacts compared to the base case become increasingly unreliable. • Economic impacts are expected to remain relatively stable once steady state production is achieved (until project close). This approach taken for the modelling is consistent with Queensland and Australian government methods.
R18030	S108	Arrow states that by the project not proceeding “economic benefits will not be realised” and that the cost benefit analysis assumes a discount rate of 15%. The case for the discount rate to be so high is not made.	EIS Chapter 21, Section 21.6	The cost benefit analysis provides analysis across four discount rates being 6%, 10%, 15% and 20% (EIS Chapter 21, Economics, Section 21.6). The analysis shows that at lower discount rates the net present value (being the difference between the present value of benefits and present value of costs at each discount rate) of the project is higher.
R18031	S024, S026, S081	The cost benefit analysis needs to include negative business impacts other than the value of foregone production, including higher costs of operation or closing of businesses resulting from labour constraints or increased input costs, or other.	EIS Chapter 21, Section 21.6	Impacts of labour movement between industries and pressures of increased input costs are captured within the computable general equilibrium (CGE) modelling. These results are used in the cost benefit analysis undertaken for EIS Appendix O, Economic Impact Assessment. The main findings of the assessment are presented in EIS Chapter 21, Economics, Section 21.6.

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R18032	S011	The economic impact report does not consider the value of lost opportunities in agriculture and other existing industries, which may not recover from the lack of resources or even be in existence (from lack of skilled labour, effects of exchange rate on export markets, access to water etc.) after the coal seam gas project is over.	EIS Appendix O, Tables 5.1 and 5.2	EIS Appendix O, Economic Impact Assessment, considers the potential draw of activity to the Surat Gas Project and its support sectors from other sectors of the economy, including agriculture, as well as effects of exchange rates. Tables 5.1 and 5.2 of EIS Appendix O, show that the Darling Downs agriculture industry is estimated to record a decline in output (compared to what would be expected to occur without the project) of 0.2% to 0.3%. This decline is not considered a sufficient reduction in agricultural output to affect the long term viability of the industry.
R18033	S015, S042, S074, S086, S110, S130, S153	A number of business owners are currently finding it difficult to maintain and source new staff and compete with the mining wages on offer. The EIS identifies high wages are offered to workers, but what happens after 2016/17 or once the project has ceased? The EIS does not adequately address mitigation measures and economic losses relating to the agriculture industry (including the increasing difficulty in attracting staff to the agricultural industry), particularly regarding wage competition from the growing mining and energy sector. Arrow should provide details on measures taken to minimise inflated market pricing in the region due to increased pay offered in mining related employment and define why the rate of pay is so much higher than other industries.	EIS Chapter 21, Section 21.4.3 SREIS Attachment 3, Section 2.5	Noted. EIS Chapter 21, Economics, Section 21.4.3 acknowledges that the project will increase real wages and place pressures on the local labour force. An average increase of 0.5% in real wages is expected and while notable, is not anticipated to destabilise the existing labour market in the region. Arrow will collaborate with state government, local council, local industry, industry organisations, and coal seam gas proponents to develop programs and strategies aimed at addressing issues of skill retention and back-filling vacancies as a result of labour being drawn to the Surat Gas Project from other sectors (Commitment C320). As detailed in SREIS Attachment 3, Social Impact Management Plan, Section 2.5, Arrow has made a commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556).
R18034	S108, S117, S138, S142	It appears likely that the project will lead to a net loss of jobs once impacts on national employment and indirect job losses are accounted for. It also appears likely that the project will show a net economic detriment of over \$530 billion once non-market impacts are properly accounted for, such as the social cost of carbon.	–	The project is not estimated to result in a net loss of jobs at the national level. The demand for labour within the resources sector and supply chain are estimated to offset any draw down effects on other sectors due to competition for labour or exchange rate effects. The inclusion of non-market goods is not expected to result in an economic detriment. Carbon emissions are not a Queensland or Australian specific issue, but global. Global demand for energy resources suggests it is likely if the Surat Gas Project did not proceed, an alternative project would be developed elsewhere to meet demand. This would result in similar carbon effects (or potentially greater, if traditional coal technologies are used). On this basis, carbon emissions can be excluded from the assessment which examines the impacts to Queensland.
R18035	S081, S108, S117, S138, S142	The cost benefit analysis neglects total costs. None of the non-market prices are identified in the report so it is impossible to tell what was included. Non-	EIS Append H to Appendix O and appendices A to S	Appendix H to EIS Appendix O, Economic Impact Assessment acknowledges that non-market goods have not been included in the cost benefit analysis due to limitations in data. Inclusion of impacts on non-market goods/ services

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R18035	S081, S108, S117, S138, S142	<p>market goods for which there is robust valuation research includes vegetation loss due to land clearing and the economic impacts of climate change. An example is provided that shows the costs outweigh the benefits of the project.</p> <p>It is unlikely that the cost benefit analysis model has properly valued non-market goods and, if it did, it is likely that the project will be a significant net economic detriment.</p> <p>Even on the limited information provided, it appears likely that the project will lead to a net loss of jobs in Australia and a net economic detriment of over \$30 billion once all non-market goods are properly accounted for. Accordingly, the project will result in a large economic detriment and the EIS should not be allowed to proceed until it can sufficiently demonstrate otherwise (with all supporting information).</p>		<p>is not expected to materially alter the findings of the cost benefit analysis. Environmental impacts associated with the project were considered and assessed using scientific and other appropriate frameworks in separate environmental and social impact assessments undertaken as a part of the EIS (see EIS appendices A to S).</p> <p>With regards to inclusion of carbon emissions it should be recognised that carbon emissions are not a Queensland or Australian specific issue, but global. Global demand for energy resources suggests it is likely that if the Surat Gas Project did not proceed, an alternative project would be developed elsewhere to meet demand. This would result in similar carbon effects (or potentially greater, if traditional coal technologies are used). On this basis, carbon emissions have been excluded from the assessment which examines the impacts to Queensland.</p>
R18036	S025, S026, S040, S083	<p>The economic benefits to the state from this project are not proven and therefore the project should not be given approval to proceed. The only obvious on-shore benefit from the project is taxation receipts – principally state royalties and eventually the mineral resources rent tax.</p>	<p>EIS Chapter 21, sections 21.4 and 21.6</p>	<p>Noted. EIS Chapter 21, Economics, Section 21.6 presents the findings of the cost benefit analysis undertaken for the project which shows that the net present value of the project to the Queensland economy is approximately \$1.66 billion, assuming a discount rate of 15%. The economic benefits of the project were found to outweigh the costs across all discount rates examined. Potential economic benefits arising from the project include increases in industry output, gross regional product (GRP), increased employment and incomes in the Darling Downs and Queensland over the life of the project as well as in Queensland and Australian Government revenue (EIS Chapter 21, Economics, Section 21.4).</p>
R18037	S015, S040, S074, S109	<p>There are no detailed figures from Arrow or government departments about the financial return to Queensland from the project. Additional revenues of great proportions will be available to the governments but at what cost? The revenue will be short term only (production decline after 20 years), whilst agriculture should be there for the long haul.</p> <p>The EIS should provide transparent calculations upon which the estimation of royalty payments to the Queensland Government is based. The government coffers are the only obvious “other” beneficiary of the project, which explains the</p>	<p>EIS Appendix O, Section 5.6.3.2</p>	<p>EIS Appendix O, Economic Impact Assessment, Section 5.6.3.2 provides details of anticipated taxation revenues associated with the Surat Gas Project. On an average annual basis the Surat Gas Project is estimated to provide:</p> <ul style="list-style-type: none"> • The Queensland Government with additional revenues of approximately \$120.8 million per annum. This equates to an average annual increase in Queensland Government revenues of approximately 0.3% from the \$39.7 billion received in 2009-10 (Queensland Government, 2010b). • The Australian Government with additional revenues of approximately \$232.7 million per annum. This equates to an average annual increase in Australian Government revenues of approximately 0.1% from the \$298.9 billion received in 2009-10 (Commonwealth of Australia, 2010). <p>Estimates of royalty payments are indicative based on benchmarks for</p>

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R18037	S015, S040, S074, S109	government's unswerving support for mining projects.		industry as outlined EIS Appendix O, Economic Impact Assessment, Section 5.6.3.2. Research undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government indicate royalty payments for gas production typically average between 6% and 8% of the gas price.
R18038	S074	Please include a discussion of the range in royalty payments possible given the variability in future gas prices.	EIS Appendix O, Section 5.6.3.2	Royalty payments are levied on an ad valorem basis (i.e., based on a proportion of the value) and as such are a derivative of gas prices. It is not a requirement of the EIS terms of reference to identify the range of taxation and royalty revenues generated by the project. EIS Appendix O, Economic Impact Assessment, Section 5.6.3.2 provides indicative estimates for information purposes.
R18039	S081	It is not clear in estimates of government tax revenue if: <ul style="list-style-type: none"> • Reduced land tax and stamp duty from reduced values of agricultural land have been taken into account. • All of the eligible deductible expenses from royalty payments have been accounted for, such as the expenditure on roads. 	EIS Appendix O, Section 5.6.3	EIS Appendix O, Economic Impact Assessment, Section 5.6.3, states that land taxes and stamp duties were not estimated. It is not a requirement of the EIS terms of reference to identify the range of taxation and royalty revenues generated by the project. Indicative estimates for some key tax and royalty revenues have been provided for information purposes in Section 5.6.3.2 of Appendix O. Estimates of royalty payments are indicative based on benchmarks for industry (as outlined in Section 5.6.3.2), and implicitly include deductible expenses based on industry averages. Research undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government indicate royalty payments for gas production typically average between 6% and 8% of the gas price.
R18040	S024, S026, S081	If the cost benefit analysis has been undertaken at the state level, how are the revenues to Arrow considered a benefit when all profits are going off-shore (as Arrow is a wholly owned company in a 50-50 joint venture)?	EIS Chapter 21, Section 21.6	The cost benefit analysis considers all project related costs and revenues accruing within Queensland, consistent with standard practice for economic impact assessment (EIS Chapter 21, Economics, Section 21.6). If profits accruing to Arrow are excluded (as it is owned by an offshore company), so should all project costs which are paid by the proponent. Such an approach would go against standard accepted practice for cost benefit analysis.
R18041	S011	Even if Arrow contributes full compensation to infrastructure costs, this amount would be an expense deducted against taxes paid to government thus the net effect to the government remains a 'cost of the project'. This should be included in the cost benefit analysis.	EIS Chapter 21, Section 21.6	Taxes paid to government are developed based on a benchmark approach, and thereby implicitly capture deductions. The cost benefit analysis undertaken for the Surat Gas Project (EIS Chapter 21, Economics, Section 21.6) excludes taxes, as they represent a transfer payment between two parties without generating a genuine increase in economic activity. While this revenue to government can be spent in a manner to generate economic benefit, it is standard practice to exclude taxation revenue as there is potential for those paying the taxes to have used this money in an alternative manner, also capable of generating economic benefit.

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R18042	S074	The terms of reference (Section 4.12.2) requirement for practical monitoring regimes for all the identified economic impacts have not been included in Section 6, Appendix O. The word (or derivations of) "monitor" only appear twice in this section of the report. The terms of reference (Section 4.12.2) requirement of measuring the success of an economic mitigation strategy has not been included in Section 6, Appendix O.	EIS Chapter 21, Section 21.8 and Attachment 6, Table 1-10 SREIS Attachment 3	EIS Chapter 21, Economics, Section 21.8 and EIS Attachment 6, Social Impact Management Plan, Table 1-10 outline strategies and actions to mitigate identified economic impacts and the respective monitoring regimes associated with these measures. The updated social impact management plan (SREIS Attachment 3, Social Impact Management Plan) provides further details, including on how the success of various measures aimed at addressing socio-economic impacts of the project will be measured.
R18043	S074	Section 4.12.2 of the terms of reference requires the EIS economics chapter to analyse the "distributional effects of the project including proposals to mitigate any negative impact on disadvantaged groups". The term "disadvantaged groups" is not used or defined in Chapter 21 or Appendix O, therefore the requirements outlined in Section 4.12.2 of the terms of reference have not been met. Please review and update Appendix O and Chapter 21 so that all the requirements of Section 4.12.2 of the terms of reference are addressed in detail.	EIS Chapter 22, sections 22.6.3, 22.6.8, Chapter 21, Section 21.8 and Appendix O, Section 5.6 SREIS Attachment 3	Distributional impacts are examined in EIS Appendix O, Economic Impact Assessment, Section 5.6. Key groups affected, as identified in the analysis, include small business and agriculture, with labour draw a key factor. EIS Chapter 21, Economics, Section 21.8 outlines a range of commitments to manage project impacts on disadvantaged groups. These include for example, organising local supplier information sessions to inform business of Arrow's development plans, tender opportunities for local business and information on how to complete tender requirements (Commitment C361). Further discussion on disadvantaged groups is included in EIS Chapter 22, Social, Section 22.6.8. The project is likely to have a positive effect on socioeconomically disadvantaged groups through the creation of employment opportunities and the stimulation of local economic activity. Training and recruitment strategies that target the more disadvantaged sectors of the community, including Indigenous residents, will assist to maximise the positive influence the project will have on reducing socioeconomic disadvantage. Section 22.6.3, further identifies that the heightened demand for skills is likely to promote the expansion of education and training opportunities in the region. Providers of education and training, particularly in those fields required for the emerging resource-based industries, are likely to expand and improve on existing education and training services, particularly apprenticeships, vocational training, support for work readiness programs and pretrade training. The availability of such education and training initiatives is likely to enhance the employment prospects of local residents, including Indigenous people, youth, and the unemployed and disadvantaged sectors of the community. The updated social impact management plan (SREIS Attachment 3, Social Impact Management Plan) provides details of the full suite of commitments Arrow has made to addressing socio-economic impacts on communities, including disadvantaged groups. The Arrow social investment program (Brighter Futures) delivers community funding, sponsorships and partnerships to a range of organisations that support community groups.
R18044	S024, S026, S081	The cumulative cost benefit of the three other	EIS	The cumulative impacts of the project were considered in the EIS. The other

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R18044	S024, S026, S081	proponents without the Surat Gas Project needs to be assessed, to allow a proper assessment of the cost benefit of the Surat Gas Project to be determined.	Chapter 28, Table 28.1 and Section 28.3.10 and Appendix O, Section 7	three LNG projects (amongst other developments in the area) were included in this assessment as detailed in EIS Chapter 28, Table 28.1. Section 28.3.10 presents the findings of the cumulative assessment for socio-economic factors. EIS Appendix O, Economic Impact Assessment, Section 7, provides further details of the cumulative economic assessment. Mitigating the cumulative impacts of multiple projects being developed requires coordination of activities across project proponents, local, state and national governments, relevant economic and industry organisations, local business and the local community. Arrow is committed to working with other coal seam gas proponents and other industries in the project development area to identifying opportunities to reduce cumulative impacts.
R18045	S081, S108	The economic assessment in the EIS ignores the costs of greenhouse gas emissions. The absence of discussion of Scope 3 emissions arising when the gas is burnt is notable. The climate impact depends on the extent to which gas displaces other fossil fuels or, alternatively, adds to the aggregate use of such fuels. A preliminary calculation suggests that, if all emissions are additional, the welfare costs would exceed the economic benefits of the project calculated in the EIS.	EIS Chapter 10, Section 10.4.2 SREIS Chapter 6, Section 6.5	SREIS Chapter 6, Greenhouse Gas, Section 6.5 provides estimates for peak and cumulative Scope 1, 2 and 3 emissions on the basis of refinements in the project description. With regards to inclusion of carbon emissions in the economic analysis presented in EIS Appendix O, Economic Impact Assessment, it should be recognised that greenhouse gas emissions are not a Queensland or Australian specific issue, but global. Global demand for energy resources suggests it is likely if the Surat Gas Project did not proceed, an alternative project would be developed elsewhere to meet demand. This would result in similar carbon effects (or potentially greater, if traditional coal technologies are used). On this basis, carbon emissions have been excluded from the economic assessment which examines the impacts to Queensland.
R18046	S108, S117, S138, S142, S150, S163	A comprehensive review by Richard Tol found social costs of carbon through climate change to be \$30/tonne rising 2% each year. If that level is applied to the total cumulative emissions from the project (843 million tonnes of CO ₂) this would produce an economic impact of approximately \$35 billion. This amount clearly outweighs the \$1.66 billion the project is estimated to benefit the Queensland economy	–	Carbon emissions are a global issue, not a Queensland or Australian specific issue. Global demand for energy resources suggests it is likely that if the Surat Gas Project did not proceed, an alternative project would be developed elsewhere to meet demand. This situation would result in similar carbon effects (or potentially greater, if traditional coal technologies are used). On this basis, carbon emissions have been excluded from the assessment which examines the impacts to Queensland.
R18047	S017	Every operation that causes disturbance on an irrigated farm has severe economic impact.	EIS Chapter 2, Section 2.3 and Chapter 21, Section 21.4.7 SREIS Chapter 2, Section 2.1	Noted. Arrow recognises that some project activities will cause disruption to agricultural practices, particularly during construction and will agree compensation arrangements with landholders. In doing so, Arrow will fulfil the requirements of the Petroleum and Gas (Production and Safety) Act 2004 (Qld). New land access laws for petroleum activities came into effect in Queensland under the Act in October 2010 along with an associated Land Access Code (DEEDI, 2010a). The code sets out the minimum requirements for entry to land and requires that a conduct and compensation agreement be

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R18047	S017			<p>negotiated before a petroleum authority holder comes onto a landholder's property to undertake 'advanced activities' that are likely to have a significant impact on business or land use.</p> <p>EIS Chapter 2, Project Approvals, Section 2.3 and SREIS Chapter 2, Section 2.1, outline the requirements associated with the conduct and compensation agreements. Arrow will compensate landowners for any impacts of the project on productivity (EIS Chapter 21, Economics, Section 21.4.7). Such compensation will be through direct negotiation with landholders (Commitment C084). Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.</p>
R18048	S014, S044, S079, S108, S130	<p>The provision of food for centuries needs to be considered in the assessment of economic and social values associated with landholder properties. All efforts should be made to ensure that short-term industries, such as coal seam gas, do not grow exponentially at the expense of long term industries, such as agriculture.</p>	<p>EIS Chapter 13, Section 13.6 and Appendix F</p>	<p>Noted. Growth of the resources sector, including coal seam gas is expected to continue for some time as Australia's conventional gas resources deplete. This depletion has prompted exploration and development of alternative, unconventional gas resources including coal seam gas. Coal seam gas development was initially pursued to serve domestic markets and is evolving to serve export markets, principally through the export of LNG.</p> <p>The regional, state and national economies rely on several sectors including agriculture and resource development; Arrow is pursuing the Surat Gas Project on the basis that its activities can coexist with agriculture, rather than exclude it. This approach recognises the importance of the Darling Downs for agricultural food and fibre production (EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report). Arrow has made numerous commitments to minimising the impacts of the project on agricultural activities (EIS Chapter 13, Agriculture, Section 13.6) including those designed to protect good quality agricultural land, strategic cropping land and intensively farmed land.</p> <p>With a coal seam gas project life of around 25 years, agricultural activities will be able to continue unhindered in the long term.</p>
R18049	S031, S075, S077, S089	<p>The economic benefits for the area will be short term in comparison with the long term loss of water reserves, biodiversity and community well-being that will be inherited from living in a gasfield. The length of time for economic benefits is not mentioned, but the length of time for negative social impacts is considered 'short term'. Given the socially divisive nature of this industry elsewhere in Queensland, it is unlikely that the impacts are short-term.</p>	<p>EIS Chapter 21, Section 21.4 SREIS Attachment 3</p>	<p>EIS Chapter 21, Economics, Section 21.4 describes the economic benefits arising from the project such as increases in industry output, gross regional product (GRP), employment and incomes in the Darling Downs and Queensland through both direct and indirect impacts. These impacts are expected to be realised over the life of the project, being a period of approximately 35 years.</p> <p>The project has been developed so that environmental and socio-economic values are protected for future generations through analyses of potential project impacts and development of appropriate avoidance, mitigation and management measures to address these impacts. The social impact management plan prepared for the EIS, which includes commitments to manage socio-economic impacts has been updated as part of the SREIS</p>

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R18049	S031, S075, S077, S089			<p>process and is included in SREIS Attachment 3, Social Impact Management Plan.</p> <p>Arrow acknowledges it has a shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program.</p>
R18050	S017, S042, S048	<p>The EIS has not considered compensation to local businesses for the economic pressures endured by agricultural businesses. If such businesses are taken out of the industry (from inability to source employees due to the development of coals seam gas in the region), there will be increased financial pressure on agricultural landholders. Additionally if a landholder is inadequately compensated, it will in turn have a significant impact on individual businesses.</p>	<p>EIS Chapter 21, sections 21.4.7 and 21.8 and Appendix O, sections 5.1.2 and 5.6.1</p> <p>SREIS Attachment 3, Section 2.5</p>	<p>The impacts on business and industry (both beneficial and adverse), are discussed in EIS Appendix O, Economic Impact Assessment, sections 5.1.2 and 5.6.1 and include opportunities for local businesses to secure new contracts and increase sales.</p> <p>Arrow will compensate landowners for any impacts of the project on productivity (EIS Chapter 21, Economics, Section 21.4.7). Such compensation will be through direct negotiation with landholders (Commitment C084).</p> <p>EIS Chapter 21, Economics, Section 21.8 details a number of commitments Arrow has made to provide opportunities to local businesses and mitigate labour draw in the local area. These include:</p> <ul style="list-style-type: none"> • Collaboration with state government, local council, local industry, industry organisations, and coal seam gas proponents to develop programs and strategies aimed at addressing issues of skill retention and back-filling vacancies as a result of labour being drawn to the Surat Gas Project from other sectors (Commitment C320). • Collaborate with the existing job referral services set up by other proponents to make available information on positions vacant in local businesses with similar trade or skills requirements. This will allow applicants to choose between industry and non-industry jobs (Commitment C363). <p>The social impact management plan prepared for the EIS, which includes commitments to manage socio-economic impacts has been updated as part of the SREIS process and is included in SREIS Attachment 3, Social Impact Management Plan. Section 2.5 details, Arrow's commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556).</p>
R18051	S048	<p>It is immoral for landholders to suffer financially, while coal seam gas companies stand to make billions off their property.</p>	-	<p>Noted. Arrow recognises that some project activities will cause disruption to agricultural practices, particularly during construction activities. Compensation arrangements will be agreed with landholders.</p> <p>New land access laws for petroleum activities came into effect in October 2010 under the Petroleum and Gas (Production and Safety) Act 2004 (Qld)</p>

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R18051	S048			<p>along with an associated Land Access Code (DEEDI, 2010b). The code sets out the minimum requirements for entry to land and requires that a conduct and compensation agreement be negotiated before a petroleum authority holder comes onto a landholder's property to undertake 'advanced activities' that are likely to have a significant impact on business or land use.</p> <p>Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.</p>
R18052	S074	<p>Please update the EIS after consulting with the agricultural sector and develop a detailed and up to date understanding of the economic challenges currently facing the agricultural industry.</p>	<p>EIS Chapter 6, Section 6.3, Chapter 21, Section 23.1, Appendix O, Section 5.6.1 and Appendix B to Appendix O, Section 4.3</p> <p>SREIS Appendix 1, Appendix 14 and Attachment 3</p>	<p>Arrow has consulted with the agricultural sector throughout the development of the EIS. EIS Chapter 6, Public and Stakeholder Consultation and EIS Appendix O, Economic Impact Assessment identify the key stakeholders involved in these consultations. SREIS Appendix 1, Supplementary Consultation Report, provides an update of consultation undertaken by Arrow since the EIS was published.</p> <p>EIS Chapter 21, Section 21.3 provides details about the existing economic environment and values of the region. The section summarises the challenges being faced by the agricultural industry in the region with additional detail provided in EIS Appendix O, Economic Impact Assessment, Section 4.3.</p> <p>SREIS Appendix 14, Supplementary Agricultural Economics Report, provides further analysis of agricultural production and trends in the Darling Downs. SREIS Attachment 3, Social Impact Management Plan includes commitments to manage socio-economic impacts associated with the project.</p>
R18053	S081, S108	<p>GDP is an inappropriate measure of the economic benefits of a capital intensive project. It is more appropriate to consider impacts on Net National Income, excluding depreciation and income payments made overseas.</p>	-	<p>Gross domestic product (GDP; or gross state/ regional product) is a headline measure of economic activity within a country or region and is considered appropriate for assessing the economic impacts of the Surat Gas Project. GDP is widely used by national and state agencies as a measure of economic prosperity.</p>
R18054	S054, S150, S153	<p>A full cost environmental accounting of coal seam gas water disposal requires social and economic issues to be addressed.</p> <p>The SREIS should review economic issues involved in re-injection and beneficial re-use of coal seam water as well as the ocean outfall pipeline.</p>	<p>SREIS Chapter 3, Section 3.7 and Attachment 5</p>	<p>Noted. Arrow has developed a revised strategy for managing coal seam gas water (SREIS Chapter 3, Project Description, Section 3.7). The strategy (SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy) identifies a number of approaches to managing coal seam gas water including treatment, storage, beneficial use and disposal. The feasibility of these management strategies are being investigated further by Arrow. The chosen management options will be detailed in the coal seam gas management plan prepared as part of the application for an environmental authority (EA) or EA amendment.</p>

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R18054	S054, S150, S153			Arrow's coal seam gas water injection pilot trials are awaiting the grant of environmental authority. If this option proves feasible, details will be presented in later environmental authority application(s).
R18055	S011, S028, S088	The cost benefit analysis does not address the true opportunity costs of agriculture especially because the analysis does not account for in perpetuity production from properly managed strategic cropping land versus the loss of productivity when strategic cropping land is permanently alienated due to coal seam gas activities. The loss of soil productivity will mean a considerable loss of agricultural output for the region. This has not been factored into the cost benefit analysis.	EIS Chapter 21, Section 21.6 and Appendix O	Noted. The economic modelling carried out for the EIS (EIS Appendix O, Economic Impact Assessment) assumes that all agricultural production on land disturbed will cease, which is unlikely. Consequently, the cost benefit analysis (summarised in EIS Chapter 21, Economics, Section 21.6) takes a conservative approach to potential costs. Arrow is committed to providing appropriate compensation to affected landholders through the conduct and compensation agreement process. Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (see Commitment C084). Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in determining the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.
R18056	S108	The cost benefit analysis does not address the true opportunity costs of agriculture especially because the analysis does not account for in perpetuity production from properly managed strategic cropping land versus the loss of productivity when strategic cropping land is permanently alienated due to coal seam gas activities. The loss of soil productivity will mean a considerable loss of agricultural output for the region. This has not been factored into the cost benefit analysis.	EIS Chapter 21, Section 21.8, Appendix F and Appendix H to Appendix O	The cost benefit analysis presented in EIS Appendix H to Appendix O, Economic Impact Assessment) assumes impacted land will not be available for production during the life of the project, and will then be appropriately rehabilitated at the completion of the project. As stated in EIS Chapter 21, Economics, Section 21.8, Arrow will consult with landholders on the most appropriate method to minimise disruption to cultivation paddocks and loss of productive land in controlled-traffic paddocks (Commitment C088). Arrow will be flexible in determining the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.
R18057	S082	The economic contribution of agriculture has been understated. More meaningful figures on production and exports, not GRP, need to be supplied.	EIS Chapter 21, Section 21.3 and Appendix O SREIS Appendix 14	The contribution of agriculture to the regional economy is described in the EIS Appendix O, Economic Impact Assessment and EIS Chapter 21, Economics, Section 21.3. SREIS Appendix 14, Supplementary Agricultural Economics Report, provides further analysis of agricultural production and trends in the Darling Downs.
R18058	S123	More economic analysis needs to be given to the benefits of gas produced from wells in strategic cropping country against which there could be potential destruction of high producing cropping country and the potential to impact on existing	EIS Chapter 14, Section 14.6.5, Chapter 21 and Appendix H to Appendix O SREIS	The cost benefit analysis in Appendix H to EIS Appendix O, Economic Impact Assessment, (summarised in EIS Chapter 21, Economics) assumes land that is impacted is appropriately rehabilitated. The productivity of intensively farmed land should not be affected in the long term. Arrow has committed to a range measures to reduce potential impacts to

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R18058	S123	water supply for irrigation.	Appendix 14	existing irrigation water supply (EIS Chapter 14, Groundwater, Section 14.6.5), including where possible make-good measures such as substitution of groundwater allocations of equal or better quality to maintain user supply, deepening of bores, modification of pumps, or supply of groundwater from an alternative source (Commitment C147). Arrow will carry out corrective actions immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities (Commitment C038). SREIS Appendix 14, Supplementary Agricultural Economics Report, provides further analysis of agricultural production and trends in the Darling Downs.
R18059	S014, S044, S119, S123, S141, S144, S150	Investments for trading on global markets are made cognisant of a number of factors which include variable commodity prices, inherent land values, environmental constraints and resources (water and land) security. Development of a coal seam gas industry in farming planning matrix is not providing a supportive influence to any of these fundamental drivers for farming profitability. A more detailed assessment is required of the economic losses from potential losses to agricultural production. The discussion regarding economic losses should: <ul style="list-style-type: none"> • Use relevant and up to date data on agriculture and agricultural practices. • Address cumulative impacts. • Include loss of labour. • Take into account other factors (some of which are social), that affect landholders economic viability and/or profitability. 	EIS Chapter 13, Section 13.6, Chapter 22, Section 22.6, Appendix O, sections 4.3, 5.2.1, 7, Table 5.2 and Appendix P SREIS Appendix 14	Noted. Arrow recognises that there will be some disruption to agricultural activities over the life of the project. However, Arrow is pursuing the Surat Gas Project on the basis that its activities can coexists with agriculture, rather than exclude it. This approach recognises the importance of the Darling Downs for agricultural food and fibre production (EIS Chapter 13, Agriculture and EIS Appendix F, Agricultural Report). Arrow has made numerous commitments to minimising the impacts of the project on agricultural activities (EIS Chapter 13, Agriculture, Section 13.6) including those designed to protect good quality agricultural land, strategic cropping land and intensively farmed land. With a project life of 25 years, following decommissioning and rehabilitation activities, agricultural activities will be able to continue unhindered in the long term. Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure. Where this is not possible, impacts will be addressed through compensation. The economic and social impact assessments completed for the project have taken into account a range of other factors, such as commodity prices, land values, employment, labour skills and housing affordability (EIS Appendix P, Social Impact Assessment and EIS Appendix O, Economic Impact Assessment). In particular, the assessments cover: <ul style="list-style-type: none"> • Cumulative economic impacts to agriculture (EIS Appendix O, Section 7). • Estimates of the potential loss of labour in the agriculture industry as a result of the Surat Gas Project (EIS Appendix O, Section 5.2.1, Table 5.2). • Social factors affecting landholders are examined in EIS Appendix P, and in the findings summarised in EIS Chapter 22, Social, Section 22.6 and identify potential impacts such as demographic and employment changes, impacts on social and community cohesion, land use, rural character and lifestyle. The potential for these factors affects to impact on economic viability of business

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R18059	S014, S044, S119, S123, S141, S144, S150			<p>including agriculture are acknowledged in the economic impact assessment (EIS Appendix O).</p> <ul style="list-style-type: none"> As stated in EIS Chapter 21, Economics, Section 21.6, Arrow intend to avoid disturbing highly productive agricultural land and will consult with landholders on the most appropriate method to minimise disruption to cultivation paddocks and loss of productive land in controlled-traffic paddocks (Commitment C088). <p>An up-to-date overview of agricultural production in the Darling Downs is presented in SREIS Appendix 14, Supplementary Agricultural Economics Report. This report provides further analysis of agricultural production and trends in the Darling Downs, including analysis of 2010-11 agricultural statistics and discussion of the factors influencing the agriculture industry in the region. The analysis outlines that many of the issues currently facing the agricultural industry are similar to the issues outlined in EIS Appendix O, Economic Impact Assessment, Section 4.3.</p>
R18060	S074, S088, S110	<p>Chapter 21, Economics is not accurate in describing the economy of agriculture. Irrigated agriculture in the Condamine is not in decline. Floodplain land has increased in value. Additionally the statement that the agriculture, forestry and fishing sector is in “decline” is not correct. Though the sector’s growth in gross value added between 2006-2007 and 2009-2010 was significantly less than other industries, the sector did not experience negative growth. Therefore it cannot be said that the sector is in “decline”. A more long-term comparison of data over the preceding three year period is required.</p>	<p>EIS Chapter 21 and Appendix O SREIS Appendix 14</p>	<p>EIS Chapter 21, Economics, summaries the findings of EIS Appendix O, Economic Impact Assessment, which used the most up to date data on agricultural production and trends (including land values) available at the time.</p> <p>SREIS Appendix 14, Supplementary Agricultural Economics Report, provides further analysis of agricultural production and trends in the Darling Downs, provides a detailed up to date analysis of agricultural production and issues being faced in the Darling Downs, including agricultural trends around drought and flood.</p>
R18061	S108	<p>The following issues need to be considered in the assessment of economic and social values associated with landholder properties:</p> <ul style="list-style-type: none"> Costs associated with water quality change from the Great Artesian Basin and Condamine Alluvium. The make good measures are inadequate given the gaps in knowledge. Depreciation of land value. True value of the strategic cropping land in the project development area – vertosols are estimated to be worth \$10,000 to \$15,000 per ha. Therefore strategic cropping land would be worth more. Capital of farm machinery, roads and dams, etc. Costs associated with flood mitigation. 	<p>EIS Chapter 14 and Chapter 21, Section 21.9</p>	<p>Social and economic values specific to the Surat Gas Project were considered throughout the EIS, including:</p> <ul style="list-style-type: none"> EIS Chapter 14, Groundwater, Section 14.4, examines potential impacts of the Surat Gas Project on water quality from the Great Artesian Basin and Condamine Alluvium. EIS Chapter 21, Economics, Section 21.9 examines potential project impacts on land and property values. The analysis acknowledges the potential for the project to result in a decline in the value of some properties. The average value of production for all agricultural land in the Darling Downs is considered appropriate for inclusion in the economic analysis presented in EIS Chapter 21, Economics. Operational costs to landholders incurred through the presence of coal seam gas infrastructure on their properties will be managed through landholder agreements. As stated in EIS Chapter 21, Economics, Section

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R18061	S108			21.6, Arrow will consult with landholders on the most appropriate method to minimise disruption to cultivation paddocks and loss of productive land (Commitment C088). Arrow will be flexible in determining the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.
R18062	S011, S024, S026, S037, S040, S081, S150	<p>The term “market failure” should include economists’ failure to value environmental and ecosystems services in their measurement of GDP and business profits. Appendix H (Cost Benefit Analysis, pg. 138) has not quantified the potential social and environmental impacts of the project including:</p> <ul style="list-style-type: none"> • Noise, dust, travel times or safety. • Groundwater impacts, greenhouse gas emissions, tree clearing, or damage to any natural habitats within the development footprint. • Dollar values of the cost to the environment used in the cost benefit analysis. <p>If it is judged impossible to quantify these impacts, can a discount factor be applied to the net present value of the project?</p>	EIS Appendices A to S and Appendix H to Appendix O	Noted. Discounting has been applied to impacts examined in the cost benefit analysis (Appendix H to EIS Appendix O, Economic Impact Assessment). Social and environmental impacts were not included in the cost benefit analysis. However, these impacts are assessed in other sections of the EIS using appropriate risk frameworks (EIS Appendices A to S).
R18063	S108, S117, S138, S142	<p>It is not clear from the calculation of estimates of government tax revenue whether;</p> <ul style="list-style-type: none"> • Future royalties have been discounted to be expressed in net present values. • The losses in payroll tax from the jobs lost from other industries (such as the negative 746 full time equivalent jobs annually in agriculture and manufacturing) have been included in those calculations. • Reduced land tax and stamp duty from reduced values of agricultural land have been taken into account; and • All of the eligible deductible expenses from royalty payments have been accounted for, such as the expenditure on roads. 	EIS Appendix O, Section 5.6.3	EIS Appendix O, Economic Impact Assessment, Section 5.6.3 presents indicative estimates of tax implications of the project. Discounting has not been applied to these estimates. All estimates are based on computational general equilibrium (CGE) modelling results, use benchmarks of tax liabilities and implicitly are net of any deductions. As CGE modelling results are used, estimates of payroll tax include movement of labour from one job to another. As outlined in Section 5.6.3 of Appendix O, land taxes and stamp duties are not estimated.
R18064	S040, S081	Were “cost blowouts” and other variations such as low LNG prices and time delays associated with uncertainty in the future incorporated into the cost	EIS Appendix O	Economic modelling was undertaken using Arrow estimates of construction and operational costs (as well as rehabilitation). Sensitivity analysis of all inputs used in the cost benefit analysis was undertaken, with detailed results

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R18064	S040, S081	benefit analysis and to what extent?		presented in Appendix H, EIS Appendix O, Economic Impact Assessment. While the sensitivity analysis does not explicitly examine scenarios of cost blowouts, low LNG prices or time delays sensitivity testing of the value added activity implicitly captures these factors.
R18065	S017	Stating that the crops mentioned in Table 4.4 are major irrigated crops and minor irrigated crops is misleading as it depends on the value of the commodity.	EIS Chapter 4, Section 4.1.3, Table 4.4, Chapter 13 and Appendix F SREIS Appendix 14	The crops and livestock presented in EIS Chapter 4, Environmental, Social and Economic Context, Table 4.4 are typical of farming operations in the region and highlight the diversity of farming practices in the project development area. The table is not intended to describe the economic or commodity fluctuations. EIS Chapter 13, Agriculture and Appendix F, Agricultural Report provides further detail on specific crops. SREIS Appendix 14, Supplementary Agricultural Economics Report, provides further analysis of agricultural production and trends in the Darling Down, provides a detailed up to date analysis of agricultural in the Darling Downs.
R18066	S040, S089	The benefits of employment, taxation etc. are secondary benefits with varying rates of efficacy depending on who earns the wages and how the taxes are spent. For example, overseas workers will spend most of their wages off-shore and taxes are not necessarily spent beneficially. The rural area economic gains will be transient and negligible. Secondary benefits should not be included in the cost benefit analysis for the purposes of calculating net present value. Additionally, if the net values or profits in the cost benefit analysis are expatriated according to the company's (foreign) ownership, then the project's net present value from Queensland and Australia's perspective is effectively zero.	EIS Chapter 21, Section 21.6 and Appendices C and H to Appendix O	EIS Chapter 21, Economics, Section 21.6, presents the computable general equilibrium (CGE) modelling undertaken to support the analysis. It accounts for repatriation of incomes (wages and salaries) of workers to their place of origin. Company profits are also modelled as being repatriated overseas. Appendix C to EIS Appendix O, Economic Impact Assessment, presents the detailed methodology applied in the CGE modelling and Appendix H to EIS Appendix O describes the approach used, and details the cost benefit analysis.
R18067	S040	The benchmark discount rate used by the cost benefit analysis of 15% has the effect of favouring the quick income from coal seam gas mining and diminishing the large costs that might be associated with "making good" late in the project's life cycle. The preferences of future generations are better represented by the use of low discount rates.	EIS Chapter 21, Section 21.6, Appendix H of Appendix O	Noted. EIS Chapter 21, Economics, Section 21.6 outlines the cost benefit analysis undertaken for the project. It includes an analysis across four discount rates being 6%, 10%, 15% and 20%. The analysis shows that at lower discount rates the Net Present Value (being the difference between the present value of benefits and present value of costs at each discount rate) is higher. Further detail is contained in Appendix H to EIS Appendix O, Economic Impact Assessment.
R18068	S026, S081, S162	The economic need for the project has not been considered on a local scale where the impacts to	–	Given the scale of the Surat Gas Project, with gas fields extending across a number of local government areas, the economic analysis in Appendix O

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R18068	S026, S081, S162	agriculture on GQAL have been measured against the potential economic gains from gas extraction from these areas. The economic need has not been demonstrated.		(Economic Impact Assessment) examined the economic impacts at the Darling Downs regional level and Queensland level (and national, as appropriate). The economic analysis found that the Surat Gas Project is expected to result in an increase in economic activity across the Darling Downs region, over and above what would occur without the project.
R18069	S014, S040, S044	Does the cost profile include all the compensation payments to landholders for both lawful and unlawful impacts? The cost benefit analysis should look critically at whether compensation payments to landholders leave them "no worse off". If Arrow were to add in to the project costs compensation for every disruption and cropping loss caused by their activities on the Condamine Flood Plain, the viability of this project may be questionable. Alternatively, if landholders are undercompensated it will have a significant impact on individual businesses and net agricultural productivity at a State level.	EIS Chapter 2, Section 2.3 and Chapter 21, Section 21.6	Compensation payments are not presented in the cost profile. Compensation payments will be negotiated between Arrow and landholders on an individual basis and represent a transfer of monies between parties rather than genuine economic activity. As such are not included in the cost benefit analysis. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will be flexible in the location of wells and infrastructure. Where this is not possible, impacts will be addressed through compensation. EIS Chapter 2, Project Approvals, Section 2.3 outlines the legal requirements associated with the conduct and compensation agreements and EIS Chapter 21, Economics, Section 21.6, provides details of the specific commitments Arrow has made to avoid disturbing highly productive agricultural land. Arrow will be flexible in determining the location of wells and infrastructure. Where this is not possible, any lost productivity as a result of the project is expected to be offset or negated in financial terms.
R18070	S130	Employment will spread evenly to create the estimated peak of approximately 0.375%. Results of the generalised modelling are misleading. Proponent should complete further investigation and report on more detailed modelling of impacts on population, employment, workforce and wages specific to the Western Downs region.	EIS Chapter 21, Chapter 22 and Appendix P	Noted. Economic modelling has been undertaken for the EIS at the Darling Downs regional level (EIS Chapter 21, Economics). Localised impacts on population, employment and workforce are assessed in more detail in the Social Impact Assessment (EIS Appendix P). The findings of the social impact assessment are summarised in EIS Chapter 22, Social.
R18071	S108, S117, S138, S142	The lack of details in the economic models preclude any scrutiny or reliance on the purported economic benefits of the project. For example it is impossible to tell whether negative employment impacts have been taken into account in estimates of payroll revenue or whether road contributions have been deducted from gas royalties. Significant details of those models are also omitted such as the national employment impacts and disaggregated direct and indirect employment figures.	EIS Chapter 21, Chapter 22 and Appendix P	Noted. Economic modelling has been undertaken for the EIS at the Darling Downs regional level (EIS Chapter 21, Economics). Localised impacts on population, employment and workforce are assessed in more detail in the Social Impact Assessment (EIS Appendix P). The findings of the social impact assessment are summarised in EIS Chapter 22, Social.
R18072	S081	No reliance can be placed on the outcome of the economic impact assessment as insufficient information was provided on the source data,	EIS Appendix O, Section 3 and appendices C,D and H to	Noted. Appendices C and D to EIS Appendix O, Economic Impact Assessment present the methodologies applied in the economic modelling. Appendix O, Section 3 and appendices C, D and H to Appendix O present the

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R18072	S081	calculations, formulas, assumptions or methodology used to enable a meaningful review of the accuracy of those models. The 'black box' nature of the models relied on by the economic analysis preclude any sensible scrutiny of the output. Therefore the government can place no reliance on the economic impact analysis until the supporting data and calculations are provided.	Appendix O	assumptions and model drivers used. As some economic information regarding the project is commercial in confidence it cannot be presented in the assessment included in Appendix O.
R18073	S040, S081	The cost benefit analysis presented in Section 21.6 is inadequate and has exaggerated the economic prospects of Arrow's project; it is only half a page and only presents the net present value figures for a range of discount rates. No assumptions were provided in the cost benefit analysis including details of the cost and benefit streams from which the figures were derived. It is not possible to make a judgement about the rigour or appropriateness of the methodology and associated results from the cost benefit analysis without access to the data and modelling used by Arrow's consultants. The project should not be allowed to proceed until it can be sufficiently demonstrated (with all supporting information) that it will not result in a large economic detriment.	EIS Chapter 21, Section 21.6 and appendices D and H to Appendix O	EIS Chapter 21, Economics. Section 21.6 provides a summary of the findings of the cost benefit analysis completed for the project. Full details of the analysis are provided in Appendix H to EIS Appendix O, Economic Impact Assessment. The analysis methodology is discussed in detail in Appendix D to EIS Appendix O, Economic Impact Assessment.
R18074	S108, S117, S138, S142, S163	The EIS is inadequate in its assessment of the economic and climatic impacts of the proposed project.	EIS Chapter 10, Chapter 11, Chapter 21, and appendices D and O	Economic impacts of the project are presented in EIS Chapter 21, Economics, which summarises the findings of the economic impact assessment (EIS Appendix O, Economic Impact Assessment). The impact of climate on the project is assessed in EIS Chapter 11, Climatic Adaptation and EIS Chapter 10, Greenhouse Gas Emissions which summarises the finding of the Greenhouse Gas Impact Assessment (EIS Appendix D).
R18075	S011	The loss of production due to land disturbance has not been correctly calculated. The residual effects of coal seam gas development on agricultural enterprises may not be known for some time due to the recovery times for soil function including accumulation of organic matter mass, reestablishment of soil continuity structures (micro and macro pores) and desired surface levels. The latter relates to the extent of settlement of reinstated or reshaped soils and its effect on	EIS Appendix F and Appendix O	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Ground disturbed during the construction and operation of CGPFs and water

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R18075	S011	drainage patterns, water delivery structures and flood flows. The success of rehabilitation will determine the degree and extent to which the disturbed land will achieve pre-disturbance productivity. Therefore the cost benefit analysis makes an incorrect assumption that affected land will be rehabilitated to pre-project conditions.		treatment facilities may not be able to be restored to its former use. However these facilities are not proposed to be located on black soils and will be located on Arrow-owned (or leased) land. Site specific requirements will be identified as the development progresses, and infrastructure locations and rehabilitation requirements are determined and negotiated with landholders under Arrow's conduct and compensation agreement.
R18076	S108, S117, S138, S142	Virtually none of the source data, calculations, formulas, assumptions or methodology is provided to enable a meaningful review of the accuracy of those models (computable general equilibrium and cost benefit analysis models used in the report). Not all of the outputs of the models are reported either, such as national employment impacts. Consequently no reliance can be placed on the purported economic benefits presented in the Economic Impact Assessment. For example, it is impossible to tell what effective multipliers have been employed to calculate indirect or induced employment. The cost benefit analysis should be re done to account for quantified and further risks, and the economic section of the EIS updated and submitted for review before any project activities are approved. Issues that required amendment in other sections of the EIS should also be reviewed to ascertain their implications for the cost benefit analysis.	EIS Appendix O, Section 3 and appendices C,D and H to Appendix O	Noted. Appendices C and D within EIS Appendix O, Economic Impact Assessment present the methodologies applied in the economic modelling. Section 3 of EIS Appendix O, as well as appendices C, D and H within EIS Appendix O present the assumptions and model drivers used. As some economic information regarding the project is commercial in confidence it cannot be presented in the assessment included in Appendix O. Modelled impacts to employment at the national level, compared to the baseline scenario, are not significant due to the fixed domestic labour assumption used (i.e., total domestic labour availability does not change as a result of the project). Under this assumption, labour mobility between states is motivated by real wage differences. This assumption was used in EIS Appendix O, Economic Impact Assessment following discussion with the Queensland Government, to be in line with modelling undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government.
R18077	S150	Arrow needs to provide more robust discussion on "international demand" and "market failure" and provide research data that analyses the manner in which market forces influence decisions on coal seam gas production.	EIS Chapter 3, sections 3.1.1, 3.2 and 3.3	Information on the international gas and energy demand is set out in EIS Chapter 3, Project Need, Section 3.1.1. The discussion draws on sources such as the International Energy Agency and Australian Bureau of Agricultural and Resource Economics and Sciences. Sections 3.2 and 3.3 describe some of the market forces that influence demand and production.
R18078	S081, S108	Although the model is solved for the Australian economy, most results are reported only at regional and state levels. This is particularly problematic in relation to employment.	EIS Appendix O	Noted. Modelled impacts on employment at the national level, compared to the baseline scenario, are not significant due to the fixed domestic labour assumption used (i.e., total domestic labour availability does not change as a result of the project). Under this assumption, labour mobility between states is motivated by real wage differences. This assumption was used in EIS Appendix O, Economic Impact Assessment following discussion with the Queensland Government and is in line with modelling undertaken on the LNG

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R18078	S081, S108			industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government.
R18079	S024, S026, S040, S081	Uncertainty surrounds both the volume and price of gas going into the future. Given that the export gas prices are likely to be weak for at least 10 years, what assumptions were adopted, and has the declining profitability of LNG exports been considered in Queensland and Australia balance of payments projections?	EIS Appendix O, Section 3.2	The market price of any internationally traded commodity is subject to global demand and supply and as such is inherently uncertain. The economic impact assessment (EIS Appendix O, Economic Impact Assessment, Section 3.2) therefore uses a long term average price for LNG of between US\$8/million metric British thermal units (MMBtu) and US\$12/MMBtu to reflect this uncertainty. The balance of payments has been based on an assumed long term average price for LNG of between US\$8/MMBtu and US\$12/MMBtu. Note that prices in Japan for imported Australian LNG in 2012 were above US \$14/MMBtu.
R18080	S074	There is concern over Australia's LNG export growth and anticipated market prices being threatened by sliding gas prices in the US, and possible expansion of LNG exports to Asia from Canada, Mexico and East Africa (Chambers, 2010). Given this degree of uncertainty about future gas prices, a range of gas price scenarios should be investigated and modelled to adequately quantify and discuss the range of potential economic benefits/ costs of the project.	EIS Appendix O, Section 3.2	The economic impact assessment (EIS Appendix O, Economic Impact Assessment, Section 3.2) uses a long term average price for LNG of between US\$8/million metric British thermal units (MMBtu) and US\$12/MMBtu. Prices in Japan for imported Australian LNG in 2012 were above US\$14/MMBtu, highlighting that the economic assessment has allowed for LNG prices to fall to some degree over the longer term. The market price of any internationally traded commodity is subject to global demand and supply and as such is inherently uncertain. The range in long term average price for LNG (of between US\$8/MMBtu and US\$12/MMBtu) was used to reflect this uncertainty, and an average of US\$10/MMBtu applied to present an estimate of the economic impacts of the project.
R18081	S074, S081, S108, S117, S138, S142	The impact of a drop in gas price from \$US10/MMBtu to \$US8/MMBtu would reduce royalty payments to \$46.6 million per year which would barely cover the infrastructure upgrades the regions need to continue supporting existing industries and the rapidly expanding energy sector. The amount of money offers little compensation for the impact of the project on the agricultural industry, the environment and social fabric of the region. Using LNG production cost data for the GLNG project provided by the global investment bank Moelis & Company, a gas price of \$US10.68/MMBtu will yield a royalty payment that is 0.9% of the gas sale price. Based on a production rate of 970 TJ/day, royalties accruing to the Queensland Government at this gas price would total \$30.2 million/ year.	–	Noted. A decline in gas prices would very likely result in a reduction in royalty payments, which are a factor of wellhead value. Royalty payments will be subject to a royalty schedule agreed between Arrow and the Queensland Government. Research undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government indicates that royalty payments for gas production typically average between 6% and 8% of the gas price. Modelling undertaken for the Arrow Energy LNG Plant EIS (Coffey Environments, 2012a) indicates that in Queensland, wholesale gas prices could rise between 8% and 14% as a result of the combined operation of the Arrow LNG Project, QCLNG and GLNG projects, over the period 2020 to 2030. Note that while royalty payments will likely vary based on gas prices, infrastructure contributions will be agreed with government and councils and will be made by Arrow at the start of the project. These payments will not be affected by the gas price and will assist in the delivery and maintenance of infrastructure requirements.

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R18082	S074	Please review and update Section 7.3, Appendix O to include a discussion of all key potential impacts as identified on page 78. This includes impacts on gas prices (domestic and international) and security of supply.	EIS Appendix O, sections 5.11 and 7.2	EIS Appendix O, Economic Impact Assessment, Section 5.11 outlines the assessment of impacts on gas prices (including cumulative). EIS Appendix O, Economic Impact Assessment, Section 7.2 outlines that the impact on gas prices and security of supply is examined in a separate study appended to the Arrow LNG Plant Environmental Impact Statement (Appendix 22)(Coffey, 2012a).
R18083	S026	The project will contribute to further erosion of natural gas values. This will devalue the existing natural gas projects and threaten their long term financial viability, which in turn will impact on state revenue from royalties and taxes.	EIS Chapter 21, Section 21.4.1	Modelling undertaken for the Arrow Energy LNG Plant Environmental Impact Statement (Coffey Environments, 2012a) indicates that in Queensland, wholesale gas prices could rise between 8% and 14% as a result of the combined operation of the Arrow LNG Project, QCLNG and GLNG projects, over the period 2020 to 2030. The Surat Gas Project is estimated to contribute a total of \$1.69 billion in revenue to the Queensland and \$3.23 billion to the Australian Government respectively (EIS Chapter 21, Economics, Section 21.4.1).
R18084	S024, S026, S074, S081	Arrow should clarify where the information on “anticipated” or “likely” price of \$US10/MMBtu mentioned in the EIS was obtained and if this information was provided by an independent CSG/LNG market analysis. If not provided by an independent source, redo the economic modelling using gas prices sourced from an independent and appropriately qualified and experienced professional, with the source referenced appropriately. Also provide estimates of the sale price of LNG over the life of the project, the minimum sale price of LNG that this project can sustain to remain financially viable and justification of the economic analysis based on a gas price that is a reflection of “existing prices for LNG” when the project has a life span of 35 years.	EIS Appendix O, Section 5.6.3.2	Indicative estimates of royalty payments resulting from the Surat Gas Project are provided in EIS Appendix O, Economic Impact Assessment, Section 5.6.3.2 and are based on a long term average gas price of US\$10/MMBtu. These estimates are indicative based on benchmarks for industry as outlined in EIS Appendix O, Section 5.6.3.2. Research undertaken on the LNG industry by McLennan Magasanik Associates (MMA, 2009) for the Queensland Government indicate royalty payments for gas production typically average between 6% and 8% of the gas price. Detailed information on the expected sale price of LNG through the life of the project is commercial in confidence and will not be publically released.
R18085	S015, S024, S026, S027, S081	What will be the impact of the Surat Gas Project on other export industries including tourism, manufacturing, education and agriculture? These sectors may be disadvantaged economically due to the resource sector driving up the Australian dollar?	EIS Appendix O, Section 5.6.1	EIS Appendix O, Economic Impact Assessment, Section 5.6.1, acknowledges that a strong Australian dollar can have a negative impact on industries which sell their products and services overseas, as these products and services will be more expensive to foreign buyers (for example, manufacturing, some agricultural commodities and tourism-related sectors). There are also positive impacts associated with a strong dollar, such as assisting many businesses and households that purchase goods and services from overseas.

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R18086	S075, S077	The EIS lists increasing household incomes as a positive economic impact, however, the project will also increase the cost of living for those in the area by the same amount.	EIS Appendix O, Section 5.6.2 SREIS Attachment 3	Noted. EIS Appendix O, Economic Impact Assessment, Section 5.6.2 outlines potential project impacts on households and acknowledges likely increases in the cost of living. Residents of the Darling Downs, Queensland and Australia are expected to be, on average, "better off" as a result of an increase in the real wage, which reflects an increase in wages and salaries above inflation. The social impact management plan prepared for the EIS includes commitments to manage socio-economic impacts in the project development area and has been updated as part of the SREIS process (SREIS Attachment 3, Social Impact Management Plan).
R18087	S024, S026, S081	What is the extent of the energy sector's and the Surat Gas Project's impact on the Australian dollar? Can Arrow provide estimates of the relative loss of revenues over the project life because of a high Australian dollar and has Arrow provided alternative scenarios of export income from the Surat Gas Project with varying values of the Australian dollar?	EIS Appendix O, Section 5.6.1	The Surat Gas Project will produce gas for the export market. Given the scale of development it is realistic to expect this level of exports to support the Australian dollar over the medium to long term. A strong Australian dollar will assist many businesses and households that purchase goods and services from overseas through potential effects of exchange rates on the price of these goods and services. However, a strong Australian dollar can also be a negative for industries which sell their products and services overseas, as these products and services will be more expensive to foreign buyers (for example, manufacturing, some agricultural commodities and tourism-related sectors).

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Issue No.	Submission No.	Issue	Reference	Responses
R19001	S002, S003, S004, S006, S009, S014, S018, S019, S020, S032, S037, S039, S044, S048, S050, S053, S055, S059, S064, S065, S067, S070, S071, S076, S085, S088, S096, S097, S098, S108, S114, S139, S140, S149, S152, S154, S167	Concerns were raised in relation to the negotiation of compensation agreements, including the high degree of uncertainty in the EIS being incompatible with the negotiation of agreements, negotiations being done in confidence, the inability to estimate the loss of production caused by the inconvenience of roads and production wells on property and intensive cropping and the need for one party to yield to another in the negotiations. In addition, it was requested that compensation amounts should be calculated by an independent assessor, that the regulator condition the issues related to site specific impacts, rather than leaving it to the landholder to negotiate and that landholders be provided with a comprehensive list of all of the various issues that must be discussed in negotiating an agreement.	–	New land access laws came into effect on 29 October 2010 under the Petroleum and Gas (Production and Safety) Act 2004 and provide a standard form for compensation agreements. This will assist in creating greater consistency between agreements. Arrow discusses compensation in confidence with individual landholders. The amount of compensation agreed depends on the level of activity conducted on a property and a range of other factors including the improved value of the land. Arrow uses valuers to assist in identifying the value of cropping and other agricultural activities and works with landholders to agree on appropriate compensation levels. Landholders also have the choice as to whether they wish to make their compensation agreement public, or may have an independent assessment carried out if they are uncertain.
R19002	S133	It is unclear whether Arrow intends to engage with individual landowners or with landowners as a group. Landowners need to feel that they are negotiating from an equal position as the proponent and feel their concerns are acknowledged and acted upon.	–	Arrow is required to negotiate conduct and compensation agreements with individual landholders in accordance with the Petroleum & Gas (Production & Safety) Act 2004 (Qld) and the mandatory conditions of the Land Access Code (DEEDI, 2010a). Arrow employs dedicated Land Liaison Officers to negotiate one-on-one with landholders.
R19003	S014, S017, S042, S044, S046, S048, S060, S067, S081, S108, S123, S134, S139, S153	Queries and concerns raised in relation to what landholders would be compensated for? For example landholder time, consultant costs, equipment costs, interruptions to farm operations, crop losses, impacts on lifestyle, amenity and property values, delays due to traffic, land that cannot be rehabilitated and accidents such as highly saline water escaping and causing soil damage. Concerns were also raised in relation to the adequacy of the compensation to be offered and the potential for landholders to experience economic losses due to the presence of coal seam gas infrastructure.	–	One of the key principles of the Land Access Code is that landholders cannot be worse off as a result of resource holders' activities being conducted on their land. Compensation will address the potential financial cost to an agricultural enterprise of lost productive land, reduced or lost productivity, and changed practices resulting in increased capital and operating costs. Arrow will work with landholders to agree on a compensation level before works commence. Tips for Landholders Negotiating Agreements with Resources Companies (DEEDI, 2010c) provides a detailed list of potential compensation and land access considerations for landholders when establishing conduct and compensation agreements.
R19004	S014, S044	Does Arrow provide thorough information regarding all activities that will ever be conducted on each landholder's property?	–	In accordance with Section 24 of the Petroleum and Gas (Production and Safety) Act 2004, Arrow must comply with appropriate notification processes and mandatory conditions of the Land Access Code (DEEDI, 2010a). These requirements include:

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R19004	S014, S044			<ul style="list-style-type: none"> • A description of the work program, including the extent and type of operations to be conducted and the duration of the program. • A description of vehicles and equipment to be used. • A detailed outline of the activity and a map including the location of fieldwork. • Proposed access routes and camp locations. • Any other relevant spatial information. • An overview of the environmental management plan including remediation/rehabilitation works. <p>The conduct and compensation agreement will also include the agreed list of activities, including location, the proposed work program and timing of activities proposed to be carried out on the land.</p> <p>These activities, once agreed, become the land access conditions that Arrow must abide to for that landholder. Arrow's Land Access Rule No. 2 requires that staff and contractors may "Only conduct activities that are approved within the access conditions".</p> <p>Should activities need to change, then Arrow is required to advise the landholder and negotiate further land access conditions. This would lead to a new or amended conduct or compensation agreement and a potential change in compensation.</p>
R19005	S079, S134	<p>What are the penalties or implications if a gas company deviates from a compensation agreement? Do breaches of these agreements get reported to a government authority and can anyone access this information?</p> <p>Arrow to detail what conditions will be put in place to ensure compliance with land access arrangements and to consider setting up a reporting line for land owners to report non-compliances with land access agreements.</p>	-	<p>In accordance with Section 24 of the Petroleum and Gas (Production and Safety) Act 2004, Arrow must comply with appropriate notification processes and mandatory conditions of the Land Access Code (DEEDI, 2010a). Compliance action can be taken against a resource authority holder who fails to comply with the mandatory conditions of the Land Access Code. Compliance and enforcement action is overseen by the Queensland Department of Natural Resources and Mines (DNRM) and may include reducing the area of a resource authority, imposing a new condition on a resource authority or a financial penalty.</p> <p>Concerns relating to breaches of compliance of the notification processes or mandatory conditions of the Land Access Code can be referred to the regional Mining Registrar or DNRM. Arrow would encourage landholders to first raise any issues of concern with the company.</p> <p>Arrow also has an internal process for handling of Land Access Condition breaches which must be followed. A breach of an access condition is a breach of Land Access Rule No 2, 'Only conduct activities that are approved within the access conditions'. Breaches and consequences are reviewed by an Arrow Senior panel.</p>
R19006	S014, S044, S060, S079	<p>A conduct and compensation agreement should be put in place before any entry onto properties to ensure the landholder is compensated for the interference to business and privacy.</p>	-	<p>Noted. In accordance with Section 24 of the Petroleum and Gas (Production and Safety) Act 2004, Arrow must comply with appropriate notification processes and mandatory conditions of the Land Access Code (DEEDI, 2010a). By legislation, a conduct and compensation agreement needs to be</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R19006	S014, S044, S060, S079	Stakeholder requires information on the process for weekly visits and if this process is decided in conduct and compensation agreements.		in place before a resource authority holder can come onto a landholder's property to undertake advanced activities (defined as activities that are likely to have a significant impact on a landholder's business or land use). As part of this process, property access requirements for infrastructure maintenance will be discussed and notification requirements agreed with the landholder.
R19007	S079, S118	In areas where neighbours are close together there is the inability to redress for damages against a neighbouring property by an adjoining landowner, caused by the activities of Arrow, thereby impacting the rights of a neighbouring property. This is further complicated by the long time frame of the gas project and recovery phase. What happens when infrastructure is placed on neighbouring properties but causes adverse effects on a connecting property i.e. what compensation can be sought, who is liable and who is to rectify the environmental damage?	-	Arrow has developed a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This will assist in balancing individual needs of landholders with the needs of neighbouring properties and the broader agricultural community. Area Wide Planning considers the potential impacts of coal seam gas infrastructure on neighbouring properties including overland flow.
R19008	S141, S144	The development should be conditioned to ensure landholders are made fully aware of the potential field design of the coal seam gas activities on their farm so that they can consider this impact in conduct and compensation agreements.	-	Yes. Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084). A plan will be included in the conduct and compensation agreements with each landholder which shows the agreed location of infrastructure. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Arrow will negotiate the location of wells and infrastructure with landholders and address impacts with compensation.
R19009	S014, S044	To date there has been no details provided on how Arrow proposes to 'add value' to our existing enterprises. For the commitment [C081] to be of any worth the supplementary report to the EIS must provide further details on how this will be achieved.	-	Arrow proposes to add value to an existing enterprise by measures in addition to financial compensation (which addresses loss of income from affected land). Through negotiation with landholders, Arrow may also be able to provide improved tracks on their properties, additional grids etc., that can be left in place once Arrow's activities are concluded.
R19010	S015, S042, S048, S062, S161	Concerns raised over the economic impacts on local businesses from the project and the lack of adequate mitigation measures in the EIS to manage potential impacts. Queries raised on whether Arrow propose to compensate local businesses for impacts such as extra time required to complete jobs resulting from the need to avoid travelling over project infrastructure with heavy	EIS Chapter 21, Section 21.8 and Chapter 25, Section 25.4.1 SREIS Attachment 3, Section 2.5	EIS Chapter 21, Economics, Section 21.8 and SREIS Attachment 3, Social Impact Management Plan, Section 2.5, outline the range of measures that Arrow will adopt to manage project impacts on local businesses. These include measures such as organising local supplier information sessions to inform businesses of Arrow's development plans, tender opportunities for local business and how to complete tender requirements and providing industry support organisations with the information that they require to assist local businesses to improve their skills base and respond to project needs.

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R19010	S015, S042, S048, S062, S161	machinery and losses from a reduction in area and potential damage to equipment from the construction of access tracks?		(Commitments C361 and C362). As set out in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1, limitations on weight are part of the risk assessment for the bearing of pipelines, which will be constructed in accordance with AS 2885.1-2012 (for high pressure gas pipelines) and AS 4130 PE Piping Systems and the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444)(for the gathering network). Property-specific requirements will be discussed with landholders during the negotiation of conduct and compensation agreements and pipelines will be designed to account for land use in accordance with applicable standards including the depth of burial which is influenced by traffic on the easement, e.g. heavy machinery.
R19011	S014, S044	In response to Appendix P, Table 6.2, entry 'reduction/loss of farm income'; while some landholders will be able to negotiate beneficial land access agreements and the project development will not result in any lost income, this cannot be assumed for all types of agriculture and land use. The proposed project development would result in significant crop losses and infrastructure impacts to farming operations on the Condamine flood plain which would be difficult to assess and result in lost income.	EIS Chapter 22, Section 22.8	Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. By law, a resource authority holder is required to compensate a landholder where resource activities carried out on private land have an impact on the landholder's business or land use. These compensation arrangements are in place so landholders are not financially disadvantaged by activities carried out on their property.
R19012	S028	How will the owners of the land, future generations and the wider community be compensated for agricultural losses due to placement of coal seam gas infrastructure?	EIS Chapter 13, Section 13.6	As set out in EIS Chapter 13, Agriculture, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity to agricultural land. Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084). Terms will be set out in conduct and compensation agreements with affected landholders. By law, a resource authority holder is required to compensate a landholder where resource activities carried out on private land have an impact on the landholder's business or land use. These compensation arrangements are in place so landholders are not financially disadvantaged by activities carried out on their property.
R19013	S048	Landholders should share in the prosperity of the gas companies that over-run their land without any real say in the matter.	-	Noted. Where infrastructure is proposed on private property, Arrow will consult and agree with landowners on the appropriate location for infrastructure and new access routes (Commitment C084). Terms will be set out in conduct and compensation agreements with affected landholders. By

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R19013	S048			law, a resource authority holder is required to compensate a landholder where resource activities carried out on private land have an impact on the landholder's business or land use. These compensation arrangements are in place so landholders are not financially disadvantaged by activities carried out on their property.
R19014	S048	By increasing the compensation received by landholders, some farmers may neglect their farms and live instead off their compensation payments.	–	Arrow has a responsibility to pay appropriate compensation in accordance with relevant legislation. It is at individual landholder's discretion how they use compensation.
R19015	S120	Compensation is requested for maintenance of roads with the increased heavy vehicle traffic resultant from coal seam gas activity.	–	Arrow will develop a road management strategy to manage any increased road maintenance requirements imposed by the project and provide developer contributions and head works charges for infrastructure (Commitments C374 and C377). Arrow currently contributes to Western Downs Council for upkeep and maintenance of roads and will continue to liaise with councils on potential project impacts on road infrastructure.
R19016	S153	Arrow should offer a socio economic package which has more of a focus on gas fields than the \$150 million package recently announced by the Queensland Gas Company.	SREIS Attachment 3	Arrow acknowledges it has a shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program. Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367). Arrow will work with government authorities such as EHP and relevant local councils to identify the most suitable mechanism to coordinate efforts across proponents and identify projects that may provide an equivalent offset or mitigation of impacts. Arrow will continue to consult with councils and the regional community consultative committee for their views on which social, community or recreational infrastructure in Western Downs region is being directly impacted by the project and the extent of this. Arrow will liaise with the relevant body to coordinate efforts across all proponents and identify opportunities that may potentially ease or mitigate impacts (Commitment C366). Further mitigation strategies and actions plans are provided as part of the social impact management plan developed for the project development area (SREIS Attachment 3, Social Impact Management Plan).
R19017	S130	Request a payment of \$150,000 (2 units) for the preparation of the application response in line with the Coordinator General's recent decisions for other projects. Western Downs Regional Council feel they must highlight the enormous time and	–	Noted.

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R19017	S130	effort used to respond to applications and in stakeholder engagement.		
R19018	S136	Queensland Police Service requests that Arrow consider the potential opportunity to contribute to case management costs to assist the Southern Police Region in managing submissions and assessments by allocating a dedicated person to perform this role.	–	Noted.
R19019	S161	What compensation will be provided to deal with the management of extra waste, in order to avoid further charges to rate payers and impacts to budgets of regional authorities?	EIS Appendix O, Section 5.6.3.1	Arrow will provide developer contribution and head works charges for infrastructure (Commitment C377). As set out in EIS Appendix O, Economic Impact Assessment, Section 5.6.3.1, the net impact to regional councils is expected to be neutral assuming fees and charges (e.g., headworks charges, developer contributions) are appropriately levied.
R19020	S042	What mitigation measures will Arrow implement to avoid negative impacts on the agricultural industry and other local industries?	EIS Chapter 13, Section 13.6 SREIS Attachment 3, Section 2	EIS Chapter 13, Agriculture, Section 13.6 and SREIS Attachment 3, Social Impact Management Plan, Section 2, outline the range of measures that Arrow will adopt to avoid and manage project impacts on agricultural and other local industries.
R19021	S119	Requests that Arrow clarify their camp policy and whether workers will be allowed to leave the camps when off-shift to visit and spend money in local towns?	SREIS Appendix 13	Most construction workers will be accommodated at temporary workers accommodation facilities (TWAFs) and will work days on / days off rosters and return to their normal place of residence during days off. As the TWAFs will be self-contained and often located in remote sites, there will be limited opportunity for interaction between many workers and the general community. A smaller number of construction workers and operations staff who move to the area will however bring economic benefits to the community. Updated workforce numbers are discussed in SREIS Appendix 13, Supplementary Social Assessment.
R19022	S155	Many student enrolments come from surrounding farm employee families. If landholders water declines and viable farming land is reduced or contaminated, employee numbers will also suffer. This will have a flow on effect and decrease student numbers.	EIS Chapter 14	The potential for the project to impact on groundwater, as described in EIS Chapter 14, Groundwater and SREIS Chapter 8, Groundwater, is not expected to result in population decline and therefore decline in local school enrolments. It should be noted that under the Water Act 2000 (Qld), Arrow is obliged to make good any impacts to landholder's groundwater bores. Potential population changes associated with the project are discussed in SREIS Chapter 14, Social.
R19023	S014, S044	To suggest that the impacts of land access will be dealt with through an Arrow land access officer is completely unacceptable. Will all land access officers be trained mental health professionals as	SREIS Attachment 3, Section 2.3	Land Liaison Officers are one mechanism developed as part of Arrow's Sustainable Development Policy, which identifies the importance of working with landholders. Initiatives in place by Arrow to build positive working relationships with landholders include: the implementation of a Land

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R19023	S014, S044	well?		<p>Management Policy; the adoption of a Land Access Compensation Framework, including land access rules; the appointment of Land Liaison Officers; and the development of a Constructive Community Engagement Policy. Arrow's land access officers are trained and vetted according to Arrow's policy. In many cases, Land Liaison officers live in the local area and have connections to the local land and community.</p> <p>When seeking to gain access to privately owned and operated land, Land Liaison Officers seek to establish an open and honest relationship with landholders with clear understanding of the agreement they are making with Arrow. Landholders are also encouraged by Arrow Land Liaison Officers to engage independent advisers for professional advice to satisfy their individual requirements or concerns.</p>
R19024	S015, S023, S035, S048, S051, S091, S092, S118, S139	<p>There is concern on the impact on everyday life and the loss of privacy, tranquillity and lifestyle. The subject of a loss of amenity has been swept under the carpet a little in the analysis. The presence of unknown persons on landholder's private space will be daunting, especially given some of the experiences undergone by other landholders where coal seam gas operations are active.</p> <p>The EIS does not address (or not address thoroughly enough), how coal seam gas activities affect the social fabric of communities and community social issues such as the fragmentation of pastoral and agricultural land. This impacts the future of farming lifestyle as this development may potentially deter the next generation of farmers. The 'rural lifestyle' will be disrupted with the general public being affected by continuous compressor noises, increased traffic on rural roads and disruption to farming operations from coal seam gas infrastructure. Arrow must be required to detail mitigation strategies for impacts on the rural lifestyle of affected landholders.</p>	<p>EIS Chapter 9, Section 9.6, Chapter 13, Chapter 18, Chapter 19, Section 19.4, Chapter 20, Chapter 21, Chapter 22 and Chapter 28, Section 28.3.8</p> <p>SREIS Chapter 7, Chapter 12 and Chapter 13</p>	<p>Noted. Arrow respects private property rights and recognises that properties are people's homes, as well as the source of their livelihoods. Potential issues and impacts pertaining to amenity, together with Arrow's proposed mitigation measures to address any issues which arise, are discussed in:</p> <ul style="list-style-type: none"> • EIS Chapter 13, Agriculture and SREIS Chapter 7, Agriculture. • EIS Chapter 18, Landscape and Visual Amenity. • EIS Chapter 19, Roads and Transport and SREIS Chapter 12, Roads and Transport. • EIS Chapter 20, Noise and Vibration and SREIS Chapter 13, Noise. • EIS Chapter 21, Economics. • EIS Chapter 22, Social. • SREIS Attachment 3, Social Impact Management Plan. <p>Arrow has committed to complying with established air quality (EIS Chapter 9, Air Quality, Section 9.6) and noise (EIS Chapter 20, Noise and Vibration, Section 20.6.1) criteria. As described in EIS Chapter 19, Roads and Transport, Section 19.4, at its peak, the project is anticipated to increase the extent of heavy-vehicle travel occurring on the district's road network by less than 2% of the existing (2009) levels. The total increase in traffic from all developments in the region is expected to be between 2% and 8%, equating to approximately two to four years of historical traffic growth (EIS Chapter 28, Cumulative Impacts, Section 28.3.8).</p> <p>Prior to commencing activities on private property, including EIS investigations, Arrow follows a protocol that involves advance communication with landholders, discussion on, and means of minimising potential impacts, and agreement on terms for access.</p>
R19025	S017, S027, S048, S067, S079, S081	There is concern over the loss of safety of property (e.g. machinery and livestock) and loss farmers' privacy and lifestyle due to unknown vehicles and	-	<p>Arrow respects private property rights and recognises that properties are people's homes, as well as the source of their livelihoods. Site access including planned activities and the notification required will be</p>

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R19025	S017, S027, S048, S067, S079, S081	people that will traverse land to access wells. What measures do Arrow propose to implement to keep landholders informed of who is on their farms at any given time?		negotiated with landholders and agreed upon by both parties as part of conduct and compensation agreements.
R19026	S002, S003, S009, S017, S018, S019, S020, S032, S034, S037, S039, S050, S053, S055, S059, S064, S065, S067, S069, S070, S071, S076, S085, S088, S095, S096, S097, S098, S114, S116, S139, S140, S152,	There is concern with safety issues surrounding drilling operations and strangers (workers and contractors) working in close proximity to children. Concerned this will impact on privacy and threaten freedom and lifestyle. A condition should be applied to ensure all workers and contactors entering a property have been subject to appropriate police checks including a "Working with Children" check.	EIS Chapter 25, Section 25.6.2	Arrow respects private property rights and recognises that properties are people's homes, as well as the source of their livelihoods. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 details a number of Arrow's commitments to personal safety including to develop and implement safety training programs for personnel and contractors, including induction training of new starters. Where applicable, this includes supervision requirements for drilling and construction activities (Commitment C442). The manner in which Arrow staff and contractors access a landholder's property can be negotiated as part of the conduct and compensation agreement.
R19027	S131, S133, S143	There is concern over social impacts to towns from rapid community and economic growth leading to demographic changes (a new social hierarchy). Recent studies indicating that fly-in, fly-out workforces create a masculine culture with an increase in single men, increased rates of drug and alcohol abuse, motor vehicle incidents and crime rates and a decline in community organisations. As the construction workforce is likely to consist of a significant proportion of males and be younger than the average age of 37. The social impact assessment has assessed the usual rise of unsociable behaviour as low as there will be limited interaction with the community. This assessment should be re-examined to reflect the potential cumulative impacts of a male construction workforce given the number of projects in the Surat Basin occurring at the same time. This is evidenced by: • Non-resident workers not being regulated by the informal social controls that traditionally characterise the architecture of rural life. Alcohol fuelled violence and social disorder is linked to some mundane working and living conditions. • Impacts of fly-in, fly-out/drive-in, drive-out arrangements on families and workers can include depression, family breakdown, alcohol and	EIS Appendix P, Section 6.5 SREIS Attachment 3, Section 2.7	EIS Appendix P, Social Impact Assessment, Section 6.5 outlines impacts of the project workforce on community cohesiveness. It notes that while there will be a large cumulative influx of non-resident workers into the area (predominantly during construction), there will be limited opportunity for interaction between many workers and the general community as many workers will be operating from remote sites and staying at self-contained temporary workers accommodation facilities (TWAFs). Few non-resident workers are likely to participate in community activities outside of their work shifts due to the length of shifts, the location of TWAFs and because recreation facilities are available at TWAFs. The updated social impact management plan (SREIS Attachment 3, Social Impact Management Plan, Section 2.7) contains a range of measures to address the potential for anti-social behaviour and other impacts associated with the fly-in, fly-out and bus-in, bus-out arrangements during construction. Arrow has committed to implement policies and programs to maintain the wellbeing of project personnel (Commitment C549). Programs to be considered include those relating to: • The provision of welfare and recreation facilities in TWAF's. • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAFs in line with guidance issued by Queensland Health. *At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies

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R19027	S131, S133, S143	substance abuse, family violence and financial difficulties. The EIS does not mention the significant community impact of community sense of safety and the increase in violence within the community.		will apply to the workforce whilst on Arrow sites and whilst engaged in Arrow work. Arrow is also aware that other groups are operating in the region on programs relating to road safety awareness, multicultural issues and domestic violence and is exploring opportunities to participate in these initiatives.
R19028	S015	The actual location of production facilities depend on results of exploration, land access, field planning and conceptual design. In this, where lie the rights of the present land holders? Might is right?	-	Arrow will seek to acquire land on which to place production facilities, or enter into long term lease arrangements for the use of land. Where infrastructure is proposed on private property (i.e., wells, gathering lines and access tracks), Arrow will consult and agree with landowners on the appropriate location for infrastructure and access routes (Commitment C084). Terms will be set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing and future land uses. Wherever possible, Arrow will be flexible in the location of wells and infrastructure and address impacts through compensation.
R19029	S081	The EIS does not consider the social impact at either the individual land owner level, or the community level, associated with the devaluing of land as a result of listing on the Environmental Management Register or Contaminated Land Register.	EIS Chapter 12, Box 12.1	Arrow activities with the potential to be classified as notifiable, and therefore require the land parcel to be listed on the Environmental Management Register or Contaminated Land Register, will occur in relation to the operation of central gas processing facilities and water treatment facilities. It is intended that all the properties identified for major facilities (such as compressor stations, camps, etc) are either owned by Arrow, or under a long term lease arrangement. Schedule 3 to the Environmental Protection Act 1994 (Qld) defines notifiable activities, which are also presented in EIS Chapter 12, Geology, Landform and Soils, Box 12.1. Under the Environmental Protection Act 1994 (Qld), Arrow is legally required to remediate any contamination caused by project activities wherever it occurs. Remediation goals include identifying proposed future land uses and will be determined as part of a Remediation Action Plan (RAP) which would be developed should land contamination occur. A validation sampling program will be conducted to verify that the site has been successfully remediated according to the objectives identified in the RAP.
R19030	S134	What standard says that wells can be located up to 200 m from a residence? Demonstrate how the safety of residents will be ensured when the proponents are this close. Arrow to identify standard that outlines wells can be located up to 200m from a residence and demonstrate how safety of residents will be ensured when the	EIS Chapter 20, Section 20.4.4 and Chapter 25, Table 25.3 SREIS Chapter 15	As set out in EIS Chapter 25, Preliminary Hazard and Risk, Table 25.3 and SREIS Chapter 15, Preliminary Hazard and Risk, minimum buffer distances will apply between wells and neighbouring land uses for the protection of people and property. Arrow's commitment to locate equipment associated with production wells and associated wellhead infrastructure at a distance of 200 m or more from a sensitive receptors (Commitment C311) has been developed to address a

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Issue No.	Submission No.	Issue	Reference	Responses
R19030	S134	proponents are this close.		range of issues including community concerns over proximity of infrastructure to people's homes.
R19031	S119, S143	Disagree with the impact assessment relating to positive social impacts from increased property prices. Why is the risk of rising accommodation costs not considered (e.g., in Table 22.11) nor options to mitigate this risk.	<p>EIS Chapter 22, Table 22.11, Appendix P, Section 6.7</p> <p>SREIS Attachment 3, Section 2.1</p>	<p>EIS Appendix P, Social Impact Assessment, Section 6.7 outlines the impacts from the project on housing and accommodation availability and affordability. The social impact assessment notes that increased rental and land prices are likely to have a positive impact on some sections of the community (i.e., homeowners) through increased returns if they were to sell their property or increase rent on rental properties.</p> <p>The social impact assessment also recognises that increased housing costs would reduce housing affordability, impacting on the ability of some groups within the community, including low income earners, disadvantaged groups, renters and others looking to enter the housing market.</p> <p>Impacts related to the risk of increased accommodation costs are presented in EIS Chapter 22, Social, Table 22.11 under Housing and Accommodation Availability and Affordability. These relate to:</p> <ul style="list-style-type: none"> • Increased house, land purchase and rental prices resulting in diminished levels of housing affordability. • High demand for hotel, motel, caravan park accommodation. • Reduction in availability of accommodation for low income and vulnerable groups including Indigenous groups. • Increased returns to existing residents through higher house, land and rental prices. <p>Arrow will consult with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548).</p> <p>Arrow has developed a range of initiatives to reduce the impact of the project on housing affordability (SREIS Attachment 3, Social Impact Management Plan, Section 2.1). These include:</p> <ul style="list-style-type: none"> • Provision of high quality temporary workers accommodation facilities (TWAFs) for the non-resident construction workforce. • Consideration for use of TWAFs during the project's operational phase. • Prior to decommissioning considering the use of TWAFs during the operational phase to ease housing demand in towns. • Continuing to collaborate with other proponents in the region and identifying opportunities to share temporary accommodation where possible for the construction and maintenance workforces. • Encouraging workers relocating to the area to move to towns better suited to growth. • Developing a Construction Workforce Accommodation Strategy and an Operations Accommodation Strategy. • Supporting government reviews on housing availability and affordability, and impacts on low income groups.

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Issue No.	Submission No.	Issue	Reference	Responses
R19032	S042, S075, S077, S119, S128, S143	<p>There is concern over impacts to local housing markets, shortages of accommodation, increases in property values and rent. The social impact management plan (SIMP) references housing assistance and support programs, including homelessness and crisis, and that these services are experiencing increased levels of requests currently. This issue hasn't been picked up in the Housing and Accommodation Availability and Affordability Action Plan of the SIMP.</p> <p>Is Arrow aware of the shortage of accommodation in Dalby, and the rising rents? The accommodation situation needs to be continually monitored as the situation is rapidly changing on a month by month basis.</p> <p>Low-income households and other vulnerable groups will be affected by lack of affordable housing.</p>	<p>EIS Chapter 22, Section 22.4.6</p> <p>SREIS Appendix 13</p>	<p>Noted. EIS Chapter 22, Social, Sections 22.4.6 discusses housing availability and affordability in areas such as Dalby and notes that large increases in demand for housing in this locality has resulted in rental prices increasing by more than 100%. The supplementary social assessment (SREIS Appendix 13, Supplementary Social Assessment) provides an updated assessment of housing and accommodation, availability and affordability.</p> <p>Arrow has developed a range of initiatives to reduce the impact of the project on housing affordability and availability. These include developing a Construction Workforce Accommodation Strategy and an Operations Accommodation Strategy, participating in initiatives related to housing affordability and working with key stakeholders including state government and councils to ensure that developable land is brought to market to meet demand (SREIS Attachment 3, Social Impact Management Plan).</p> <p>Arrow will provide accommodation advice services for workers and their families (Commitment C382) and will undertake an accommodation audit on a monthly basis during construction and operations to enable management strategies to respond to any changes in the market (SREIS Attachment 3, Social Impact Management Plan).</p>
R19033	S153	<p>The SEIS should describe how Arrow will improve local housing and infrastructure within the gas fields in order to mitigate against socio-economic impacts.</p> <p>This should include contributing to rural power and water systems, and providing large lot residential developments suitable for a rurally-based workforce rather than small lots in towns.</p>	<p>SREIS Attachment 3, Section 2.1</p>	<p>Arrow has proposed a range of initiatives to manage project impacts on local housing and infrastructure. These include negotiating a developer contribution and head works charges for infrastructure, developing a Construction Workforce Accommodation Strategy and an Operations Accommodation Strategy, participating in regional planning forums, and working with councils and infrastructure and service providers to manage potential impacts (SREIS Attachment 3, Social Impact Management Plan, Section 2.1).</p>
R19034	S134	<p>Arrow to undertake more research into the impacts on housing and accommodation including indirect and cumulative impacts.</p>	<p>SREIS Attachment 3, Section 2.1 and Appendix 13, Section 5.2.7</p>	<p>SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.7 provides additional information around housing impacts and demand. SREIS Attachment 3, Social Impact Management Plan, Section 2.1 details a number of Arrow's commitments to housing and accommodation. These include developing an Operations Accommodation Strategy 12 months prior to the commencement of operations. The strategy will identify the preferred approach for facilitating accommodation for the operational workforce based on the ability of the market to meet project generated demand and required market interventions to reduce adverse impacts on the community (Commitment C381).</p> <p>Arrow will also develop a Construction Workforce Accommodation Strategy (Commitment C378) three months after Financial Investment Decision (FID). The strategy will identify the preferred approach for facilitating accommodation for construction workers who relocate to the local area for the</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R19034	S134			<p>project, based on the state of the market to meet project generated demand and required market interventions to minimise adverse impacts upon the community. The strategy will also Identify opportunities to bring forward facilitation of housing intended for the operations workforce that can be used for the construction workforce.</p> <p>The strategies include supporting government reviews on housing availability and affordability and on impacts on low-income groups (Commitment C383) and working with key stakeholders to identify cumulative housing impacts. Arrow will consider supporting the intent of the Surat Basin Regional Planning Framework and work with state government, councils, building industry, realtors and other project proponents to identify co-operative strategies that address cumulative housing impacts and to ensure that developable land is brought to market to meet demand (Commitment C381). This ongoing communication will enable Arrow to better understand direct and cumulative impacts on housing and accommodation.</p>
R19035	S108, S119	<p>The operations workforce concept makes no provision for the construction of accommodation to allow the staff to live locally. Availability of existing housing is already stretched. Rents, house process and wages are already increasing making it difficult for residents not involved in the industry to financially cope. This is a major social impact on community sustainability and needs to be added to the development planning list as a significant social constraint.</p> <p>Arrow to reassess:</p> <ul style="list-style-type: none"> • The ability to access accommodation for local operations staff in Dalby and Chinchilla when both towns have acute accommodation shortages. • The potential to accommodate local staff in Cecil Plains and Millmerran as these towns have accommodation shortages. • Availability and affordability of local area staff in all communities given accommodation in western and rural towns is a significant issue. 	<p>EIS Appendix P, sections 3.5.2, 3.6.1 and 6</p> <p>SREIS Attachment 3, Section 2.1 and Appendix 13, sections 4.2 and 5.2.7</p>	<p>The social impact assessment discussed living costs and housing costs and availability in the project area and outlined anticipated impacts of the project in these areas (EIS Appendix P, Social Impact Assessment, sections 3.5.2, 3.6.1 and 6). A number of key indicators have been reviewed and updated using 2011 ABS census data as a part of the SREIS (Appendix 13, Supplementary Social Assessment, Section 4.2).</p> <p>Arrow's preference is to source operations and maintenance workers from the local area. These workers are assumed to have existing accommodation, while workers sourced from outside the local area will relocate and purchase, rent or share housing which may be facilitated by Arrow. New or additional housing stock will be considered to mitigate the impact of the project on the existing housing market. Until appropriate housing stock is established, Arrow will consider accommodating the operations and maintenance workforce in the temporary workers accommodation facilities to ease housing demand in towns, and providing accommodation advice services.</p> <p>As set out in SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.7, the Western Downs Regional Council Housing Strategy (KPMG, 2012) notes that by 2016, a year before the Surat Gas Project construction workforce is expected to peak, most towns, with the exception of Wandoan, will have sufficient land available to meet housing demand. SREIS Attachment 3, Social Impact Management Plan, Section 2.1, details Arrow's commitment to develop an Operations Accommodation Strategy 12 months prior to the commencement of operations. The strategy will identify the preferred approach for facilitating accommodation for the operational workforce based on the ability of the market to meet project generated demand and required market interventions to reduce adverse impacts on the community as much as reasonably practicable.</p>

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R19035	S108, S119			<p>Per Commitment C381, the strategy will consider:</p> <ul style="list-style-type: none"> • Continued participation in initiatives such as the Western Downs Regional Council affordable housing strategy. • Supporting the intent of the Surat Basin Regional Planning Framework and work with state government, councils, building industry, realtors and other project proponents to identify co-operative strategies that address cumulative housing impacts and to ensure that developable land is brought to market to meet demand. • Providing incentives to private investors and developers of accommodation such as through head leasing agreements, rental guarantees. • Contributing to a government-sponsored community and affordable housing initiative. • Housing 'rent to buy scheme' option for workers.
R19036	S128	Requests more specificity of main stakeholder groups/ organisations for consultation concerning Housing and Accommodation Availability and Affordability Strategy.	–	Arrow participates as a member of the Western Downs Housing Trust Reference Group. This reference group includes members from Western Downs Regional Council, local community service providers and regional businesses. The role of the group is to identify housing affordability strategies.
R19037	S119	Given that housing assistance and support programs is an identified issue, Arrow to provide increased or new services that assist low to moderate income families and vulnerable groups to remain in existing rental housing in their community or access affordable rental housing in the region. Could be in collaboration with other LNG proponents who have developed programs.	SREIS Attachment 3, Section 2.1	<p>Arrow has committed to a range of measures to manage the project's impact on cost of living and housing affordability (SREIS Attachment 3, Social Impact Management Plan, Section 2.1). These include the development of an Operations Accommodation Strategy 12 months prior to the commencement of operations. The strategy will identify the preferred approach for facilitating accommodation for the operational workforce based on the ability of the market to meet project generated demand and required market interventions to reduce adverse impacts on the community (Commitment C381). Arrow will also develop a Construction Workforce Accommodation Strategy three months after Financial Investment Decision (FID) (Commitment C378). Arrow will continue to support government reviews on housing availability and affordability and on impacts on low-income groups, and contribute to government-sponsored community and affordable housing schemes. Arrow has also committed to continue to collaborate with other proponents to identify opportunities to minimise project impacts on housing availability and affordability (Commitment C380). Arrow will consult with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). This reference group includes members from Western Downs Regional Council, local community service providers and regional businesses.</p>

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R19038	S119	Arrow to provide more details of the housing 'rent to buy' scheme referred to in the EIS and how it will be targeted.	SREIS Attachment 3, Section 2.2	SREIS Attachment 3, Social Impact Management Plan, Section 2.2 identifies Arrow is considering a range of management and mitigation measures during the development of its Construction Workforce Accommodation Strategy (Commitment C378) and Operations Accommodation Strategy (Commitment C381). Should this potential scheme be included, further detail will be contained in the evolution of the social impact management plan and developed with consultation with relevant bodies.
R19039	S119	It is recommended that using housing rental markets in key locations of project footprint where vacancy rates are below 3% for families or share arrangements should not be considered. This could be considered if vacancies return above 3%. If Arrow begins to source private rental properties for the project workforce this must cease if vacancy rates fall below 3%. This should apply to all non-resident workers (Arrow employees and contractors).	SREIS Attachment 3, Section 2.2	The Department of Communities has suggested that an ideal rental market vacancy rate is approximately 3%. This rate is used more generally across the housing industry as an indicator with values below 3% indicating a constrained rental market. SREIS Attachment 3, Social Impact Management Plan, Section 2.2 identifies Arrow's commitment to develop a Construction Workforce Accommodation Strategy (Commitment C378) and Operations Accommodation Strategy (Commitment C381). Arrow will consult with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). The role of the group is to identify housing affordability strategies.
R19040	S136	Arrow should commit to discussions about the provision of temporary accommodation in the Dalby and Roma districts.	EIS Chapter 21, Section 21.8 SREIS Attachment 3, Section 2	EIS Chapter 21, Economics, Section 21.8 outlines Arrow's commitments towards accommodation for temporary workers including to accommodate workers required to construct camps in temporary accommodation wherever practicable (Commitment C322) and to consider building construction worker camps prior to construction of production facilities to minimise any impacts on property markets during early phase construction works (Commitment C321). SREIS Attachment 3, Social Impact Management Plan, Section 2.1 details Arrow's Construction Workforce Accommodation Strategy.
R19041	S119	For workers seeking to settle (potential for 39 houses per year across project footprint as per SIA) new or additional housing stock should be considered to mitigate impact on existing housing market.	SREIS Attachment 3, Section 2.1	New or additional housing stock will be considered to mitigate the impact of the project on the existing housing market. Should this need be identified, Arrow will work with key stakeholders to ensure that developable land is brought to market to meet demand; and to provide incentives to private investors and developers of accommodation, such as through head leasing agreements or rental guarantees (SREIS Attachment 3, Social Impact Management Plan, Section 2.1).
R19042	S119	Arrow to inform the tourism body and other peak	SREIS	Noted. Per Commitment C386, Arrow will inform the tourist body and other

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Issue No.	Submission No.	Issue	Reference	Responses
R19042	S119	business bodies of anticipated time frames for peak temporary accommodation demand.	Attachment 3, Section 2.1	peak business bodies of anticipated time frames for peak temporary accommodation demand (SREIS Attachment 3, Social Impact Management Plan, Section 2.1).
R19043	S128, S134	Request consideration of project timing and impacts of construction workforces and contract staff on local housing markets. SREIS should recognise, quantify and cost the provision of supplementary housing, health and social services in the region.	EIS Appendix P, sections 5 and 6 SREIS Chapter 3, Section 3.5 and Attachment 3	Noted. EIS Appendix P, Social Impact Assessment, Section 5 outlines the timing of peak workforce numbers and Section 6 considers the timing and duration of project impacts. SREIS Chapter 3, Project Description, Section 3.5 sets out details on revised project timing. Arrow will develop a range of initiatives to minimise the impact of the project on housing and accommodation (SREIS Attachment 3, Social Impact Management Plan). These include development of a housing strategy, provision of temporary workers accommodation facilities (TWAFs), and monthly accommodation audits.
R19044	S131	The department requests that the proponent ensure the selected camp sites will not have negative amenity or structural impacts on departmental properties as a result of the construction or operational use of the sites.	EIS Chapter 18, Section 18.6 and Appendix P, Section 5.4.1 SREIS Chapter 3, Section 3.6.8	The location of the temporary workers accommodation facility (TWAF) sites will be determined through a site selection process guided by a range of factors including design, environmental, social and cultural heritage constraints and the need to minimise commuting times to the work fronts. As a part of this process, Arrow will work to minimise disturbance to local communities and properties. EIS Appendix P, Social Impact Assessment, Section 5.4.1 provides further detail. Arrow has also committed to a series of mitigation measures related to the siting and screening of project infrastructure to minimise the impact on visual amenity (EIS Chapter 18, Landscape and Visual Amenity, Section 18.6). Additional information regarding TWAF sites has been included in SREIS Chapter 3, Project Description, Section 3.6.8.
R19045	S131	Certain disadvantaged groups within the community such as low income families, youth, seniors, people with a disability and Indigenous communities may experience undue hardship as a result of the negative consequences of growth; particularly in the area of affordable housing. Maintaining a liveable community will be essential to ensuring local towns in the Surat Basin can attract and retain a higher proportion of workers and their families as permanent residents. This will drive flow-on benefits for social and economic resilience and community vibrancy. It is recommended that more detailed mitigation strategies should be provided.	EIS Chapter 22, Table 22.11 SREIS Attachment 3, Section 2.1 and Appendix 13, Section 5.2.7	Noted. The EIS acknowledged the potential adverse impacts of the project on housing affordability and availability (EIS Chapter 22, Social, Table 22.11). SREIS Attachment 3, Social Impact Management Plan, Section 2.1, details Arrow's commitment to providing affordable housing options in the region. Arrow will consult with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). Arrow has developed a range of measures to manage the project's impact on cost of living and housing through the development of a Construction Workforce Accommodation Strategy (Commitment C378) and an Operations Accommodation Strategy (Commitment C381). Arrow's accommodation strategies consider support for a government-sponsored community and affordable housing initiatives and participation in initiatives such as the Western Downs Regional Council affordable housing strategy. Arrow will support government reviews on housing availability and affordability and on

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R19045	S131			<p>impacts on low-income groups (Commitment C383) and will continue to collaborate with other proponents in the region and identify opportunities to share temporary accommodation where possible for the construction and maintenance workforces (Commitment C380)(SREIS Attachment 3, Social Impact Management Plan, Section 2.1).</p> <p>Arrow recognises the importance of maintaining liveable communities in order to attract and retain workers as permanent residents. Arrow has a proactive approach towards community enhancement and community wellbeing and, as part of the Operations Accommodation Strategy, will consider a housing 'rent to buys scheme' as part of its housing strategy, to encourage workers to take up permanent residence in project area towns and drive flow-on social and economic benefits (SREIS Attachment 3, Social Impact Management Plan). SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.7 provides more detail regarding housing and accommodation.</p>
R19046	S131	<p>The social impact assessment outlines a mitigation that involves consulting with councils and the Consultative Committee to gauge what infrastructure is being impacted by the project. The department would like to ensure that the NGO sector is adequately represented to ensure that data and information is being provided in real time. Similarly, Arrow should be accessing hard data indicators to assess impacts throughout the project some of which are becoming more useable due to impacts progressively occurring through QGC and Origin developments.</p>	-	Noted.
R19047	S119	<p>When lodging Final Draft SIMP, Arrow to include where possible confirmation that mitigation and management strategies in individual Action Plans have been agreed by agency or key stakeholder. If this agreement is still being negotiated then include reference to consultation, liaison and negotiation or if yet to be started include current status as part of Action Plans. Where an agreement has been reached within Arrow as to budget commitments and/or agreement has been reached with stakeholders or Agencies for specific strategies, then where possible these should be included as part of commitment register or within action plans. In each action plan, where appropriate, include targets where these have been identified by Arrow</p>	<p>EIS Chapter 28, Table 28.1 and Figure 28.1 SREIS Attachment 3, Section 2.5</p>	<p>Noted. SREIS Attachment 3, Social Impact Management Plan (SIMP), Section 2, provides clear action plans developed or scheduled to be developed by Arrow for the Surat Gas Project. Table 3-1 details the stakeholder groups with particular interest in the SIMP who were engaged in the development of the SIMP and the strategies contained within the action plans. As the SIMP is a living document, it will continue to evolve and be updated following consultation with relevant stakeholders and government bodies as part of Arrow's stakeholder engagement program as discussed in SREIS Attachment 3, Social Impact Management Plan, Section 3 and Table 3-1.</p>

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R19047	S119	and/or where they have been negotiated with agencies or stakeholders.		
R19048	S131	The South West Region confirms that crisis accommodation is still required in both Toowoomba and Dalby. The Department recommends that the current Toowoomba Homelessness Community Action Plan be examined by the proponents in the context of potential mitigation strategies. This plan identifies actions to support and build on previous work and delivering better coordinated services that will deliver outcomes for homeless people or those at risk of homelessness in Toowoomba.	–	Noted.
R19049	S119	Requests Arrow explore the possibility of an accommodation subsidy or other support mechanisms. What is Arrows commitment to housing subsidisation for workers relocating into the region?	SREIS Attachment 3, Section 2.1	Arrow will develop a Construction Workforce Accommodation Strategy (Commitment C378) and an Operations Accommodation Strategy (Commitment C381) which considers, among other measures, a 'rent to buy' scheme and contribution to a government sponsored community and affordable housing initiative. This and other accommodation mitigation measures are listed in SREIS Attachment 3, Social Impact Management Plan, Section 2.1.
R19050	S119	All non-resident workers (Arrow employees, short and long-term workers associated with this project both direct and indirect) should be placed in temporary workers accommodation facilities (TWAF)'s to ensure hotels are not booked for extended periods. Commitment C384 should be amended to insert 'including major subcontractors' after 'visiting workers'.	SREIS Attachment 3, Section 2.1	Arrow will provide high-quality temporary workers accommodation facilities (TWAFs) for all non-resident construction workers, and will consider extending use of the TWAF for operations staff if required (SREIS Attachment 3, Social Impact Management Plan, Section 2.1). Arrow will have visiting workers stay in TWAFs rather than in hotel or motel accommodation where possible (Commitment C384) and continue to collaborate with other proponents in the region and identify opportunities to share temporary accommodation where possible for the construction and operations workforces (Commitment C380).
R19051	S119	Mitigation strategies need to be looked at to house workers at the Wandoan camp.	SREIS Attachment 3, Section 2.1	The location of the temporary workers accommodation facility (TWAF) in the Wandoan region will be determined through a site selection process that will consider factors including design, environmental, social and cultural heritage constraints and the need to minimise commuting times to work fronts. SREIS Attachment 3, Social Impact Management Plan, Section 2.1 details Arrows commitments and action plans around housing and accommodation including the development of a Construction Workforce Accommodation Strategy (Commitment C378) and an Operations Accommodation Strategy (Commitment C381).

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R19052	S133	The EIS needs to identify whether food will be produced and provided onsite for workers in the worker camps in accordance with Food Act 2006. Recommends healthy food be made available.	–	Food will be provided at workers' accommodation facilities. Any food produced and provided onsite (including camp kitchens) will comply with all relevant legislation including the Food Act 2006, which outlines the requirements for the handling and selling of food.
R19053	S133	The EIS has not adequately considered management of alcohol and tobacco and/or other drugs at accommodation camps. The proponent should consider the National Tobacco Strategy in eliminating harmful exposure to tobacco among non-smokers and the design the accommodation camps to encourage smoke free environments. Additionally the proponent should develop an Alcohol Management Plan to encourage safe and responsible consumption of alcohol, in accordance with Australian Guidelines to Reduce Health Risks From drinking Alcohol. A Code of Conduct should be developed as one strategy and provide information to employees about potential harms.	SREIS Attachment 3, Section 2.7	<p>Policies and codes of conduct relating to public and worker's health and safety will be developed for the project. These policies will be based upon Arrow's existing Code of Conduct and drug and alcohol policy, and will be developed prior to construction commencing. A number of strategies will be developed to manage issues relating to alcohol, tobacco and drug use in accordance with Arrow's comprehensive Health, Safety and Environmental Management System. SREIS Attachment 3, Social Impact Management Plan, Section 2.1 details Arrow's implementation of policies and programs to maintain the wellbeing of project personnel (Commitment C549). Programs to be considered include those relating to:</p> <ul style="list-style-type: none"> • The provision of welfare and recreation facilities in temporary workers accommodation facilities (TWAFs). • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAFs in line with guidance issued by Queensland Health. <p>*At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies will apply to the workforce while on Arrow sites and while engaged in Arrow work.</p>
R19054	S131	Commends the detailed project and workforce details that have been provided in the EIS.	–	Noted.
R19055	S026, S081, S119, S162	The EIS repeatedly acknowledged that there will be a skills shortage if the project were to proceed. Concerned that: <ul style="list-style-type: none"> • Job opportunities cannot therefore be considered to be a benefit of the project. • It will be difficult to recruit local workers in the Wandoan/Taroom area due to low unemployment rates. 	EIS Chapter 22, Section 22.6.3 SREIS Appendix 13, Section 5.2.2, Attachment 3, Section 2.5	<p>Arrow acknowledges that there are concerns relating to deepening the existing skills shortage and competition for labour in the region. EIS Chapter 22, Social, Section 22.6.3 notes that skill shortages in resource-oriented professions and construction trades are already becoming apparent, and therefore it is anticipated that only 15% of the construction workforce will be able to be found within the local population. Job opportunities are still a benefit of the project, with the creation of up to 2,070 and 400 jobs across the construction and operations phases, respectively (SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.2). The project will also stimulate local business opportunities, creating further direct and indirect employment. Arrow is also committed to</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R19055	S026, S081, S119, S162			provide industry support organisations with the information they require to assist local businesses improve their skills base and respond to project needs (Commitment C362) (SREIS Attachment 3, Social Impact Management Plan, Section 2.5).
R19056	S014, S019, S021, S027, S042, S044, S081, S088, S119, S153, S161	<p>Concern that the project will put additional pressure on the local agricultural industry and other local businesses in terms of finding and retaining suitable staff, dealing with a skills shortage and competing with higher wages offered by petroleum and mining companies. Request that further information be provided on:</p> <ul style="list-style-type: none"> • How Arrow expects that local businesses will be able to operate at full capacity with little or no staff? • What measures Arrow has in place for when the agricultural industry is unable to recruit employees? • What mitigation measures Arrow will implement to avoid negative impacts on the agricultural industry and other local industries? <p>On a more general level, there is concern that the pressures being experienced by the local agricultural industry and other local businesses will lead to a major influx of foreign workers and a greater portion of school leavers following careers in mining, creating a skills shortage in the agriculture sector for many decades.</p>	<p>EIS Chapter 22, Section 22.6.3</p> <p>SREIS Appendix 13, Section 5.2.4 and Attachment 3, sections 2.5 and 2.6</p>	<p>Noted. EIS Chapter 22, Social, Section 22.6.3 acknowledges that the project has the potential to cause local businesses to struggle to retain staff in the short term as higher wages are offered and that the loss of skilled workers to the project and other resource projects in the region may affect service provision, which may both affect the cost of services and the ability of businesses to meet demand. However, job opportunities are still a benefit of the project, with the creation of up to 2,070 and 400 jobs across the construction and operations phases, respectively (SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.4). The project will also stimulate local business opportunities, creating further direct and indirect employment. Arrow is also committed to provide industry support organisations with the information that they require to assist local businesses to improve their skills base and respond to project needs (Commitment C362) (SREIS Attachment 3, Social Impact Management Plan, Section 2.6). Arrow acknowledges it has a shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program. Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367). An example of this is the partnering with Dalby State High School. This partnership is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements. Attachment 3, Section 2.5, details Arrow's commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556). Higher wages will also stimulate local spending and create business opportunities, further diversifying the economy and improving resilience to externalities, such as drought and market fluctuations. In addition, a diverse range of skills and abilities will be brought to the area by new residents, including the partners and spouses of direct project employees relocating to the region. Arrow will continue to build on existing training and skills development programs, including apprenticeships, scholarships, vocational training, support for work readiness programs and pretrade training (Commitment</p>

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R19056	S014, S019, S021,			C353).
R19057	S014, S044	The social impact assessment states, "People who move to rural areas tend to have similar rural values to the existing population" which may be true. However, in the instance of this project the new workforce moving into the area will have particular skills and interests specific to the coal seam gas industry, not the agricultural industry. Food and fibre production also requires a specialised skill set.	EIS Chapter 22, Section 22.6.5 SREIS Attachment 3, Section 2.7	Noted. EIS Chapter 22, Social, Section 22.6.5 describes the potential for the project to impact on a number of community values. For instance, the influx of new residents who may not be from a rural background and may not be employed in rural occupations may be perceived as diluting the rural heritage of the community, leading to a change in the character and values of the community. SREIS Attachment 3, Social Impact Management Plan, Section 2.7 details a number of Arrow's commitments to community health and safety. Arrow will encourage resident employees and contractors to integrate and become involved in their local communities (e.g., volunteer work, participation in clubs and organisations) (Commitment C368).
R19058	S119	Arrow to provide more information regarding where the workforce is being located, including a breakup of upstream and downstream workforces.	SREIS Chapter 3, Section 3.6.8	SREIS Chapter 3, Project Description, Section 3.6.8 provides updated information on the accommodation for construction and operational workforces in the project development area. The downstream workforce requirements, including housing and accommodation and workforce locations has been assessed in the Arrow LNG Plant Project EIS, Chapter 26, Social, Section 26.5.4. The majority of the Surat Gas Project construction workforce will be accommodated in construction camps and the operational workforce in permanent housing within the project development area.
R19059	S119	Arrow assumes that 20% of the construction work force will be sourced locally. Please clarify what processes will be in place to ensure that local workers are able to access emerging employment opportunities and why the local area employment is capped at 20%?	EIS Chapter 22, Section 22.6.3 and Chapter 5, Section 5.5.7 SREIS Attachment 3, Section 2.5	Noted. The target of 20% local employment is based on the available manpower for the project residing in the local area, from Arrow's construction workforce modelling and the known skill shortages in resource-oriented professions and construction trades (EIS Chapter 22, Social, Section 22.6.3). Arrow is committed to a hierarchy of preferred employment, with the highest preference being given to people living in the study area (Commitment C349). This employment strategy is described in more detail in EIS Chapter 5, Project Description, Section 5.5.7. Arrow will maximise opportunities for potential local candidates by working with local employment and education/training organisations during the planning phase of the project to identify workers who would be able to obtain qualifications, and to provide training opportunities to candidates without the necessary industry-specific skills, who show a strong willingness to be trained. SREIS Attachment 3, Social Impact Management Plan, Section 2.5 provides a range of workforce and training commitments.
R19060	S015	The EIS (Executive Summary) states "Project employment will peak in 2015/17... with a generally downward trend experienced after the peak construction activity in 2016/17... Population is	EIS Chapter 5, Figure 5.10 SREIS Chapter 3, Section 3.6.8 and	At the time of publication of the EIS, peak construction workforce was expected to occur in 2015/17; with peak overall workforce (continuing construction and operations and maintenance) occurring in 2021 (EIS Chapter 5, Project Description, Figure 5.10).

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R19060	S015	anticipated to increase". Not great numbers to give much in employment growth locally so a decline could definitely be expected after 2016/17. Will families help in the population increase? Not so if the husband/father is accommodated in construction workforce camps, then families will remain in their present homes and see husband/father during his time off work.	Attachment 3, Section 2.1 and Appendix 13 Section 5.2.2	Based on the project description changes, project employment is now expected to peak in 2017 before gradually reducing by 2035 (SREIS Chapter 3, Project Description, Section 3.6.8). Arrow has committed to implement a hierarchy of preferred employment based on home location, with the highest preference being workers living locally. Arrow will encourage local population growth where it is desired and planned for, enforcing the expectation that non-local operations employees will relocate to the project development area as there are no plans to establish fly-in, fly-out or drive-in, drive-out operations (Commitment C334) (SREIS Attachment 3, Social Impact Management Plan, Section 2.1). SREIS Chapter 3, Project Description, Section 3.6.8 and Appendix 13, Supplementary Social Assessment, Section 5.2.2 provides updated estimates of peak workforce numbers required on the project. It is expected that the project will result in an increase in the residential population of up to 690 people during construction and 360 people during operation, which includes workers and their families.
R19061	S042	There is concern that mining personnel will find it hard to readjust to a reduced wage after the project has ceased.	SREIS Attachment 3, Section 2.5	Arrow will facilitate opportunities for workers to transition to other project phases and to assist workers in transitioning to other employment once the project ceases. Attachment 3, Section 2.5, details Arrow's commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556).
R19062	S074, S128	General concern regarding accuracy of workforce figures for the life of the project. For example, operational workers are assumed to reside in the region with approximately 50% assumed to be current residents. On what basis is this assumption made? And if it is not based upon historical employment data collected by Arrow, then justify why it isn't?	EIS Chapter 22, Section 22.6.3 SREIS Appendix 13, Section 5.2.2	SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.2 presents the estimated workforce requirements for the project. These are based on Arrow's construction workforce modelling and the known skill shortages in resource-oriented professions and construction trades (EIS Chapter 22, Social, Section 22.6.3). Estimates will continue to be refined through project planning and be informed by local conditions.
R19063	S015, S134	The construction workforce is likely to be predominately fly-in, fly-out due to the specialised nature of the work, and the short term duration of construction related roles, meaning many people involved in coal seam gas will not settle in the mining areas. This is also the case if workers have established homes elsewhere, the fly-in, fly-out method will be used and the benefits envisioned will not eventuate. SREIS should include the impact of fly-in-fly-out employees in the analysis of	EIS Appendix O, Section 5 SREIS Attachment 3, Section 2.5	The economic impact assessment for the project (EIS Appendix O, Section 5) considers the impact of fly-in-fly-out (FIFO) employees in the analysis of the employment impacts on the region. While the construction workforce will be predominantly fly-in, fly-out, a range of direct and indirect employment and business opportunities are likely to arise from their presence in the project area. Arrow is committed to inform council, development organisations, industry networks and government about goods and services required by the project, and to establish a service or network to connect local business and enable collaboration to meet supply requirements (SREIS Attachment 3, Social Impact Management Plan, Section

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R19063	S015, S134	employment impacts on the region.		2.5).
R19064	S136	Continue to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. Request that Arrow provides details of the locations of all worker camps to Queensland Police Service to be updated every three months and with a breakdown according to permanent/non-permanent residents.	SREIS Chapter 3, Section 2.1 and Attachment 3, sections 2.2 and 2.7	Arrow will continue to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning during the construction and operations phases of the project (SREIS Attachment 3, Social Impact Management Plan, Section 2.2). Updated information on the temporary workers accommodation facilities (TWAfs) is included in SREIS Chapter 3, Project Description, Section 2.1. In addition, the updated social impact management plan (SREIS Attachment 3, Social Impact Management Plan, Section 2.7) includes a commitment coordinate with relevant authorities (e.g., Queensland Police, Department of Transport and Main Roads and council) for movement of heavy or oversized loads. (Commitment C298), including TWAf vehicle movements.
R19065	S128	The target of 50% of local workforce may not be practicable and alternatives should be considered.	–	Noted. Arrow aims to fill approximately 50% of new operations positions for the project from within or near the local area, however workforce estimates will continue to be reviewed and refined in response to project planning and local employment market conditions.
R19066	S108	Arrow states that by the project not proceeding “job opportunities may be lost”. Arrow admits that a fly-in, fly-out workforce is needed because there is no pool of labour available within the region. However, this does not account for increasing agricultural productivity on farms with vertosols overlying the Condamine Alluvium, where this agricultural activity will continue to provide job opportunities for the region well beyond the timeframe of the coal seam gas industry.	EIS Chapter 21	Noted. Should the project not proceed, the potential direct and indirect job opportunities associated with the project would be lost. EIS Chapter 21, Economics, discusses the job opportunities and other economic benefits created by the project.
R19067	S108	How will the requirement for “suitably qualified and experienced persons” be assured and monitored? For example, there are concerns around: <ul style="list-style-type: none"> • Finding experienced workers who will abide by the environmental requirements during activities (e.g. that machinery is not permitted to leave the ROW). There should be penalties attached to breaching these conditions. • The limitation of licensed drillers to ensure correct well installation. • Are there enough dedicated DERM representatives with the knowledge to undertake 	SREIS Attachment 3, Section 2.5	Arrow acknowledges the importance of employing suitably qualified and experienced workers on the project and will work to achieve this through a number of means such as implementing training and skill development programs including: apprenticeships, scholarships, vocational training, support for work readiness programs and pre-trade training (SREIS Attachment 3, Social Impact Management Plan, Section 2.5).

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R19067	S108	the task? • Accurate determination of strategic cropping land. • Dam construction. • Water and soil chemistry to ensure suitability of irrigation with coal seam water.		
R19068	S119	Are there jobs for cultural heritage monitors within Arrow?	–	Arrow has committed to prepare CHMPs or equivalent agreements in accordance with the provisions of the Aboriginal Cultural Heritage Act 2003 (Qld) (Commitment C396). To meet this commitment and its legislative requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People. The engagement of cultural heritage monitors will be detailed in these ILUAs. Arrow also has an active Aboriginal and Torres Strait Islander Action Plan through which employment and training opportunities allied to cultural heritage management will be afforded to Aboriginal Party members associated with each particular agreement.
R19069	S131	The outline of implementation measures provides little information as to how local population growth will be encouraged, and how information and cultural awareness training will be delivered to overseas workers.	SREIS Attachment 3, sections 2.1, 2.5 and 2.7	SREIS Attachment 3, Social Impact Management Plan, sections 2.1, 2.5 and 2.7 provide details of Arrow cultural awareness training. This includes Arrow's commitment to encourage local population growth where it is desired and planned for, enforcing the expectation that non-local operations employees will relocate to the project development area as there are no plans to establish fly-in, fly-out or drive-in, drive-out operations (Commitment C334). Arrow will provide information and Australian cultural awareness briefing for overseas workers and their families on how to undertake day-to-day activities; for example, provide advice on banking and shopping (Commitment C335). This training will be delivered for overseas workers and their families as a part of workplace inductions and briefings. In addition, Arrow has committed to provide cultural awareness training to Arrow employees and contractors within three months of employment or engagement by the company. Arrow will include the following as objectives for the awareness and training programs: <ul style="list-style-type: none"> • Staff and contractors effectively engage and work with Indigenous people, suppliers and communities. • Indigenous staff are understood, respected and retained in the organisation. • Arrow maintains positive relationships with Indigenous communities (Commitment C553).

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R19070	S119, S130	<p>Arrow to develop a Local Industry Participation Plan in consultation with DEEDI and consistent with the Australian Industry Participation Plan. The Local Industry Participation Plan (LIPP) will need to be consistent with the Queensland Government's Local Industry Policy and associated guidelines and provide measures to address how they will procure and engage from local and regional businesses.</p> <p>In addition, Arrow should require their subcontractors to develop LIPPs in partnership with the Industry Capability Network and the Department of State Development, list all work packages on the Industry Capability Network database, engage with regional Industry Capability Network officers and DIP and agree with their subcontractors to provide the Industry Capability Network with the names and contacts of awarded contractors.</p>	<p>SREIS Attachment 3, Section 2.6</p>	<p>In June 2012, the newly formed Department of State Development, Infrastructure and Planning (DSDIP) initiated discussions with the Queensland Resource Council to investigate the development of a voluntary code of conduct for local content in private sector projects that would replace the requirement to develop a Local Industry Participation Plan (LIPP). Based on this initiation, Arrow requested that the Coordinator General remove the LIPP requirement on the Arrow LNG Project and accept that Arrow would comply through the development of an Australian Industry Participation Plan (AIPP). On 4 December 2012 the Coordinator General's office confirmed that: "The proponent should submit a copy of their full Australian Industry Participation Plan (AIPP) (refer to AusIndustry http://www.ausindustry.gov.au/programs/import-export/epbs/Pages/Australian-Industry-Participation-Plan1July2012-.aspx) with the final SIMP across all Arrow Energy EIS projects (Arrow LNG Plant, Arrow Bowen Pipeline, Bowen Gas Project and Surat Gas Project)".</p> <p>Arrow is committed to maximising opportunities for and minimising adverse impacts on local businesses. These commitments are set out in the social impact management plan (SREIS Attachment 3, Social Impact Management Plan, Section 2.6). Arrow has a Local Procurement Policy and will provide information to local businesses to assist them in maximising opportunities to service the project.</p> <p>Since the delivery of the EIS in 2011, Arrow has developed Commitment 358 and will implement the Australian Industry Participation Plan (AIPP), which provides detailed information about the strategies and approaches to be undertaken by Arrow to:</p> <ul style="list-style-type: none"> • Encourage contractors to source local goods and services where possible. • Encourage business to consider Indigenous procurement to maximise Indigenous employment opportunities. • Engage with key business bodies regarding appropriate opportunities for local businesses to supply goods and services to the project. <p>The AIPP was developed in consultation with the state government and is consistent with the Queensland Resource Council (QRC) Code of Conduct (Commitment C358).</p> <p>In addition to these measures, Arrow will continue to use the Industry Capability Network database for potential suppliers in the area (Commitment C359) and develop and maintain a business vendor register (Commitment C360).</p>
R19071	S119	<p>Requests an opportunity for local business to be skilled up to undertake decommissioning of wells and facilities.</p>	<p>EIS Chapter 22, Table 22.7 SREIS Attachment 3, Section 2.5</p>	<p>EIS Chapter 22, Social, Table 22.7 outlines that Arrow intends to source 100% of the workforce for well decommissioning and 90% of the workforce for the decommissioning of other facilities from the local area. Arrow is committed to provide industry support organisations with the information they require to assist local businesses improve their skills base to respond to</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R19071	S119			project needs (SREIS Attachment 3, Social Impact Management Plan, Section 2.5).
R19072	S119	<p>Does Arrow have a long-term commitment to the employment of apprentices and trainees to increase the development of the regional skills base of the 35 year life of the project? For example, suggest that Arrow should:</p> <ul style="list-style-type: none"> • Consider community programs that encourage first year apprentices to stay in non-LNG construction and complete their apprenticeship. • Commit to employing apprentices and trainees with Arrow and significant contractors, lessening the impact of poaching skilled workers from other employers. 	<p>SREIS Attachment 3, Section 2.5</p>	<p>Arrow acknowledges that it has an important role to play in training and employing apprentices. It is committed to implementing a training and employment program for local school leavers and implementing training and skill development programs including: apprenticeships, scholarships, vocational training, support for work readiness programs and pre-trade training (SREIS Attachment 3, Social Impact Management Plan, Section 2.5). Arrow has committed to provide opportunities for students and recent graduates, including:</p> <ul style="list-style-type: none"> • Graduate development program, offering a planned development path for newly degree-qualified employees. • Scholarships to first-year university students who want to pursue a career in the coal seam gas industry. • Vacation employment for undergraduates in their penultimate year of study, with 12 weeks' paid employment within the company. • School-based training for year 11 and 12 students in Dalby and Moranbah who want to gain vocational qualifications at the Certificate II level (Commitment C342). <p>Further to this Arrow will develop a policy identifying training pathways for students and school leavers to assist students in gaining employment upon graduation. The policy will be developed in consultation with Education Queensland. Where relevant training programs have been initiated by other project proponents, Arrow will consider coordinating support with these, where appropriate (Commitment C338).</p> <p>Existing Arrow training programs and initiatives include:</p> <ul style="list-style-type: none"> • Go Women in Engineering and Science and Technology (Go WEST), which conducts networking and/or mentoring activities for female staff and students and enhances collaborative partnerships between regional industry, Queensland Office for Women, local government and USQ Student Services. • Work with group training organisations and encouraging contractors to recruit and retain apprentices or trainees during operations. • Support for Dalby Agricultural Scholarships through a partnership with Dalby State High School, Arrow is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements. • Involvement in the CSG Industry/Schools Partnership with Education Queensland. The Program will deliver a suite of education programs and activities in selected schools in the Surat Basin to increase the awareness and knowledge of career opportunities in the coal seam gas industry or trades directly related to supply chain opportunities. <p>In addition, Arrow will provide industry support organisations with the information they require to assist local businesses improve their skills base</p>

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R19072	S119			and respond to project needs and provide greater opportunities for local businesses and their employees to benefit from the project (Commitment C362).
R19073	S119, S122, S131	There should be a solid commitment by Arrow and its contractors to employing, educating and training of Indigenous Australians, including local Indigenous worker percentage targets. More detail is required on the Indigenous Participation Plan within the SIMP such as when and how the plan will be developed and implemented. The plan should include more specific information on areas such as how the proponent will build a quality relationship with the local Indigenous community, provide mentoring, up-skilling and retention programs for new and existing Indigenous employees, tailor information on job opportunities to Indigenous people, identify recruitment strategies and employment targets for Indigenous people and support Indigenous businesses.	SREIS Attachment 3, Section 2.4	Arrow acknowledges that it has an important role to play in providing employment, education and training opportunities for Indigenous people. SREIS Attachment 3, Social Impact Management Plan, Section 2.4, includes a range of measures to provide project employment and education and training opportunities to Indigenous people and communities which have been developed since the EIS was presented in 2011. This includes a number of new commitments designed to highlights Arrow's ongoing efforts including: <ul style="list-style-type: none"> • Continue the Arrow Energy Whanu Binal project to provide assistance to Traditional Owners and other interested members of the Indigenous community to further develop business development, employment and training and workforce planning capacity and capability (Commitment C552). • Implement actions within Arrow's Aboriginal and Torres Strait Islander Reconciliation Action Plan (RAP) relating to educational opportunities for Indigenous students (Commitment C551). Existing initiatives include: <ul style="list-style-type: none"> – The Queensland Aboriginal and Torres Strait Islander Foundation (QATSIF), which includes support to 69 Indigenous students entering years 11 or 12 in 2013 through bursaries that cover school-related expenses such as uniforms, IT levies, and VET expenses. – The Yalari Foundation, which provides support to three Indigenous students commencing high school in 2013 to obtain education at a boarding school suited to their education and cultural needs. – Partnering with six Queensland universities (University of Southern Queensland, Central Queensland University, James Cook University, University of Queensland, Queensland University of Technology and Griffith University) to provide 25 scholarships to Indigenous students, including financial support, mentoring and peer support. – Encouraging Indigenous Australians to apply for Arrow's graduate program, vacation employment, traineeships and apprenticeships.
R19074	S119	Arrow mentions a Wandoan Camp. How will local workers be recruited in this area? Has Arrow taken into account the impact that Xstrata and Cockatoo Coal will have on the Wandoan community?	EIS Chapter 28, Table 28.1 and Figure 28.1 SREIS Attachment 3, Section 2.5	Arrow will utilise a range of strategies to recruit workers on the project. These include use of recruitment websites, local advertising and local recruitment agencies and participation in existing employment and training programs developed by the State and federal government (e.g. Critical Skills Investment Fund, Productivity Places Program; Indigenous Cadetship Support; Indigenous Employment Program; Skilling Queenslanders for Work Initiative) (SREIS Attachment 3, Social Impact Management Plan, Section 2.5). EIS Chapter 28, Cumulative Impacts, Table 28.1 and Figure 28.1 identify the Wandoan Coal Project. Cockatoo Coal (Woori project) is yet to publicly

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R19074	S119			<p>release their EIS and as such it is past the cut-off date for inclusion of cumulative impacts in the Surat Gas Project. The Cockatoo Coal project will be required to include the cumulative impacts of the Surat Gas Project in its EIS.</p> <p>Wandoan has received relatively small population change in the past decade. Given temporary workers accommodation facilities (TWAFs) will be self-sufficient, only 5% of the total construction workforce are expected to relocate across the total project description area and as Miles is likely to be the operations base for the drainage area, the potential impacts for Wandoan are not considered to be significant.</p>
R19075	S014, S044	<p>We request, the supplementary report to the EIS include a comprehensive study into the effects from "Loss of social connection to the land/agricultural production".</p>	<p>EIS Chapter 22, Section 22.6.4 and Table 22.11, Appendix P, sections 3.16 and 6.4</p>	<p>Noted. EIS Chapter 22, Social, Section 22.6.4 discusses farming communities strong connection to the land and the potential impacts associated with a break in that connection even if voluntarily. These impacts are further discussed in EIS Appendix P, Social Impact Assessment, sections 3.16 and 6.4.</p> <p>EIS Chapter 22, Social, Table 22.11 identifies loss of social connection to the land/agricultural production and presents a range of mitigation and management measures including:</p> <ul style="list-style-type: none"> • Engage closely with landholders to minimise impacts on their land and existing agricultural activities. • Continue to provide Community Officers, Land Liaison Officers and the 1800 free-call number, for people to ask questions or raise concerns about Arrow's activities. • Continue regular consultation with landholders through mechanisms such as the Arrow Intensively Farmed Land Committee.
R19076	S131	<p>Commends the detail within Appendix P specifically in reference to communication with departmental staff and issues highlighted.</p>	-	Noted.
R19077	S131	<p>SIMP Table 7-10 does not adequately address the negative affect on local Indigenous people. Under Land Use and Property, the "loss of social connection to land" for Indigenous people has the potential to be high and ongoing yet there is no mention of Indigenous in the Indicator/Target measures. The Department suggests that Indicator/Target measures and mitigations to do with "loss of social connection to land" be incorporated into the SIMP and also addressed in the CHMP development process.</p>	<p>SREIS Attachment 3, sections 1.2.8 and 2.4 and Appendix 13, Section 4.2.3</p>	<p>SREIS Attachment 3, Social Impact Management Plan, Section 1.2.8 highlights Arrow's principles on social responsibility including managing relationships with Aboriginal communities holding traditional connections or historical links to areas where they operate.</p> <p>Arrow has committed to prepare CHMPs or equivalent agreements in accordance with the provisions of the Aboriginal Cultural Heritage Act 2003 (Qld) (Commitment C396). To meet this commitment and its legislative requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The</p>

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R19077	S131			<p>remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People. The ILUAs address such issues as potential loss of native title rights and interests on account of developing the project. Arrow also has an active Aboriginal and Torres Strait Islander Action.</p> <p>Arrow continues to acknowledge that it has an important role to play in providing opportunities for Indigenous people. The social impact management plan (SREIS Attachment 3, Social Impact Management Plan, Section 2.4), includes a range of measures to provide project employment and education and training opportunities to Indigenous people and communities which have been developed since the EIS was presented in 2011.</p> <p>Appendix 13, Supplementary Social Assessment, Section 4.2.3, indicates the changes to the project description have increased opportunities for Indigenous participation in the Surat Gas Project.</p>
R19078	S108, S119	<p>The construction workforce concept for the project does not detail how Arrow will mitigate the impacts associated with a fly-in, fly-out workforce on the individual and community health, e.g. additional pressures on medical care facilities, additional traffic on the roads, deterioration of roads and potential for accidents with tired workers travelling to and from Dalby/Toowoomba airports etc. The EIS Impacts on infrastructure should include all hard and soft infrastructures.</p>	<p>EIS Chapters 5, 13 and 19, Appendix M and Appendix P, Section 6.6</p> <p>SREIS Chapters 3, 7 and 12, Appendix 8 and Attachment 3</p>	<p>Potential impacts on hard and soft infrastructure have been assessed throughout the relevant sections of the EIS using appropriate risk frameworks (EIS Appendices A to S). The outcomes of these assessments carried out by Arrow are included in EIS Chapters 9 to 28. Where updates to the project description or potential changes in impacts have been identified, further studies have been undertaken for inclusion in the SREIS (Appendices 1 to 14) and discussed in SREIS Chapters 1 to 15. Sections where relevant hard infrastructure have been examined include:</p> <ul style="list-style-type: none"> • EIS Chapter 5, Project Description and SREIS Chapter 3, Project Description (location of infrastructure, telecommunications, and project components). • EIS Chapter 13, Agriculture and SREIS Chapter 7, Agriculture (impacts and integration of infrastructure). • EIS Chapter 19, Roads and Transport, EIS Appendix M, Road Impacts Assessment, SREIS Chapter 12, Roads and Transport and SREIS Appendix 10, Supplementary Road Impact Assessment (impacts to roads and transport, including Arrow's commitment to assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the Department of Transport and Main Roads (Commitment C284). <p>Impacts to soft infrastructure have been assessed in EIS Appendix P, Social Impact Assessment, Section 6.6. SREIS Attachment 3, Social Impact Management Plan, is designed to capture mitigations and provide action plans to address potential impacts, including where applicable on hard and soft infrastructures.</p>

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R19079	S131	<p>The current SIMP does not include the extent of impacts on community services. It is suggested that some of the mitigation measures do not adequately cover the effects that will be felt by disadvantaged and low income groups. Social investments and community development activities outlined in SIMPs should seek to build the capacity of communities to undertake activities and minimise dependency on proponents. The SIMP could be re-examined to include mitigations around family support and counselling services as well as support for landholders. The region welcomes an opportunity to discuss the SIMP with the proponents in further detail.</p>	<p>EIS Chapter 22, Section 22.6.8 and Appendix P, Section 6.6 SREIS Attachment 3, Section 2</p>	<p>Arrow acknowledges it has shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to working to manage the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program. EIS Appendix P, Social Impact Assessment, Section 6.6 details the potential impacts and mitigations for community infrastructure and services as they are understood to date. Arrow will continue to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. Arrow will provide this information in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333). Discussion around disadvantaged groups is examined in EIS Chapter 22, Social, Section 22.6.8. Training and recruitment strategies that target the more disadvantaged sectors of the community, including Indigenous residents, would serve to maximise the positive influence the project will have upon reducing socioeconomic disadvantage. These actions and further actions around community investment and wellbeing, indigenous communities, community health and safety and local content are located in the social impact management plan (SIMP), located in SREIS, Attachment 3, Section 2. The SIMP has been developed for the project development area and will provide a means to monitor and report on issues such as potential impacts to disadvantaged groups. The SIMP supports ongoing management of the potential social impacts of the project and recognises the changing nature of impacts over the life of the project. The SIMP is adaptive and reassessed at regular intervals.</p>
R19080	S134	<p>Arrow to demonstrate the impact that water supply, waste removal and sewage treatment from the camps will have on rural water, sewerage and waste facilities of our communities, including Cecil Plains and Millmerran.</p>	<p>EIS Chapter 26, Section 26.6</p>	<p>Where available TWAFs will be connected to water sewerage and power. The capacity of existing services and any upgrades required to service the TWAF will be key considerations in the feasibility of connection to these services. Where unavailable or not feasible, on-site package water and sewage treatment and power generation will be required. Arrow will work with regional councils with regard to the management of project waste. Arrow will discuss these requirements, including options and the payment of user fees, prior to construction. EIS Chapter 26, Waste Management, Section 26.6 sets out the proposed avoidance, mitigation and management measures to achieve environmental protection objectives in regard to waste.</p>
R19081	S133	<p>The proponent provides no commitment to assist with service planning within the area. The</p>	<p>EIS Chapter 22, Section 22.8</p>	<p>Arrow will provide developer contribution and head works charges for infrastructure (Commitment C377). Arrow has made a number of</p>

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R19081	S133	proponent must commit and articulate clear actions on how they are going to address service planning issues within the area. Proponent is relying on state and local government departments to take exclusive responsibility for providing infrastructure and services. Any mitigation and management measures provided are described in vague terms making it difficult for the proponent to be held accountable as the project progresses.	SREIS Attachment 3	commitments (EIS Chapter 22, Social, Section 22.8), to planning in the areas in which it operates including: <ul style="list-style-type: none"> • Consult with councils and the regional community consultative committee for their views on which social, community or recreational infrastructure in Western Downs region is being directly impacted by the project and the extent of this. Liaise with the relevant body to coordinate efforts across all proponents and identify opportunities that may potentially ease or mitigate impacts (Commitment C366). • Collaborate with state government and local councils to assess the suitability of current planning arrangements to handle a likely increase in demand for industrial and commercial developments and to help them position themselves to reduce response times to planning applications, particularly as the number of planning applications is likely to increase (Commitment C331). • Continue to develop and implement Arrow's site-selection process for project facilities (such as integrated processing facilities and TWAFs) that considers the availability and capacity of existing utilities. Consult with councils and other utility providers during the project facility design process to understand existing capacity, and consider installing stand-alone utilities as required, to reduce demand on community utilities (Commitment C376). SREIS Attachment 3, Social Impact Management Plan has been developed for the project development area, which will monitor and report on the success of the above and additional actions. The social impact management plan is adaptive and reassessed at regular intervals.
R19082	S119	EIS to present more detail regarding where the projects are in relation to regional centres, and what the staffing requirements of the projects will be, thereby making it easier to identify towns to be impacted by population growth and additional demands on municipal infrastructure and services.	SREIS Chapter 3, sections 3.6.8 and 3.5	SREIS Chapter 3, Project Description, Section 3.6.8 outlines revised workforce numbers. Section 3.5 presents potential sites for four production facilities and a temporary workers accommodation facility. Further facility locations will be identified as the project progresses.
R19083	S133	Arrow should consider that local councils are preparing future planning schemes which will identify where future residential growth will occur and therefore where future sensitive receivers will be proposed.	–	Noted.
R19084	S130	The number of workers and contractors in camps on private tenures should be provided on a monthly basis to local council.	–	Noted.
R19085	S091	The haste in which the industry is proceeding results in negative impacts on communities.	SREIS Attachment 3	Noted. The social impact management plan has been updated and continues to be developed for the project development area (SREIS Attachment 3). The

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R19085	S091			plan supports ongoing management of the potential social impacts of the project and recognises the changing nature of impacts over the life of the project. The plan is adaptive and will be reassessed at regular intervals.
R19086	S014, S044	The supplementary report to the EIS should include a Social Impacts Assessment based on facts relating the projects impacts on groundwater, because all sections of the community have identified water impacts as issues of concern.	EIS Chapter 6, Section 6.6, Chapter 14 and Appendix G SREIS Chapter 8 and Appendix 4	The EIS identifies the community's concern regarding groundwater (EIS Chapter 6, Public and Stakeholder Consultation, Section 6.6). Impacts and results of groundwater modelling are located: • EIS Chapter 14, Groundwater and EIS Appendix G, Groundwater Impact Assessment. • SREIS Chapter 8, Groundwater and SREIS Appendix 4, Supplementary Groundwater Impact Assessment.
R19087	S119, S150	Arrow's statement that "a number of communities in the region" are benefitting from the development of energy resources needs to be supported by real data and research which compares both positive and negative impacts of the mining and energy industry on local communities. Project development in these communities will have a negative impact and provide no benefit. Arrow has been asked what the benefits are at community meetings in Cecil Plains and cannot answer this question.	EIS Appendix P, sections 6.3 and 6.5 and Appendix O, Section 5 SREIS Attachment 3, Section 2.3	Economic Impact Assessment, Section 5 discuss the economic benefits of the project. The project is expected to deliver an economic benefit to the local area through higher levels of employment, individual and household incomes, and business turnover as a result of up to 20% of the workforce being sourced locally during construction which will increase to up to 50% during operation. SREIS Attachment 3, Social Impact Management Plan, Section 2.3 details Arrow's acknowledgement of its shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program. Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367). Examples of social investment initiatives that Arrow is currently undertaking in the region are: • Education – Partnering with Dalby State High School. This partnership is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements. – Supporting the Ignition Project (Ignition), an initiative of the Queensland Police Service to address the increasing problem of youth boredom and inactivity in the Western Downs Region, inclusive of the townships of Dalby, Chinchilla and Tara. The initiative targets 11 to 19 year olds considered to be at risk. – Partnering with the Brisbane Broncos. This partnership has engaged over 1,400 students and residents in the Central Darling Downs region throughout 2012. It has delivered programs that focus on health, safety and education including the Brisbane Broncos Book Club, Coaching Clinics and Regional Fan Day.

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R19087	S119, S150			<p>– Working with the Endeavour Foundation to deliver the Stepping Stones Positive Parenting Program, Latch On tertiary learning program for young adults with a disability and a school holiday respite program for children with disabilities.</p> <ul style="list-style-type: none"> • Health and safety <p>– Braking the Cycle which provides disadvantaged young people in Surat with supervised driving practice under the guidance of a community volunteer to safely meet the 100 log-book hours required in Queensland to attain a driver's license. Braking the Cycle is a partnership with the Dalby Police-Citizens Youth Club (PCYC).</p> <ul style="list-style-type: none"> • Environment <p>– Partnering with the Condamine Alliance, the regional body for natural resource management in the Condamine catchment.</p>
R19088	S064	Will children now and in the future have the opportunity to farm on their rich productive soil where they live, or will the land be ruined and farming unviable because the precious water resource they rely on is drained.	EIS Chapter 13, Section 13.6	As per EIS Chapter 13, Agriculture, Section 13.6, Arrow believes that, through appropriate consultation with landholders and the broader community together with coal seam gas development planning, intensively farmed land and coal seam gas developments can coexist without causing permanent alienation of, or diminished productivity from, intensively farmed land. The potential impacts of the project to groundwater are described in EIS Chapter 14, Groundwater and SREIS Chapter 8, Groundwater. It should be noted that under the Water Act 2000 (Qld), Arrow is obliged to make good any impacts to landholder's groundwater bores.
R19089	S014, S044	The rural population will have to endure the worst of the project impacts. Some of these impacts will be un-compensable and of most importance, it must also be considered landholders will have no choice in whether or not they become involved with the project. Social impacts resulting from this must be considered.	–	Noted. Arrow will negotiate with every landholder on how coal seam gas infrastructure is developed on their property to integrate it with existing and proposed farming operations to the greatest extent practicable.
R19090	S014, S044	We request the supplementary report to the EIS describe the types of light industry that have been occurring for several years (as outlined in Appendix P) and identify, describe and quantify the relatively low community impacts that this light industry has had on the community. Provide the locations where the light industry has been occurring over the last several years. We request the supplementary report to the EIS defines what percentage of light industry is occurring on rural properties and what percentage is occurring in townships, or in close	EIS Appendix C, Section 3.2	As set out in EIS Appendix C, Air Quality Impact Assessment, Section 3.2, there is a presence of light industry including coal and gas fired power stations, coal/minerals mining, and industrial manufacturing. Coal seam gas production has also been established on a number of rural properties in recent years by Arrow and other companies.

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R19090	S014, S044	proximity to towns?		
R19091	S133	There is a significant inconsistency in the demography data (esp. household size, population, median rental cost) when compared with available government data.	SREIS Appendix 13, Section 4.2	Noted. At the time of preparing the EIS, Australian Census data from 2006 was the most recent census data available. SREIS Appendix 13, Supplementary Social Assessment, Section 4.2, provides an update of key demographic data in the region, including housing costs and population.
R19092	S014, S044	While the EIS provides the population of towns within and surrounding the project development area, there is no defined rural population within the project development area. It is most important that this population is identified because the issues and impacts that relate to this demographic are completely different to the urban population within the study area.	–	Noted. Title searches at the time the EIS was published identified 4,080 parcels of land within the project development area, owned by approximately 2,150 landholders. Notice of the EIS process was given to all landholders in accordance with Environmental Protection Act 1994 (Qld) (EP Act) EIS provisions.
R19093	S119	Arrow to add Toowoomba and Surat Basin Enterprise (TSBE) to the list of regional organisations.	–	Noted.
R19094	S131	Given that the Indigenous % of population exceeds the Queensland average for 5 of the 9 communities presented in Table 7-1, SIA p. 143, the SIMP should contain information about the key health statistics for Indigenous people living within the study area; and also their comparative socio-economic disadvantage and include proportion of indigenous students who have completed Year 10 and Year 12. The stakeholder engagement activities listed (SIMP p. 150 Stakeholder Engagement) make no mention of Indigenous engagement. Table 7.11 (p. 175 Stakeholder groups for SIMP) does not mention Indigenous stakeholders. Suggests that the SIMP include information about Indigenous engagement activities which have occurred to date and details about future engagement activity opportunities, e.g. the engagement mechanism and role of Indigenous people in the annual stakeholder review and SIMP annual reporting processes.	SREIS Attachment 3, Section 2.4 and Appendix 13, Section 2.4	Appendix 13, Supplementary Social Assessment provides updated data around persons identifying as Indigenous within the project development area. Since the preparation of the EIS, Arrow has advanced a number of actions to support the Indigenous community and Indigenous students (SREIS Attachment 3, Social Impact Management Plan, Section 2.4). Including a commitment to implement actions within Arrow's Aboriginal and Torres Strait Islander Reconciliation Action Plan (RAP) relating to educational opportunities for Indigenous students (Commitment C551). Existing initiatives include: <ul style="list-style-type: none"> • The Queensland Aboriginal and Torres Strait Islander Foundation (QATSIF), which includes support to 69 Indigenous students entering years 11 or 12 in 2013 through bursaries that cover school-related expenses such as uniforms, IT levies, and VET expenses. • The Yalari Foundation, which provides support to three Indigenous students commencing high school in 2013 to obtain education at a boarding school suited to their education and cultural needs. • Partnering with six Queensland universities (University of Southern Queensland, Central Queensland University, James Cook University, University of Queensland, Queensland University of Technology and Griffith University) to provide 25 scholarships to Indigenous students, including financial support, mentoring and peer support. • Encouraging Indigenous Australians to apply for Arrow's graduate program, vacation employment, traineeships and apprenticeships. Arrow consults and negotiates as required under the Native Title Act 1993

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R19094	S131			<p>(Cwlth) and Cultural Heritage Act 2003 and two Indigenous Land Use Agreements (ILUA's) are in the process of being finalised for the project development area</p> <p>Further to this, the social impact management plan (SIMP) has been developed for the project development area, which will monitor and report on the success of the above and additional actions. The SIMP supports ongoing management of the potential social impacts of the project and recognises the changing nature of impacts over the life of the project. The SIMP is adaptive and reassessed at regular intervals. The update to the SIMP is located in SREIS Attachment 3, Social Impact Management Plan.</p> <p>Additional to these measures Arrow will implement the Arrow Reconciliation Action Plan which outlines Arrow's commitment to Indigenous Australians, working with Traditional Owners and negotiating Indigenous Land Use Agreements (ILUA's). The Arrow Reconciliation Action Plan was endorsed by Reconciliation Australia and launched in May 2013. The Arrow Reconciliation Action Plan complies with the quality assurance mechanism provided by Reconciliation Australia identifying actions in relation to relationships, respect and opportunities (SREIS Attachment 3, Social Impact Management Plan, Section 2.5).</p>
R19095	S131	<p>Table 7-10 (SIMP) does not adequately address the negative affect on local Indigenous people. Under "Increased potential for social divide and social tension" there is no specific mention of Indigenous people; mitigations or Indigenous cultural awareness training for employees and contractors.</p> <p>It is suggested that, under "Increased potential for social divide and social tension" specific mention be made of the potential for negative impact on local Indigenous people; plans to mitigate the impact and the intention to provide Indigenous cultural awareness training for employees and contractors. These issues could be addressed through the CHMP and Indigenous Participation Plan.</p>	<p>SREIS Attachment 3, sections 2.4, 2.5 and Appendix 13</p>	<p>Arrow acknowledges that it has an important role to play in providing opportunities for Indigenous people. Since the EIS, Arrow has developed a number of action plans and commitments though the evolution of the social impact management plan (SIMP). SREIS Attachment 3, Social Impact Management Plan, Section 2.4 includes a range of measures to provide project opportunities to Indigenous people and communities. This includes the implementation the Arrow Reconciliation Action Plan (RAP) which outlines Arrow's commitment to Indigenous Australians, working with Traditional Owners and negotiating Indigenous Land Use Agreements (ILUA's) around the four goals of:</p> <ul style="list-style-type: none"> • Ensuring Arrow is culturally safe and culturally competent. • Recruiting and retaining Aboriginal and Torres Strait Islander staff. • Connecting Aboriginal and Torres Strait Islander people with business and employment opportunities. • Supporting Aboriginal and Torres Strait Islander education (Commitment C550). <p>The Arrow RAP was endorsed by Reconciliation Australia (RA) and launched in May 2013. The Arrow RAP complies with the quality assurance mechanism provided by RA identifying actions in relation to relationships, respect and opportunities.</p> <p>SREIS Appendix 13, Supplementary Social Assessment, Section 4.2.3 provides an update of key demographic data in the region, including persons identifying as Indigenous. The report identifies due to population changes there could be a larger number of Indigenous people who are able to benefit from the employment and business opportunities presented by the project.</p>

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R19096	S119	Due to recent Machinery of Government changes, references to Employment and Indigenous Initiatives Division of DEEDI as a stakeholder for workforce and employment management strategies, should be updated to Employment Initiatives Division, Department of Education, Training and Employment.	–	Noted.
R19097	S130	Requests that Arrow identify the urban areas and/or localities in the Western Downs where population increases are expected and the impacts that increased populations will have in these communities. Upon completion, the proponent will develop and release a comprehensive report, including revised project strategies and plans, mitigation measures and project impacts, for public consideration.	SREIS Attachment 3 and Appendix 13	Appendix 13, Supplementary Social Assessment provides an update of key demographic data in the region, including increased business activity and population increases. SREIS Attachment 3, Social Impact Management Plan, sets out Arrow's proposed measures for reporting on social indicators.
R19098	S134	General concern over potential impacts on social services, local communities and economies.	SREIS Attachment 3, Section 2.2	Noted. While the project is not expected to significantly increase the demand on social services, Arrow is committed to consulting with local councils to identify which social or community infrastructure is being directly impacted by the project and to what extent. Arrow will continue to provide state and local government departments responsible for social services and infrastructure with forecasts of workforce numbers to assist in their future service planning (SREIS Attachment 3, Social Impact Management Plan, Section 2.2).
R19099	S011, S062, S072, S134, S161	The proponent should investigate further the emergency response resources currently available in each of the proposed operational regions, and propose specific commitments to ensure that adequate resources are available in the immediate locality, and that the levels of services available to existing residents and businesses are not impacted by the increased demand generated by the project.	EIS Chapter 25, Section 25.6.2 SREIS Attachment 3, Section 2.7	SREIS Attachment 3, Social Impact Management Plan, Section 2.7, contains a number of Arrow's commitments. This includes Commitment C373, in relation to emergency response services: Arrow, in collaboration with Origin Energy, QGC and Santos, has funded since 2011 the Surat Gas Aero Medical Service in the region. The service is provided by CareFlight, one of only two fully integrated aero medical retrieval operations in the world. CareFlight employs its own full time emergency doctors, paramedics and flight crews. The Aero Medical Retrieval Service provides 150 free hours to Queensland Health for community based aero medical recovery services. Arrow will continue to support this initiative. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 details Arrow's commitment to develop emergency response plans in consultation with emergency services organisations that include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (Commitment C424).
R19100	S131	The expected population growth of 44% over the next 20 years in the Surat Basin, indicates a	SREIS Attachment 3 and Appendix	SREIS Appendix 13, Supplementary Social Assessment, provides an update of key demographic data in the region, including expected population growth.

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R19100	S131	<p>significant shift in client numbers and issues that will be presented to the Health and Community Services Sector.</p> <p>Given that the atypical demographic structure promoted by shift work reduces the viability of some human services organisations as well as other volunteer organisations in the community, the SIA should identify alternative avenues to allow the services to build capacity to focus on the challenges that an increased population base will present.</p>	13, Section 2.7	<p>Potential impacts, mitigation and management measures to community health services have been discussed in SREIS Attachment 3, Social Impact Management Plan, Section 2.7, which includes detailed action plans including the commitment to implement policies and programs to maintain the wellbeing of project personnel (Commitment C549).</p> <p>Programs to be considered include those relating to:</p> <ul style="list-style-type: none"> • The provision of welfare and recreation facilities in TWAF's. • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAFs in line with guidance issued by Queensland Health. <p>*At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies will apply to the workforce whilst on Arrow sites and whilst engaged in Arrow work.</p>
R19101	S131	Toowoomba will face significant population increase and may benefit from detailed mitigation strategies particularly relating to community support services and facilities.	<p>EIS Appendix P, Table 6-2</p> <p>SREIS Chapter 3 and Attachment 3, Section 2.2</p>	<p>As set out in EIS Appendix P, Social Impact Assessment, Table 6-2, Arrow anticipates approximately 15% of the potential new residents may choose to relocate to Toowoomba (114 persons including workers and their families). Based on these assumptions and the revised project workforce numbers presented in SREIS Chapter 3, Project Description, this could increase to around 160 persons including workers and families. This increase was not considered significant to the regional centre.</p> <p>SREIS Attachment 3, Social Impact Management Plan, Section 2.2 details Arrow's community investment and wellbeing commitments. This includes continuing to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. Information will be provided in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333).</p>
R19102	S086, S133, S134	The EIS should provide more detail relating to how non-emergency medical services will be provided to direct and indirect project workers, considering the already scarce community regional health services. Dalby for example has not been able to keep pace with the growth and of particular concern is the ability of the local medical practices keeping up with the demand. It can take weeks to make an appointment for even a serious medical	-	<p>Arrow, in collaboration with Origin Energy, QGC and Santos, has funded since 2011 the Surat Gas Aero Medical Service in the region. The service is provided by CareFlight, one of only two fully integrated aero medical retrieval operations in the world. CareFlight employs its own full time emergency doctors, paramedics and flight crews. The Aero Medical Retrieval Service provides 150 free hours to Queensland Health for community based aero medical recovery services. Arrow will continue to support this initiative (Commitment C373).</p> <p>Further to this, Arrow will continue to provide state and local government</p>

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R19102	S086, S133, S134	condition. Commitment C372 identifies the provision of medical assistance with opportunities to extend to wider communities, where possible.' – How will this be implemented and how will it be measured? Which communities will have access?		departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. Arrow will provide this information in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333).
R19103	S121	Queensland Ambulance Service (QAS) requires notification of planned emergency exercises for attendance and participation and recommends ongoing consultation between Arrow and QAS concerning project status and emergency access to ensure a timely and appropriate response.	EIS Chapter 25, Section 25.6.2	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 details Arrow's commitment to develop emergency response plans in consultation with emergency services organisations that include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (Commitment C424).
R19104	S131	The department recommends that as impacts to the current NGO sector have not been adequately reflected, particularly around family support services, counselling, domestic and family violence and community development, that further consultation is required. This should include a strategy to not duplicate rather compliment current services funded by other proponents.	SREIS Attachment 3, Section 2.7	Arrow will manage potential social and health concerns on issues such as mental health and domestic and family violence in accordance with Arrow's comprehensive Health, Safety and Environmental Management System. Arrow has committed to implement policies and programs to maintain the wellbeing of project personnel (Commitment C549). Programs to be considered include those relating to: <ul style="list-style-type: none"> • The provision of welfare and recreation facilities in TWAF's. • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAFs in line with guidance issued by Queensland Health. *At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies will apply to the workforce whilst on Arrow sites and whilst engaged in Arrow work. These strategies will be developed in consultation with relevant government and non-government organisations as well as other proponents, as appropriate (SREIS Attachment 3, Social Impact Management Plan, Section 2.7).
R19105	S119, S136	Coordinate with local law enforcement to develop commitments and mitigation strategies, for movement of heavy or oversized loads and vehicles. Arrow to commit to discussions with the Queensland Police Service Southern Region about the provision of marked vehicles and contact	–	Noted.

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R19105	S119, S136	regarding the Dalby and Roma Districts should be direct with the District Officers.		
R19106	S133, S136	Maintain an emergency management plan that will cover joint emergency response planning in collaboration with emergency service providers. Requests that the development of Emergency Management Plans include consultation with the Executive Officers of the Dalby and Roma Disaster District Management Groups. The EIS has not provided enough commitment to identifying and mitigating adverse impacts from emergencies other than just reporting them.	EIS Chapter 22, Section 22.8 and Chapter 25, Section 25.6	Arrow has committed to maintain an emergency management plan that will cover joint emergency response planning in collaboration with emergency service providers (Commitment C389). The plan will be prepared in consultation with relevant Queensland government authorities and emergency services organisations and maintained for the project in collaboration with emergency service providers. Arrow will develop emergency response plans in consultation with emergency services organisations that include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (Commitment C424).
R19107	S161	The emergency service assets listed in Appendix P of the EIS are located too far away to respond to emergency callouts within the project area (travelling time from Toowoomba is 45 minutes to 1 hour).	EIS Chapter 25, Section 25.6	Emergency management planning will be undertaken for the project in consultation with relevant Queensland government authorities and emergency services organisations. Emergency response plans will include a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (Commitment C424).
R19108	S133	The proponent has not considered that the accommodation camps/ mining operations are likely to require the provision of medical facilities. The necessary approvals will need to be obtained from Queensland Health in accordance with the Health (Drugs and Poisons) Regulation 1996 if workforce accommodation camps/mining operations employ a person that will be in possession of a scheduled medicine or poison.	–	Noted.
R19109	S014, S027, S035, S044, S092, S133, S134	The EIS does not include impacts on the community such as possible anxiety and depression resulting from a changing community and the associated lifestyle. The stress and anxiety levels created by the Arrow proposal are already elevated, and there is a genuine concern that the mental health issues resulting from coal seam gas impacts on family farming enterprises will become unmanageable. Farming style communities may feel an overwhelming sense of loss due to the lack of profitability and professional success, the degradation of community status, physical wellbeing and comfort, the ability to participate within the changing community and above all detachment of relationships (family and friends)	EIS Appendix P SREIS Attachment 3	Arrow is aware that the environmental approvals and gas field planning processes (including the uncertainty as to where infrastructure will be placed) are causing anxiety for some landowners and community members. The availability and capacity of existing health services to provide support to landholders and the broader community is addressed in the EIS Appendix P, Social Impact Assessment. Proposed management measures are presented in the social impact management plan (SREIS Attachment 3, Social Impact Management Plan) but limited to the aspects which Arrow can control or has statutory responsibility. Arrow is not a healthcare provider. However, it has committed to provide information about its activities to relevant government agencies to assist them plan for increased demand and the provision of additional support services if existing services are not adequate. Arrow has undertaken extensive consultation to date and will continue to do so in the future to assist the community understand its development plans. The incremental nature of coal seam gas development results in uncertainty

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R19109	S014, S027, S035, S044, S092, S133, S134	<p>due to the changing social/economic environment in the area, which could ultimately lead to depression and suicide.</p> <p>Arrow's only suggested mitigation and management measure to deal the lack of mental health services identified in the social baseline is to talk to a land access officer from Arrow. Arrow needs to foster an open and transparent process when dealing with the community to minimise mental health concerns. The supplementary report to the EIS should address the mental health impacts relating to landholders directly impacted by the project and to others within the community (not Arrow staff) who are indirectly impacted by the project e.g., through cost of living, housing availability, rental market prices. The proponent could publish a community satisfaction survey in a local paper and provide more thorough community consultation, which could include health risks or perceived risks.</p>		<p>about the location of future activities. Arrow has committed to progressively inform landholders and the community throughout the development process to provide them with the most up-to-date information. Notwithstanding the uncertainty associated with some aspects of the gas field planning process, this approach aims to increase awareness of the location and timing of activities.</p>
R19110	S134	<p>Arrow to carry out a detailed assessment of impacts on 'communities of interest'.</p>	<p>EIS Appendix P, Section 6</p>	<p>EIS Appendix P, Social Impact Assessment assesses project impacts on communities of interest, which include Cecil Plains, Millmerran, Toowoomba, Dalby, Chinchilla, Miles, Wandoan and Goondiwindi.</p>
R19111	S133	<p>The EIS does not mention the significant community impact of increases in diseases such as sexually transmitted diseases.</p>	<p>EIS Attachment 3, Section 2.7</p>	<p>The social impact management plan identifies a range of policies and programs that aim to promote the health and wellbeing of project personnel, including a Constructive Community Engagement Policy which sets out appropriate behaviour and interaction with the public, and a Code of Conduct for workforce behaviour including disciplinary procedures (SREIS Attachment 3, Social Impact Management Plan, Section 2.7). Implementation of policies and programs to maintain the wellbeing of project personnel (Commitment C549) is also included in the plan. Programs to be considered include those relating to:</p> <ul style="list-style-type: none"> • The provision of welfare and recreation facilities in temporary workers accommodation facilities (TWAFs). • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAFs in line with guidance issued by Queensland Health.

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Issue No.	Submission No.	Issue	Reference	Responses
R19111	S133			*At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies will apply to the workforce whilst on Arrow sites and whilst engaged in Arrow work.
R19112	S014, S044	Stakeholder frustrated that the administering authority referred to Arrow's intensively farmed land committee in their response to landowners' previous request for involvement in developing a satisfactory Erosion and Sediment Control Plan as the landowners don't feel the committee can make site-specific decisions.	–	Due to the site-specific nature of erosion and sediment control, controls will be tailored to reflect the specific impacts and mitigation measures required for individual sites. The Best Practice Erosion and Sediment Control Manual (IECA, 2008) will be used in the preparation of the erosion and sediment control plan. Site specific conditions will be discussed with landholders as part of the land access negotiations.
R19113	S119	Arrow and their subcontractors to work with the Chambers of Commerce, Local and State Governments to deliver a range of tailored services (including training and support programs) that will assist them to operate in a changing environment.	SREIS Attachment 3, Section 2.5	Arrow is committed to working with government agencies and other relevant organisations on a range of workforce and training initiatives (SREIS Attachment 3, Social Impact Management Plan, Section 2.5). These include developing a policy identifying training pathways for students and school leavers to assist students in gaining employment upon graduation. The policy will be developed in consultation with Education Queensland. Where relevant training programs have been initiated by other project proponents, Arrow will consider coordinating support with these, where appropriate (Commitment C338). Existing Arrow training programs include: <ul style="list-style-type: none"> • Go Women in Engineering and Science and Technology (Go WEST), which conducts networking and/or mentoring activities for female staff and students and enhances collaborative partnerships between regional industry, Queensland Office for Women, local government and USQ Student Services. • Work with group training organisations and encouraging contractors to recruit and retain apprentices or trainees during operations. • Support for Dalby Agricultural Scholarships through a partnership with Dalby State High School, Arrow is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements. • Involvement in the CSG Industry/Schools Partnership with Education Queensland. The Program will deliver a suite of education programs and activities in selected schools in the Surat Basin to increase the awareness and knowledge of career opportunities in the coal seam gas industry or trades directly related to supply chain opportunities.
R19114	S119, S134	Arrow to actively link with other engagement processes if possible. This will assist with the	EIS Appendix P	Noted. Cumulative social impacts have been discussed in EIS Appendix P, Social Impact Assessment. Arrow participates in a number of forums with

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R19114	S119, S134	management of cumulative impacts associated with the project. Arrow to undertake more work to understand cumulative social impacts.		project proponents and the Queensland Government to address cumulative impacts of coal seam gas operations.
R19115	S119	The Community Infrastructure and Services Action Plan talks about ongoing consultation with Queensland Police Services regarding vehicle movement only.	SREIS Attachment 3, Section 2.7	Arrow recognises the importance of consulting with emergency services organisations such as the Queensland Police Service on a range of issues associated with the project including emergency response management (SREIS Attachment 3, Social Impact Management Plan, Section 2.7).
R19116	S014, S044	No stakeholders in Toowoomba identified "Relationships with landholders" as an issue of concern. Toowoomba's population accounts for 80% of the study area population and the majority would have no understanding of the impacts and issues as that relate to land use and landholders within the project area.	–	Noted.
R19117	S014, S026, S044, S069, S081, S162	Landholder stakeholders on the Condamine flood plain are in no way confused or misunderstanding the impacts that the project will have on their farms and businesses if it is to go ahead as proposed in the EIS. The best assessors of the impact that this project will have on the land in particular, are the landholders themselves. Arrow's community information sessions have included enough information to assist landholders to make an informed decision on the impacts of coexistence with their type of agriculture. The EIS however, clearly demonstrates Arrow are obviously not listening and understanding what landholders, especially on the Condamine flood plain, are trying to tell them. On more than one occasion landholders have asked Arrow what benefits they bring to our community. Arrow has no answer.	EIS Appendix P, sections 6.3 and 6.5 and Appendix O, Section 5 SREIS Attachment 3, Section 2.5	EIS Appendix P, Social Impact Assessment (SIA), sections 6.3 and 6.5 and EIS Appendix O, Economic Impact Assessment, Section 5 discuss the economic benefits of the project. The project is also expected to deliver an economic benefit to the local area through higher levels of employment, individual and household incomes, and business turnover as a result of up to 20% of the workforce being sourced locally during construction which has the potential to increase to up to 50% during operations. SREIS Attachment 3, Social Impact Management Plan, Section 2.5 details Arrow's shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program. Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367). Examples of social investment initiatives that Arrow is currently undertaking in the region are: • Education – Partnering with Dalby State High School. This partnership is funding six agricultural scholarships in 2013 for the school's Agricultural Futures and Agricultural Professionals programs intended to support the region's ability to meet future agricultural workforce requirements. – Supporting the Ignition Project (Ignition), an initiative of the Queensland Police Service to address the increasing problem of youth boredom and inactivity in the Western Downs Region, inclusive of the townships of Dalby, Chinchilla and Tara. The initiative targets 11 to 19 year olds considered to be at risk.

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Issue No.	Submission No.	Issue	Reference	Responses
R19117	S014, S026, S044, S069, S081, S162			<ul style="list-style-type: none"> – Partnering with the Brisbane Broncos. This partnership has engaged over 1,400 students and residents in the Central Darling Downs region throughout 2012. It has delivered programs that focus on health, safety and education including the Brisbane Broncos Book Club, Coaching Clinics and Regional Fan Day. – Working with the Endeavour Foundation to deliver the Stepping Stones Positive Parenting Program, Latch On tertiary learning program for young adults with a disability and a school holiday respite program for children with disabilities. • Health and safety – Braking the Cycle which provides disadvantaged young people in Surat with supervised driving practice under the guidance of a community volunteer to safely meet the 100 log-book hours required in Queensland to attain a driver's license. Braking the Cycle is a partnership with the Dalby Police-Citizens Youth Club (PCYC). • Environment – Partnering with the Condamine Alliance, the regional body for natural resource management in the Condamine catchment.
R19118	S014, S044	The primary mitigation measures for countless impacts relating to landholders throughout the EIS refer to communication, talking and listening. It would be of benefit to all landholders if Arrow could clarify, will they be doing any of the listening? This project will not work on our farms. We request, the supplementary report to the EIS include a re written Social Impact Management Plan based on new information that will be provided in the Social Impact Assessment.	SREIS Attachment 3 and Appendix 13	Noted. Arrow has actively listened to community groups and landholders through its Surat Reference Group and Arrow's Intensively Farmed Land committees. The input into Arrow from these committees is demonstrated in Arrow's commitments regarding coexistence on intensively farmed land. The potential social impacts of updates to the project description are outlined in SREIS Appendix 13, Supplementary Social Assessment and the updated social impact management plan ins presented in SREIS Attachment 3, Social Impact Management Plan.
R19119	S092	Requests proponent documents further social impacts such as the number of affected landholders/community members and the social cost of such a development.	EIS Chapter 22, Section 22.6 and Appendix P, Section 6 SREIS Appendix 13	EIS Chapter 22, Social, Section 22.6 outlines the key social impacts and costs of the project, with further information provided in EIS Appendix P, Social Impact Assessment, Section 6. The potential social impacts of updates to the project description are outlined in SREIS Appendix 13, Supplementary Social Assessment.
R19120	S119	The Social Impact Assessment unit (of the Department of State Development, Infrastructure and Planning), will discuss with Arrow the possibility of modifying the requirement for a Social Impact Management Plan and developing a model that consists of a Social Impact Management Plan for LNG Facility (Significant Projects Coordination	–	Noted.

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Issue No.	Submission No.	Issue	Reference	Responses
R19120	S119	PROJECT) and Action Plans for all EHP/Arrow projects for Social Mitigation Strategies to ensure that appropriate mechanisms are in place.		
R19121	S089	The dissemination of information about Arrow's plans to members of the agricultural community is limited, since local governance for outlying agricultural communities such as Millmerran is now based in in the Toowoomba business centre. Many people in agricultural areas are still largely unaware of the likely impact of the proposed Surat Gas Project. A symptom of this is that the EIS display was in the Service Centre, which was once a thriving local portal but is now comparatively dormant (due to amalgamated government and services in Toowoomba).	EIS Chapter 6, Section 6.7 and Appendix B SREIS Chapter 4 and Appendix 1	Sections 43 and 51 of the Environmental Protection Act 1994 (Qld) require all registered property owners whose land is included in the EIS process to be provided written notification of the preparation of the EIS. In accordance with this requirement, Arrow conducted two in-excess-of 8,000 letter mail outs to all registered property owners within the project development area. The first mail out occurred in March 2010 when the draft terms of reference were released for public comment. The second mail out occurred in March 2012, when the EIS was placed on public display. In addition, landholders received invitation letters to Arrow's community information sessions, as part of the broader consultation program described in EIS Chapter 6, Stakeholder and Community Engagement and Appendix B, Consultation Report, and SREIS Chapter 4, Stakeholder and Community Engagement and Appendix 1, Supplementary Consultation Report. Arrow also conducted a stakeholder consultation program, with the overriding intent to facilitate broad engagement and participation in the consultation process. In excess of 3,000 invitations were sent to stakeholders listed on Arrow's Consultation Manager database in advance of each community information session. Throughout the consultation process, Arrow has sought to provide the community with the most up-to-date information on the project, the planning of which is undergoing continual refinement. Arrow has also held drop-in sessions, which facilitated one-on-one conversations with stakeholders. Arrow has displayed the EIS on its website in an interactive version or in downloadable form which can be located at http://www.arrowenergy.com.au/community/project-assessment-eis/surat-gas-project-eis .
R19122	S050, S099, S162	Section 22.4.5 states "wireless is only available in Toowoomba". This is incorrect as wireless internet has been available since the Next G network started in 2007. The source used for table 3.35 used in Appendix P is ABS data from 2006. The EIS states it is only available in Toowoomba, however wireless internet is available in Dalby.	–	Noted. At the time of preparing the EIS, Australian Census data from 2006 was the most recent census data available.
R19123	S050, S162	Arrow should partially fund the upgrade of Next G towers within the EIS area to 4G and increase range and capacity to the community as a legacy. Information should be provided on how Arrow's	–	Noted. Arrow operations will require effective and reliable communication between personnel and infrastructure on the project. Given this requirement, Arrow will assess the capability of existing telecommunications networks and work with telecommunications providers to make appropriate infrastructure

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R19123	S050, S162	telemetry and communication system is going to react with the existing communication set-up and if there is the potential to impact on local phone and internet capacity?		available for the project, without disrupting existing services.
R19124	S161	The social management impact plan does not address the social impacts of decommissioning the project. How long will Arrow remain in the area after decommissioning to ensure its long term sustainability?	EIS Chapter 22, Section 22.3.3	The social impact management plan will continue to be reviewed and adapted throughout the life of the project and will incorporate further actions on decommissioning, if required, once further details on the decommissioning process are available. Similarly, the decommissioning phase has been given limited analysis in the social impact assessment as the lengthy project life span militates against the accuracy of such an assessment (EIS Chapter 22, Social, Section 22.3.3). Arrow will be required to decommission project infrastructure and rehabilitate land in accordance with the conditions of the environmental authority for the project.
R19125	S027	What about when the project ends, people leave, real estate values drop and businesses close?	EIS Appendix P, sections 6.10 and 6.1.1	EIS Appendix P, Social Impact Assessment, Section 6.10 outlines the potential for communities in the project area to revert back to population stagnation or population decline trends post-project. This is hard to qualify other than it is a continuation of the current trend, in which case the project was a temporary reversal of the trend. However, there is also evidence that some retired workers from the various projects will remain in the area, and will not be affected by changes in employment trends as they are already out of the market. This may help prolong the population levels in the region. Regardless, it is unlikely that communities will disappear given the road transportation networks through the area, the supply requirements for agricultural industries, the agricultural industries themselves, and the desire of many people in the region to maintain their rural lifestyle and culture. As discussed in Appendix P, Section 6.1.1, the region is very resilient to hardships and change, and is likely to maintain those traits beyond the project.
R19126	S133	The proponent describes a reactive approach to problems through the implementation of a grievance register, however does not outline any resultant strategies or framework that would reduce the level of grievance in the community before being reported or ensuring the same type of grievance will not be reoccurring.	SREIS Attachment 3, Section 2	Arrow is committed to a range of measures to reduce the potential for community concern and grievances in relation to the project. These are outlined in the social impact management plan (SREIS Attachment 3, Social Impact Management Plan, Section 2), and include the development and implementation of mitigation measures that address the potential impacts relating to air and noise emissions through environmental management plans (Commitment C394) and the requirement that all project personnel only access land in accordance with DEEDI's (2010a) Land Access Code, Section 24A of the Petroleum and Gas (Production and Safety) Act 2004 and Arrow's land access rules and protocols (Commitment C365).

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R19127	S134	SREIS must recognise, quantify and cost potential impacts on rural towns, communities and social services.	EIS Chapter 21, Section 21.4 and Chapter 22, Section 22.6	EIS Chapter 21, Economics, Section 21.4 and EIS Chapter 22, Social, Section 22.6 outline social and economic impacts of the project on local communities. Where appropriate, impacts have been quantified.
R19128	S161	The rapid development and 35 year life span for this project create risks and instability for the small communities and public services in rural towns in the area. These risks and burdens could be vastly reduced by extending the life of the project to 200 years.	SREIS Attachment 3, Section 2.7	The life of the project is based on the coal seam gas resource available for extraction within the Surat Gas Project development area. Presently, this has been estimated at 35 years. Arrow is committed to introducing measures to manage potential project impacts on local communities and services as set out in SREIS Attachment 3, Social Impact Management Plan, Section 2.7.
R19129	S108	The other three major coal seam gas projects in Queensland are already impacting negatively on services in the region and the availability of labour for other industries.	–	Noted. Arrow will continue to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. This information will be provided in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333). Arrow will explore opportunities to effectively address cumulative impacts in consultation with the Department of State Development and Infrastructure Planning (Formerly Department of Employment Economic Development Innovation) SIA Unit, State and local governments, industry and communities.
R19130	S108	The development of this resource is creating a considerable amount of public concern about the pace of change and effects on community harmony.	EIS Chapter 22, Section 22.6	Noted. EIS Chapter 22, Social, Section 22.6 provides an outline of key issues and concerns raised by communities in relation to the project.
R19131	S131	The current ratings in relation to the impact on Community Services outlined in Table 6-8 are questionable. Current evidence suggests that consequences and significance be reviewed to “medium”.	EIS Appendix P, Section 6.6.1 SREIS Attachment 3, Section 2.7	Impacts on community services are assessed in EIS Appendix P, Social Impact Assessment, Section 6.6.1. The project is expected to have a minor consequence on community services once the positive impact of maintaining population thresholds and the flow on impacts of continued provision of services at existing or higher levels of service is balanced against increased demand for housing support, emergency financial assistance, family support, counselling and relationship services; and ethnic/multicultural services. Arrow actions to address impacts on community services include the implementation of policies and programs to maintain the wellbeing of project personnel (Commitment C549). Programs to be considered include those relating to: <ul style="list-style-type: none"> • The provision of welfare and recreation facilities in temporary workers accommodation facilities (TWAFs).

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Issue No.	Submission No.	Issue	Reference	Responses
R19131	S131			<ul style="list-style-type: none"> • Provision of a counselling service for all workers (including drug and alcohol services and sexual health education*). • Arrow policies including OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy. • Enforcement of smoking regulations on site. • Restrictions on working hours to reduce worker fatigue. • Provision of nutritionally balanced food to all personnel living within TWAfs in line with guidance issued by Queensland Health. <p>*At all times Arrow's Drug, Alcohol and Contraband and Fit For Duty Policies will apply to the workforce whilst on Arrow sites and whilst engaged in Arrow work.</p> <p>In addition Arrow will:</p> <ul style="list-style-type: none"> • Continue to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. This information will be provided in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333).
R19132	S134	Arrow to revise the significance rating of impacts related to 'increased landholder and community uncertainty' to 'very high' as the consequence should be 'major'.	<p>EIS Appendix P, Section 6.4</p> <p>SREIS Attachment 3, Section 2.3</p>	<p>The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), is based on the probability of the impact occurring and the likely consequence of that impact.</p> <p>This impact relates to uncertainty for landholders and community members about project decisions on such things as the location of project infrastructure. EIS Appendix P, Section 6.4 determined that the consequence of this impact was moderate, partly due to the time that will elapse between when there is an indication that the property may be subject to gas well development and when it actually occurs during the project life.</p> <p>Arrow will seek to assist in managing potential impacts of project uncertainty (SREIS Attachment 3, Social Impact Management Plan, Section 2.3) through actions such as:</p> <ul style="list-style-type: none"> • Continue regular consultation with landowners and other stakeholders through mechanisms such as the Arrow Intensively Farmed Land Committee and the Surat Community Reference Group. The Arrow Intensively Farmed Land Committee considers opportunities to co-create a plan for coexistence between coal seam gas and farming. The Arrow Surat Community Reference Group provides a strong consultative forum for community and industry groups (Commitment C364). • Communicate with landowners at least three months before any activities take place on private property (Commitment 370). • Engage with landowners to develop a strategy for minimising impacts on land and existing agricultural activities (e.g., through strategic siting of project facilities) (Commitment C369).

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Issue No.	Submission No.	Issue	Reference	Responses
R19133	S134	Arrow to revise the significance rating of impacts related to 'increased demand on medical and health facilities' to 'very high', as the consequence should be 'major'.	EIS Appendix P, Section 6.6.4 SREIS Attachment 3, Section 2.2	The significance rating used in in EIS Appendix P, Social Impact Assessment (SIA), is based on the probability of the impact occurring and the likely consequence of that impact. The SIA determined that the significance rating of this impact was high. Section 6.6.4 notes that increased demand on medical and health services will have a medium level social impact in towns such as Chinchilla, Dalby, Miles and Millmerran as it will compound the current existing shortage of services. Arrow has committed to minimise this impact by continuing to provide state and local government departments responsible for educational, health and other social infrastructure with forecasts of workforce numbers and projected families to assist in their future service planning. This information will be provided in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333) (SREIS, Attachment 3, Social Impact Management Plan, Section 2.2).
R19134	S134	Arrow to revise the significance rating of impacts related to 'Heightened road safety risk' to 'very high', as the likelihood should be 'very likely'.	EIS Appendix P, Section and Chapter 19, Section 19.6	The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact. EIS Chapter 19, Roads and Transport, Section 19.6 sets out a number of commitments to road safety including the implementation of an in-vehicle monitoring system (IVMS) for project vehicles (Commitment C288). The monitoring system identifies the location of vehicles and monitors driver behaviour. All vehicles operated for or on behalf or in the course of delivering works or services for Arrow are fitted with IVMS. Arrow has also committed to assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared in consultation with relevant councils or the Department of Transport and Main Roads (Commitment C284) and develop and implement safety training programs for personnel and contractors, including induction training of new starters (Commitment C442). Given these commitments and Arrow's continued and demonstrated focus on safety and security the SIA determined that the likelihood of this impact occurring was nevertheless 'possible', as project activities will increase traffic on the road.
R19135	S134	Arrow to revise the significance rating of impacts related to 'increased demand on emergency services' to 'very high', as the consequence should be 'major' and the likelihood 'likely'.	EIS Appendix P, Section 6.6.2 SREIS Attachment 3, Section 2.7	The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact. Project impacts on emergency services are discussed in EIS Appendix P, Section 6.6.2. The SIA considers that while the project is likely to create additional demands on emergency services, the impacts are likely to be low, given Arrow's emergency service planning provisions. The SIA also considers that there

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R19135	S134			<p>would not be a noticeable increase in demand for emergency services from people moving to the area for the project. As such, the SIA determined that the overall significance of this impact was medium.</p> <p>Arrow will assist in managing potential impacts of increased demand on emergency services (SREIS Attachment 3, Social Impact Management Plan, Section 2.7) through actions that include:</p> <ul style="list-style-type: none"> • Provide medical assistance with opportunities to extend to wider communities, where possible (Commitment C372). • Arrow, in collaboration with Origin Energy, QGC and Santos, has funded since 2011 the Surat Gas Aero Medical Service in the region. The service is provided by CareFlight, one of only two fully integrated aero medical retrieval operations in the world. CareFlight employs its own full time emergency doctors, paramedics and flight crews. The Aero Medical Retrieval Service provides 150 free hours to Queensland Health for community based aero medical recovery services. Arrow will continue to support this initiative (Commitment C373). • Maintain an emergency management plan that will cover joint emergency response planning in collaboration with emergency service providers (Commitment C389).
R19136	S134	Arrow to revise the significance rating of impacts related to 'Reduction in availability of accommodation to low income groups including indigenous groups' to 'very high', as the likelihood should be 'likely'.	<p>EIS Appendix P, Section 6.7.2</p> <p>SREIS Attachment 3, Section 2.1</p>	<p>The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact. Housing impacts for low income and disadvantaged groups are discussed in EIS Appendix P, Section 6.7.2. The SIA notes that the project could lead to an increase in housing costs and that it is possible increased housing rental costs may impact on low income groups. While areas such as Dalby are experiencing a surplus in housing, other areas such as Chinchilla have limited housing availability.</p> <p>The likelihood of this impact was assessed as possible as the Surat Basin Regional Planning Framework identifies opportunities to cater for expected residential demand in the region and dwelling activity rates indicate that the building industry has the capacity to meet forecast increases in demand. SREIS Attachment 3, Social Impact Management Plan, Section 2.1 provides detail around Arrow's housing and accommodation commitments including consulting with state and local government and community stakeholders to deliver the most appropriate program for providing affordable housing options in the region including continued participation in the Western Downs Housing Trust Reference Group (Commitment C548). The role of the group is to identify housing affordability strategies.</p>
R19137	S134	Arrow to revise the significance rating of impacts related to 'High demand for hotel/motel/caravan park accommodation' to 'high', as the likelihood should be 'likely'.	<p>EIS Appendix P, Section 6.7.1</p> <p>SREIS Attachment 3, Section 2.1</p>	<p>The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact. Demand for hotel, motel and caravan park accommodation is discussed in EIS Appendix P, Section 6.7.1.</p>

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R19137	S134			<p>The SIA notes that there is likely to be increased demand for hotel and motel accommodation in the initial stages of construction prior to the development of the temporary workers accommodation facilities (TWAFs). However Arrow will seek to have visiting workers stay in TWAFs rather than in hotel or motel accommodation, where possible (Commitment C384) (SREIS Attachment 3, Social Impact Management Plan, Section 2.1).</p> <p>While the SIA recognises that there is likely to be increased demand for hotel, motel and caravan park accommodation, the provision of TWAFs means that the likelihood of this resulting in 'high' demand was assessed as possible.</p>
R19138	S134	<p>Arrow to revise the significance rating of impacts related to 'Increased community anxiety on health, safety and environment effects of project' to 'very high', as the consequence should be 'major'.</p>	<p>EIS Attachment 8 and Appendix P, Section 6.8 SREIS Attachment 3, sections 2.1 and 2.7</p>	<p>The significance rating used in EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact. Community perceptions of health, safety and environmental effects generated by the project are discussed in EIS Appendix P, Section 6.8.</p> <p>The SIA determined that the consequence of this impact was moderate as the project meets the statutory guidelines for air quality and noise and vibration limits from sensitive receptors. Arrow has committed to a range of measures to assist in managing environmental, health and safety impacts associated with the project. These are detailed in EIS Attachment 8, EIS Commitments Summary. Key measures to manage potential community anxiety on health, safety and environmental effects of the project include maintaining an emergency management plan for the project, a grievance process and continuing to implement a robust community engagement program to notify the community of project activities and identify and address community issues (SREIS Attachment 3, Social Impact Management Plan, Section 2.7).</p>
R19139	S134	<p>Table 2.3 in the SIA is missing the 'almost certain' column, yet it is used in the rating of potential impacts in the SIA and Table 1.9 of the SIMP. Arrow to amend.</p>	<p>EIS Appendix P, Table 2-3 SREIS Appendix 13, Table 3-1</p>	<p>Noted. This has been amended in the Supplementary Social Assessment Report (Appendix 13, Supplementary Social Assessment, Table 3-1).</p>
R19140	S134	<p>The SIA identified no potential negative impacts with a 'very high impact' significance rating. This seems to be due to the unrealistic rating of likelihood and consequence in some cases. Arrow to revise the impact significance ratings in the SIA, and to disclose and clearly articulate the methodology of the rating process. Arrow to provide more precise mitigation measures.</p>	<p>EIS Appendix P, Section 2.3</p>	<p>The methodology used in EIS Appendix P, Social Impact Assessment (SIA), to assess the significance of particular impacts is adapted from the AS/NZ4360 environmental risk assessment standard. It involved a qualitative risk assessment to assess the likelihood of harm to the social environment from the project's construction, operation, maintenance and decommissioning activities, and the consequences of those impacts. Further information on the methodology and rankings used are contained in EIS Appendix P, Section 2.3.</p>

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R19141	S021	There is little economic benefit associated with workers accommodated in camps, where they stay within the camp area and not engage with local businesses.	EIS Appendix P, sections 5.4.1, 6.3, 6.5 and Appendix O, Section 5	EIS Appendix P, Social Impact Assessment (SIA), sections 6.3 and 6.5 and EIS Appendix O, Economic Impact Assessment, Section 5 discuss the economic benefits of the project. While Section 6.5 of the SIA acknowledges that few non-resident workers are likely to engage with local businesses outside their work shifts, Section 5.4.1 of the SIA notes that up to 80 workers are expected to relocate and rent or purchase property locally creating an economic benefit for local businesses. The project is also expected deliver an economic benefit to the local area through higher levels of employment, individual and household incomes, and business turnover as a result of up to 20% of the workforce being sourced locally during construction which is likely to increase to around 50% during operation.
R19142	S119	In addition to Western Downs, impacts on other council areas, such as Southern Downs Regional Council area, should also be mentioned.	EIS Appendix P, section 1.2, 2.2.1 and Section 6.2.3.	The study area for EIS Appendix P, Social Impact Assessment, is described in sections 1.2 and 2.1.1 and includes the regional councils of Toowoomba, Goondiwindi and Western Downs.
R19143	S134	The EIS underrates the significance of the reduction of accommodation availability for low income or vulnerable groups.	EIS Appendix P, sections 6.7 and 6.7.3	EIS Appendix P, Social Impact Assessment (SIA), Section 6.7 outlines the impacts from the project on housing and accommodation availability and affordability. The SIA considers the potential for the project to result in a reduction in the availability of accommodation for low income and vulnerable groups to be of high significance. The SIA notes that while the likelihood of impacts was considered possible, the consequences would be major, particularly as increased housing rental costs in some areas may make it more difficult for low income groups to secure tenancies. The SIA also notes that increased housing costs may result in some people moving to areas with more affordable housing. The likelihood for the impact to occur would depend on a range of factors including existing supply of affordable housing and the amount of land identified for future housing development. EIS Appendix P, Section 6.7.3 notes that residential land supply is being addressed through the Surat Basin Regional Planning Framework, which identifies opportunities to allocate land to cater for expected residential demand in the region. The SIA also notes that dwelling activity rates indicates an active building industry that has the capacity to meet forecast increases in demand.
R19144	S119	The figures shown in Tables 22.3 and 22.4 need to be broken into towns: Dalby, Chinchilla, Miles, Tara and Wandoan. These figures hide the real picture of accommodation in crisis.	SREIS Appendix 13, Section 4.2.4	Updated data on housing sales for Chinchilla, Dalby and Miles as well as rental information for Miles have been included in SREIS Appendix 13, Supplementary Social Assessment, Section 4.2.4. Recent rental and sales data is unavailable for both Wandoan and Tara.

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R19145	S131	Table 7-10 (SIMP) does not adequately address the negative affect on local Indigenous people. Under "Reduction in availability of accommodation of low income and vulnerable groups there is no specific mitigation for the impact on Indigenous people (despite them being named as a group at significant risk on SIMP p.156). The Department suggests specific mitigations for the impact on Indigenous people of a reduction in accommodation for low income and vulnerable people are incorporated into the SIMP.	SREIS Attachment 3, Section 2.4 and Appendix 13, Section 4.2.3	Arrow acknowledges that it has an important role to play in providing opportunities for Indigenous people. Since the EIS, Arrow has developed a number of action plans and commitments through the evolution of the social impact management plan (SIMP). SREIS Attachment 3, Social Impact Management Plan, Section 2.4 includes a range of measures to provide project opportunities to Indigenous people and communities. This includes the implementation the Arrow Reconciliation Action Plan (RAP) which outlines Arrow's commitment to Indigenous Australians, working with Traditional Owners and negotiating Indigenous Land Use Agreements (ILUA's) around the four goals of: <ul style="list-style-type: none"> • Ensuring Arrow is culturally safe and culturally competent. • Recruiting and retaining Aboriginal and Torres Strait Islander staff • Connecting Aboriginal and Torres Strait Islander people with business and employment opportunities. • Supporting Aboriginal and Torres Strait Islander education (Commitment C550). The Arrow RAP was endorsed by Reconciliation Australia (RA) and launched in May 2013. The Arrow RAP complies with the quality assurance mechanism provided by RA identifying actions in relation to relationships, respect and opportunities. SREIS Appendix 13, Supplementary Social Assessment, Section 4.2.3 provides an update of key demographic data in the region, including persons identifying as Indigenous. The report identifies due to population changes there could be a larger number of Indigenous people who are able to benefit from the employment and business opportunities presented by the project.
R19146	S024, S026, S081	What is the demographic of the sizeable and growing transient population related to mining and gas activities?	EIS Appendix P, Section 3.4.4	EIS Appendix P, Social Impact Assessment (SIA), Section 3.4.4 presents characteristics of non-resident workers in Western Downs Regional Council area. Figures on non-resident workers are not available for other locations within the study area. In June 2008, there were 1,208 non-resident workers in the Western Downs Regional Council area. The SIA notes that this is likely to change due to increased economic development within the region. More recent information indicates that in June 2012, the number of non-resident workers on-shift in the Western Downs Council area was 4,175 people (OESR, 2012).
R19147	S024, S026, S081	What is the projected size of the transient workforce for the Surat Gas Project?	SREIS Appendix 13, Section 5.2.2	Updated information on the project workforce is presented in SREIS Appendix 13, Supplementary Social Assessment, Section 5.2.2. The non-resident component of the construction workforce is now expected to peak at 1,656 people in 2017 before gradually reducing. During the operation phase, it is anticipated that the project workforce will reside within communities in the project area rather than being transient as

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R19147	S024, S026, S081			there are no plans to establish fly-in, fly-out or drive-in, drive-out operations.
R19148	S074	It is unclear as to whether the additional 500 full time equivalent jobs mentioned in Section 5.2.1 are for residents of the Darling Downs or jobs for fly-in, fly-out workers. Please specify what proportion of the 500 full time employment jobs created by the project will be jobs belonging to residents of the Darling Downs, and what proportion will be conducted by fly-in, fly-out workers.	EIS Appendix O SREIS Chapter 3, Section 3.6.8	The net increase of just under 500 full time equivalent employees in the Darling Downs, as stated in EIS Appendix O, Economic Impact Assessment, pertains to existing or new residents of the area. The EIS states approximately 20% (142) of the construction workforce and 100% (360) of the operations workforce will be sourced from the local area. The 360 additional staff will be in addition to the existing operations workforce of 100. While the percentage workforce breakdown assumptions have remained the same as presented in the EIS, there has been an increase in the expected peak construction, resulting in the creation of more than 500 full time jobs in the Darling Downs region. SREIS Chapter 3, Project Description, Section 3.6.8 provides updated workforce numbers for the project.
R19149	S074	The agricultural industry in the region is suffering from a massive skills/labour shortage. There is no mention of the skill shortages being faced by the agricultural sector or any other industry. It is misleading and simply untrue to state in Section 7.1 that this is an issue specific to the energy sector only.	EIS Appendix O, Section 4.1, Appendix P, sections 3.5.3 and 6.3.2 SREIS Attachment 3, Section 2.5	EIS Appendix P, Social Impact Assessment (SIA), sections 3.5.3 and 6.3.2 discuss skills and labour shortages occurring within the region. The SIA notes that the region is currently experiencing some of the lowest unemployment rates in Australia and is subject to skills shortages. It is recognised in the assessment that other businesses outside of the energy sector could be compelled to increase staff wages to compete for scarce labour and so their profit margins, particularly in the case of smaller businesses, may experience downward pressure. EIS Appendix O, Economic Impact Assessment, Section 4.1 also addresses the issue of skills shortages across the region. It notes that there is limited local supply of labour which has resulted in significant skills shortages developing in the region and growing competition for labour between industries. As detailed in SREIS Attachment 3, Social Impact Management Plan, Section 2.5, Arrow has made a commitment to undertake regular reviews of non-project related labour requirements and current skills sets for the study area by engaging with state agencies and other skills bodies to facilitate the development of training strategies (Commitment C556).
R19150	S014, S044	Table 6.6 of Appendix P, Social Impact Assessment summary identifies "Loss of social connection to land/agriculture production" as a negative impact of medium significance. The assessment concludes the likelihood of this happening is only 'possible'. This should be 'almost certain'. The supplementary report to the EIS should provide evidence to support the statement that "the perception of social loss of connection to	EIS Appendix P, sections 6.4 and 6.4.1	Loss of social connection will be dependent on individuals' perceptions before, during and after the project. Hence, the likelihood is considered 'possible'. Landholders may experience greater concern about impacts while still uncertain as to how the development will specifically affect their property. Arrow recognises that there are a number of issues that need to be addressed to fully understand how coal seam gas development will coexist with intensively farmed land. Arrow's Intensively Farmed Land Committee considers opportunities to co-create a plan for coexistence between coal seam gas and farming. The Arrow Surat Community Reference Group

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R19150	S014, S044	land/agricultural production occurs in the early stages of a project". Also provide evidence to support the statement that "this may or may not be realised as the project's activities commence". From a rural person's perspective the impact assessors have identified the impacts that we are concerned about but clearly do not have an understanding of the severity of the impacts on family farming businesses and the flow on effect.		provides a strong consultative forum for community and industry groups (Commitment C364). These committees provide a platform to work through issues to demonstrate how development can occur. Arrow is required to negotiate conduct and compensation agreements with landholders and through negotiation will address issues specific to each property in agreeing the location of infrastructure and protocols for access during construction, operation and maintenance activities.
R19151	S014, S044	If the property is large and the landholder resents the intrusion, from a social perspective, the impact on him/her will be far greater than that of a smaller property owner who may not feel the same resentment. The logic that suggests impacts on large property owners will be lower than that of smaller properties is flawed. Landholders who have intensive farming practices, specifically intensive irrigated cropping, would suffer a higher impact regardless of property size. We request, the supplementary report to the EIS Social Impact Assessment re-assess the 'hierarchy of individual impacts' and take into consideration the type of agriculture affected.	EIS Appendix P, Section 6.1.3	EIS Appendix P, Social Impact Assessment (SIA), Section 6.1.3 outlines the hierarchy of impacts by land use, size, and access to additional land. The SIA notes that in general the impact on large blocks used for grazing or cropping could be lower than on small blocks but that every person is different and the effect of a potential impact can differ significantly from individual to individual. Arrow discusses compensation in confidence with individual landholders. The amount of compensation agreed depends on the level of activity conducted on a property and a range of other factors including the improved value of the land. Arrow uses valuers to assist in identifying the value of cropping and other agricultural activities and works with landholders to agree on appropriate compensation levels. To plan for differing impacts across landholders and their properties, and to account for the differing land uses that may be disrupted by the project Arrow has committed to: <ul style="list-style-type: none"> • Ongoing provision of Community Officers, Land Liaison Officers and the 1800 free-call number for people to ask questions or raise concerns about Arrow's activities. This includes the establishment of the Dalby Community Information Centre (Commitment C371). • Engage with landowners to develop a strategy for minimising impacts on land and existing agricultural activities (e.g., through siting of project facilities) (Commitment C369). • Develop and implement a compensation framework to 'add value' rather than just compensating for impacts (Commitment C081). Arrow continues regular consultation with landowners and other stakeholders through mechanisms such as the Arrow Intensively Farmed Land Committee and the Surat Community Reference Group. The Arrow Intensively Farmed Land Committee considers opportunities to co-create a plan for coexistence between coal seam gas and farming. The Arrow Surat Community Reference Group provides a strong consultative forum for community and industry groups (Commitment C364). These committees provide a platform to work through issues and demonstrate how coal seam gas development can integrate with agricultural activities in the region. In addition, Arrow has commenced a process of Area Wide Planning which

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R19151	S014, S044			incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This planning will seek to balance individual needs of landholders with the needs of neighbouring properties and avoid fragmenting agricultural areas.
R19152	S014, S044	We request, the SREIS include a Social Impact Assessment which includes the following; conduct an impact assessment taking into account the impacts the project will have on different types of agricultural operations within the project development area.	EIS Appendix F, Section 5 and Appendix P, Section 6.4	Appendix F, Agricultural Report, provides a broad description of the agricultural enterprises in the region and potential project impacts. EIS Appendix P, Social Impact Assessment (SIA), Section 6.4 also outlines project impacts associated with land use and property. Specific impacts to properties (including measures to minimise impacts associated with infrastructure placement) will be determined in consultation with landholders.
R19153	S014, S044	In response to Table 6-6 of Appendix P; reduced vulnerability to impacts associated with agriculture (drought and pests) identified as positive when in fact landholders will be more vulnerable to financial pressure because of the interference of coal seam gas in their established and future farming systems.	EIS Appendix P, Table 6-6	Noted. The allocation of 'positive' to 'reduced vulnerability to impacts associated with agriculture (drought, weather)' recognises that some landholders derive regular land rental payments from coal seam gas infrastructure, which can reduce the vulnerability of income during times when farm productivity is affected by climatic and other events. The potential reduction/loss of farm income has been recognised as a potential negative impact, also in EIS Appendix P, Social Impact Assessment, Table 6-6. Potential impacts to properties will ultimately have to be determined on a case by case basis and will depend on the specific farming method and productivity of a property.
R19154	S014, S044	Interconnectivity between groundwater aquifers is far from a landholder perception, it is a fact that has been acknowledged in this EIS. It has also been acknowledged that there will be an impact on groundwater aquifers, which are underlying and overlying the Walloon coal measures, as a result of Arrow's drawdown. This will have a direct impact on many landholders with water entitlements, if the project is approved. The URS Social Impact Assessment has completely dismissed genuine landholder concerns as perceptions based on incorrect information. While some sections of the community may accept the above explanation and reasoning, water users do not because it is a distortion of the truth and plainly incorrect.	EIS Appendix P, Section 4.2 and 6.8 SREIS Chapter 8 and Attachment 3, Appendix 2.7	EIS Appendix P, Social Impact Assessment (SIA), sections 4.2 and 6.8 discuss community concerns about the environmental impacts of the project, while EIS Appendix G, Groundwater Impact Assessment, assessed the potential project impacts on groundwater aquifers. The SIA recognised increased community anxiety on health, safety and environmental effects of the project (including potential groundwater impacts) as having a high level of significance. Arrow has committed to a number of strategies to allow for community concerns to be raised and addressed (SREIS Attachment 3, Social Impact Management Plan, Section 2.7), including: <ul style="list-style-type: none"> • Continuing to implement a robust community engagement program and other measures to notify community of project activities and to identify and address community issues. • Ongoing provision of community officers, land liaison officers and the 1800 free call number, and the Dalby Community Information Centre for people to ask questions or raise concerns about Arrow's activities. • Establishing a Regional Community Consultative Committee. SREIS Chapter 8, Groundwater, provides details of updated groundwater

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R19154	S014, S044			modelling undertaken for the SREIS.
R19155	S014, S044	In response to Table 6.2 of Appendix P; Increased landholder and community uncertainty this has been identified as 'high' but is easily solved. If Arrow would stop treating the community with contempt by reverting to their 'rights' and start genuinely reaching resolutions to issues, even if those resolutions mean they cannot integrate with certain types of agriculture, the uncertainty would be significantly reduced.	SREIS Attachment 3, Section 2	Noted. Arrow has an ongoing commitment to engage with landholders and local communities to avoid or reduce uncertainty associated with the project. Some community members have expressed disappointment and in some cases frustration at Arrow's staggered delivery of information, i.e., development sequence, groundwater modelling results. The fact that Arrow has not been in the position to provide the detailed level of information sought by the community further adds to their stress and sense of being not adequately informed of the potential impacts of the proposed development. Other community members accept that project planning is still underway and property-level impacts will be resolved through negotiation with individual landholders. In December 2012, Arrow commenced a process of Area Wide Planning, which incorporates individual landholder requirements into an integrated plan across neighbourhoods and catchment areas. Area Wide Planning aims to balance individual needs of landholders with the needs of neighbouring properties and the project. SREIS Attachment 3, Social Impact Management Plan, Section 2, states a number of Arrow's assurances to ongoing engagement, including: <ul style="list-style-type: none"> • Establishing a Regional Community Consultative Committee. • Close engagement with landholders to minimise impacts on their land and existing agricultural activities. • Prior to initial activities, communicating with landholders at least three months before any activities take place on private property. • Ongoing provision of community officers, land liaison officers and a 1800 free call number, for people to ask questions or raise concerns about project activities. • Develop and implement a compensation framework which seeks to 'add value' rather than just compensating for impacts. • Continue regular consultation with landholders through mechanisms such as the Arrow Intensively Farmed Land Committee. In addition, Arrow has commenced a process of Area Wide Planning which incorporates negotiations with individual landholders into an integrated plan across neighbours and catchment areas. This planning will seek to balance individual needs of landholders with the needs of neighbouring properties.
R19156	S119, S133	Updated census data on demographics, household characteristics and Indigenous people should be reviewed and any significant variations justified/explained.	SREIS Appendix 13	Noted. A number of key indicators have been reviewed and updated using 2011 ABS census data as a part of the SREIS (Appendix 13, Supplementary Social Assessment).
R19157	S014, S044	Half the population of the project development area is outside the study area towns and have not been	EIS Appendix P, sections 3.4	EIS Appendix P, Social Impact Assessment (SIA), Section 3.4 presents information on the population, demographics and household composition of

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Issue No.	Submission No.	Issue	Reference	Responses
R19157	S014, S044	clearly identified in the Social Baseline. We request the supplementary report to the EIS identify the rural population and the issues and impacts as they directly relate to this population within the project development area.	and 6 SREIS Appendix 13	the study area. The SIA presents information at a local government area level as well as for specific localities within the study area. Data at a local government area level includes both urban centres and rural populations. The social baseline also includes information on community values, such as community cohesion, as they relate to rural populations. Impacts and opportunities associated with the project are addressed in Section 6 of the SIA. This included assessment of impacts on both rural and urban communities. Note that a number of key indicators have been reviewed and updated using 2011 ABS census data as a part of the SREIS (Appendix 13, Supplementary Social Assessment).
R19158	S014, S044	The Social Impact Assessment (SIA) has failed to properly identify all significant population and has assessed the issues and impacts as they relate to the population based on incorrect and misleading information. The document was clearly written by someone who has absolutely no understanding of the land and the impacts that will relate to its inhabitants. The SIA is the document that informs the Social Impact Management Plan (SIMP), therefore the SIMP is also a flawed document.	EIS Appendix P SREIS Appendix 13	EIS Appendix P, Social Impact Assessment (SIA), was based on the most recent data available at the time the assessment was prepared. In most cases, this was data from the 2006 ABS census. Data from the 2006 census was supplemented with more recent information, including from commonwealth and state government agencies, local government and other sources as relevant. This included data on residential population, population growth, age, gender and other information required by the terms of reference. Where 2006 data was presented and where relevant, the SIA recognised changes that may have occurred due to recent development activity within the region. The assessment was also informed by targeted consultation with key stakeholders as well as the outcomes of the consultation program more generally. Key indicators have been reviewed and updated using 2011 ABS census data as a part of the SREIS (Appendix 13, Supplementary Social Assessment).
R19159	S150	The description of the social environment and the history of settlement in the Darling Downs is inadequate.	EIS Appendix P, sections 3.16, 3.17, Appendix Q and Appendix R	EIS Appendix P, Social Impact Assessment (SIA), Section 3.16 details the non-Indigenous history and heritage of the region. A summary of the Indigenous heritage technical report is contained in Section 3.17. Further detail is contained within EIS Appendix Q, Aboriginal Cultural Heritage Impact Assessment and EIS Appendix R, Non-Indigenous Heritage Impact Assessment. The detail provided is consistent with the requirements of the EIS Terms of Reference issued by DERM (now EHP) and consistent with the level of information typically provided in an assessment of this nature.
R19160	S120	The social impacts from limited access to health/education services due to an increase in	EIS Appendix P, sections 6.6,	EIS Appendix P, Social Impact Assessment (SIA), Section 6.6 outlines the impacts of the project on community infrastructure and services. Impacts on

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Issue No.	Submission No.	Issue	Reference	Responses
R19160	S120	demand not addressed adequately.	6.6.4 and 6.6.5	<p>medical and health facilities, schools and childcare are assessed in sections 6.6.4 and 6.6.5 of the SIA respectively.</p> <p>The SIA included an assessment of impacts on these services due to the potential increased demand from the project. This considered potential demand, based on the likely population increase from the project and services provided at the TWAFs, along with the supply of existing facilities in the study area. The assessment was informed by the outcomes of consultation with key agencies such as Queensland Health and the Department of Education and Training.</p> <p>The SIA acknowledges that medical, health, education and childcare services will experience increased demand from project workers and their families. For medical, health and childcare services, this has the potential to compound the current existing shortage of services.</p> <p>Arrow will liaise with emergency services and Queensland Health in planning these facilities, as required. Arrow will also continue to provide to state and local government departments responsible for educational, health and other social infrastructure forecasts of workforce numbers and projected families to assist in their future service planning. Arrow will provide this information in an agreed format that will allow these departments to plan for cumulative population change (Commitment C333).</p>
R19161	S014, S044	Consultation during the Social Impact Assessment identified mental health services were 'lacking' in the region. It has been established there will be an increased demand on mental health services if the project were to proceed. Table 6.2 in Appendix P lists this as low impact.	EIS Appendix P, Section 6.6.8	<p>The significance rating used EIS Appendix P, Social Impact Assessment (SIA), includes consideration of the probability of the impact occurring and the likely consequence of that impact.</p> <p>Section 6.6.8 of the SIA determined that the significance of increased demand generated by the project on community support services would be low as Toowoomba appears to have the capacity to cater for additional demand and a new hub for delivering family, community and individual support services is to be built in Chinchilla to address the community's current and growing needs.</p>
R19162	S150	Arrow's identification of "production capacity" and demand driven gas production fails to address issues associated with its "social licence to operate".	SREIS Attachment 3, Section 2.2	<p>SREIS Attachment 3, Social Impact Management Plan, Section 2.2, describes Arrow's recognition of the company's shared responsibility with government, and society more broadly, to help facilitate the development of strong and sustainable communities. Arrow is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program.</p> <p>Arrow has already committed to the Brighter Futures Program, providing funding for community grants, sponsorships and partnership opportunities (Commitment C367).</p> <p>Examples of social investment initiatives that Arrow is currently undertaking in the region are:</p>

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Table 19.19 Social

Issue No.	Submission No.	Issue	Reference	Responses
R19162	S150			<ul style="list-style-type: none"> • Education <ul style="list-style-type: none"> – Partnering with Dalby State High School. This partnership is funding six agricultural scholarships in 2013 for the school’s Agricultural Futures and Agricultural Professionals programs intended to support the region’s ability to meet future agricultural workforce requirements. – Supporting the Ignition Project (Ignition), an initiative of the Queensland Police Service to address the increasing problem of youth boredom and inactivity in the Western Downs Region, inclusive of the townships of Dalby, Chinchilla and Tara. The initiative targets 11 to 19 year olds considered to be at risk. – Partnering with the Brisbane Broncos. This partnership has engaged over 1,400 students and residents in the Central Darling Downs region throughout 2012. It has delivered programs that focus on health, safety and education including the Brisbane Broncos Book Club, Coaching Clinics and Regional Fan Day. – Working with the Endeavour Foundation to deliver the Stepping Stones Positive Parenting Program, Latch On tertiary learning program for young adults with a disability and a school holiday respite program for children with disabilities. • Health and safety <ul style="list-style-type: none"> – Braking the Cycle which provides disadvantaged young people in Surat with supervised driving practice under the guidance of a community volunteer to safely meet the 100 log-book hours required in Queensland to attain a driver’s license. Braking the Cycle is a partnership with the Dalby Police-Citizens Youth Club (PCYC). • Environment <ul style="list-style-type: none"> – Partnering with the Condamine Alliance, the regional body for natural resource management in the Condamine catchment.
R19163	S089	EIS does not account for the underrepresentation of small agricultural communities given recent council amalgamations. Many rural people feel that they no longer have a say in the development of their locality and that decisions are made in the larger centres. The EIS does not consider this salient aspect of the socio-political context (even though there has clearly been liaison between Arrow and local government), nor does it consider the further socio-economic divisions between urban and rural which will result from the Surat Gas Project.	EIS Appendix P, Section 2.5 and Chapter 6	<p>Noted. EIS Appendix P, Social Impact Assessment (SIA), sections 6.3 and 6.5 considered the potential socio-economic divisions that could be driven by the project such as:</p> <ul style="list-style-type: none"> • Disparity in incomes between small town residents, and potential for localised inflation for services and accommodation. • Impacts on community cohesion and loss of “rural friendliness”. • Potential for skills shortages in some industries. • Potential impacts on businesses associated with increased labour costs and competition for labour.
R19164	S014, S044	SREIS to include a Social Impact Assessment which includes the cumulative impacts of:	EIS Appendix P, Section 6 and	Cumulative impacts are considered in EIS Appendix P, Social Impact Assessment (SIA), Section 6, in relation to housing, community

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Issue No.	Submission No.	Issue	Reference	Responses
R19164	S014, S044	<ul style="list-style-type: none"> • Increased landholder and community uncertainty. • Vulnerability to impacts associated with agriculture. • Loss of social connection to land/agricultural production. • Loss of agricultural land affects food supply and security. • Reduction/loss of farm income. • Disruption to farm operations. 	Table 6-13	<p>cohesiveness, land use and property and population. Table 6-13 of the SIA lists the potential key considerations for the regional area regarding potential cumulative impacts, including:</p> <ul style="list-style-type: none"> • Loss of large and productive farming areas to coal seam gas use. • Reduction in farming efficiency and productivity. • Improvement to farmers' livelihoods through supplementary income. • Heightened landholder anxiety. <p>The likelihood and consequence of cumulative impacts is inherently difficult to identify or assess because they are based on assumptions of assessments made by other projects which may be impossible to ascertain. Arrow will explore opportunities to manage cumulative impacts in consultation with relevant government agencies such as the Department of State Development and Infrastructure Planning (Formerly Department of Employment Economic Development Innovation) SIA Unit, State and local governments, industry and communities.</p>
R19165	S143	The SIMP does not quantify a number of additional negative impacts. These should be included to ensure accurate consideration of the project (e.g., impacts to existing rates of employment, impact of high wages and the ability of local business to attract and retain staff, long term viability of local business, impacts to memberships of local organisations such as Lions, Rotary, CWA, land care etc.).	EIS Appendix P, Section 6 SREIS Attachment 3, sections 1.3 and 2	<p>EIS Appendix P, Social Impact Assessment (SIA), Section 6 presents a detailed assessment of the positive and negative socio-economic impacts associated with the project on employment and skills shortages, income disparity, businesses and participation in the community. These impacts have been considered qualitatively utilising a risk framework, an approach that is consistent with other assessments of this nature.</p> <p>SREIS Attachment 3, Social Impact Management Plan, sections 1.3 and 2, addresses medium to high impacts identified in the SIA and is intended to support ongoing management of potential social impacts of the project.</p>
R19166	S015	Regarding the EIS Executive Summary, Table 10, Stakeholder contributions on managing project impacts: The table shows responses of people but this does not necessarily mean that these wishes will become reality.	EIS Executive Summary, Table 10	<p>EIS Executive Summary, Table 10 summarises the results of focus group sessions, in which participants were asked how the project could manage potential impacts. Arrow has proposed and/or must comply with a number of measures which align with the participants views. This includes compliance with requirements to negotiate conduct and compensation agreements with individual landholders in accordance with the Petroleum & Gas (Production & Safety) Act 2004 (Qld) and the mandatory conditions of the Land Access Code (DEEDI, 2010); compliance with the Strategic Cropping Land Act 2011; and management of coal seam gas water and salt as set out in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy.</p>

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Table 19.20 Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R20001	S119	Consider the need to engage cultural heritage monitors. Will there be jobs for cultural heritage monitors?	EIS Chapter 23, sections 23.6 and 23.7	Arrow will prepare Cultural Heritage Management Plans (CHMPs) or equivalent agreements in accordance with the provisions of the <i>Aboriginal Cultural Heritage Act 2003</i> (Qld) (Commitment C396). To meet this commitment and its legislative requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project development area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People. The engagement of cultural heritage monitors will be detailed in these ILUAs. Arrow also has an active Aboriginal and Torres Strait Islander Action Plan through which employment and training opportunities allied to cultural heritage management will be afforded to Aboriginal Party members associated with each particular agreement.
R20002	S122	Arrow must comply with the authorised cultural heritage management plan in accordance with the Aboriginal Cultural Heritage Act 2003.	EIS Chapter 23, sections 23.6 and 23.7	Arrow will prepare CHMPs or equivalent agreements in accordance with the provisions of the Aboriginal Cultural Heritage Act (Commitment C396). To meet this commitment and its legislative requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project development area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People. Arrow acknowledges that compliance with these ILUAs will constitute compliance with the cultural heritage duty of care. Arrow will establish an active cultural heritage management regime across its infrastructure footprint for the life of the project.
R20003	S159	Mitigated risk levels relating to Indigenous cultural heritage impacts assume compliance with policies and protocols.	–	Correct. Residual impact ratings assume that avoidance, management and mitigation measures described in the EIS are implemented and sustained.
R20004	S159	Adequate monitoring for compliance and identification of emergent issues over the life of a project may present challenges (e.g., recognition of new / additional information, sites or artefacts over the life of the project).	EIS Chapter 23, sections 23.6 and 23.7	Management, monitoring and protocols related to Indigenous cultural heritage management will be set out in CHMPs or equivalent agreements, which will be agreed with the relevant Aboriginal parties. In addition Arrow has committed to incorporate cultural heritage awareness into site induction procedures, including information on heritage values of the region, legal obligations and implementation of the 'chance finds' procedure (Commitment C409). CHMPs or equivalent agreements (i.e., ILUAs) will inform internal controls on how Arrow operationalises various aspects of its project.
R20005	S122	EIS Chapter 23, Section 23.3.1 refers to current	EIS	Noted. Arrow will give notice of the development of CHMPs or equivalent

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Table 19.20 Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R20005	S122	Aboriginal parties but does not refer to previously registered native title parties that continue to constitute the Aboriginal party as per sections 34 and 35 of the Aboriginal Cultural Heritage Act 2003 (Qld). Specifically, this includes the Barunggam People (QC99/5) and Western Wakka Wakka People (QC99/4). It is noted that these parties are referred to in EIS Appendix Q but are not included in EIS Section 23.3.1.	Chapter 23, Section 23.3.1	agreements in accordance with the notification requirements of the <i>Aboriginal Cultural Heritage Act 2003</i> (Qld). Arrow consults and negotiates as required under the Native Title Act and Cultural Heritage Act. Further, Arrow also has voluntary consultations with Traditional Owners within it's footprint. The SGP EIS area is a relatively small area in comparison to the area of Arrow's total footprint. The groups consulted with in the SGP EIS area are: Iman, Emon, Cobble Cobble, Wakka Wakka, Western Wakka Wakka, Bigambul, Mandandanji, Barunggam, Jarowair (Yarrowair), Wulli Wulli, Northern Gomeri, Kamilaroi, Yeeman, Gambuwal (Kambuwal) Other groups consulted with include: Bailai, Jangga, Barada Barna, Jetimarala, Birri, Kabalbara, Bunda, Southern Barada, Darumbal, Ewamian, Wiri, Gaangalu, Gooreng Gooreng, Yarowair, Gudjala, Gurang, Yetimarla, Yirendali.
R20006	S131	The department expects a rigorous Cultural Heritage Management Plan (CHMP) development process with comprehensive Indigenous consultation and an assurance that CHMPs will be completed before construction commences in any development area.	EIS Chapter 23, Section 23.6	Under Section 87 of the <i>Aboriginal Cultural Heritage Act 2003</i> (Qld), an approved CHMP (or equivalent agreement) is mandatory for projects for which an EIS is required, prior to project activities commencing. Arrow will prepare CHMPs or equivalent agreements in accordance with the provisions of the Aboriginal Cultural Heritage Act (Commitment C396). To meet this commitment and its legislative requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project development area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People.
R20007	S131	EIS Appendix Q, page 36 notes that no Cultural Heritage Management Plans (CHMPs) have yet been settled for the project development area and EIS Appendix Q, page 3 states that the proponent will issue notices for CHMPs approximately three years in advance of its intention to develop any particular section of tenement. The outstanding question is: Will CHMPs be completed before construction commences?	EIS Chapter 23, Section 23.6	Under Section 87 of the <i>Aboriginal Cultural Heritage Act 2003</i> (Qld), an approved CHMP (or equivalent agreement) is mandatory for projects for which an EIS is required, prior to project activities commencing. It is a legal requirement that approved CHMPs or equivalent agreements are in place before construction commences. To meet these legal requirements, Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project development area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People.
R20008	S134	Arrow to provide details on why only significant heritage sites will be avoided (EIS Chapter 5,	EIS Chapter 5, Table 5.10 and	EIS Chapter 5, Project Description, Table 5.10 has been provided to briefly summarise the environmental and social design specifications of Arrow's

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Table 19.20 Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R20008	S134	Project Description Section 5.4.2, Table 5.10), and not all heritage sites. How does Arrow intend to gain approvals and acceptance from the local groups for heritage sites not listed as 'significant'?	Chapter 23, Section 23.6	health, safety and environmental management system (HSEMS). The table is not intended as an outline of Arrow's cultural heritage commitments. Indigenous cultural heritage avoidance, mitigation and management measures are discussed in EIS Chapter 23, Indigenous Cultural Heritage, Section 23.6. Indigenous cultural heritage will be managed in accordance with approved CHMPs or equivalent agreements, which will involve consultation with the endorsed Aboriginal Parties.
R20009	S150	Arrow has restricted itself to an exclusive Aboriginal consultation which denies some Aboriginal communities and traditional owner groups the chance to exercise their unique and special relationship (spiritual and physical) with their country. The submission references groups within the Border Rivers and Maranoa Balonne catchments. If the Aboriginal communities and traditional owners in whose country the project development area lies are to have a more meaningful involvement in the future decision-making, planning and management of the region's natural resources then their voices must be recognised by Arrow.	-	Arrow is negotiating two Indigenous Land Use Agreements (ILUAs) that overlap the Surat Gas Project development area. Negotiations for the Western Downs Unclaimed Area agreement are complete. Arrow has lodged this agreement with the National Native Title Tribunal for registration. The remaining area of the Surat Gas Project is overlapped by the proposed Bigambul ILUA. Arrow is currently negotiating an agreement with the Bigambul People. Arrow gives notice of the development of CHMPs or equivalent agreements in accordance with the notification requirements of the <i>Aboriginal Cultural Heritage Act 2003</i> .

Table 19.21 Non-Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R21001	S014, S044	The EIS has acknowledged impacts to the land and lifestyle within the project development area that have significant cultural value. The non-indigenous cultural heritage assessment discusses the European built heritage but not the non-built heritage sites relating the history of the project development area.	EIS Chapter 24, Section 24.2 and Appendix R	International, national and state heritage registers, regional councils, and local historical societies and archives were consulted during the course of the non-Indigenous cultural heritage assessment. In addition, a public information campaign was conducted, using community forums and direct mail out to obtain responses from landowners about heritage items that might occur on their properties. Property owners who responded were contacted and the sites were inspected and recorded. See EIS Chapter 24, Non-Indigenous Cultural Heritage, Section 24.2.1 and EIS Appendix R, Non-Indigenous Heritage Impact Assessment. To date, no non built heritage sites within the project development area have been identified or brought to Arrow's attention, though the importance of these sites to the community is acknowledged. Of the highly significant state-listed heritage sites which have been identified, all but one (Wyaga homestead) are located within towns and are therefore excluded from potential impacts associated with project activities. Wyaga homestead will be avoided through site selection. Potential remains for impacts to unknown sites during construction, for which Arrow will develop a 'chance-finds' procedure. Should further details of local non built heritage sites within the project development area be available, Arrow would welcome this information for consideration in project planning.
R21002	S014, S044	People have defined the area since it was first settled. Towns and regional history relate directly to the people who lived and worked the land since it was first settled. Road, street and landmark names are a general indication of these families in any town or region. The cultural heritage of the region will be dealt a serious blow if the administering authority does not take into account this generation's knowledge and expertise regarding impacts on the land.	EIS Chapter 24, Section 24.6 and Appendix R, Section 5	The existing environment and history of the area has been detailed in EIS Appendix R, Non-Indigenous Heritage Impact Assessment, Section 5. Arrow has committed to: <ul style="list-style-type: none"> • Consult with the local community regarding the management of threatened historic sites and places (Commitment C408). • Incorporate cultural heritage awareness into site induction procedures, including information on heritage values of the region, legal obligations and implementation of the 'chance finds' procedure (Commitment C409).
R21003	S162	Although being outside of the EIS tenement, the heritage listed Jimbour House is not identified in Chapter 24 as a point of significance. In Chapter 18, it is considered a critically important viewing platform with regards to visual amenity yet the cultural significance that brings a lot of people from many locations has been ignored. There are many concerts both free and priced held either at the amphitheatre or next to the house, which overlooks the entire Jimbour Plain. It is one of the Western Down Regional Council's biggest tourist attractions. The oversight again raises questions about the	–	<i>Jimbour</i> (Queensland Heritage register, Place Id 600941) is identified and discussed in EIS Appendix R, Non-Indigenous Heritage Impact Assessment, Section 2, p.79. The main buildings, including the homestead and associated features, lie to the east of the project development area. However, a complex of historic buildings and features including a woolshed, washpool, cemetery, bridge on the Cobb and Co route, historic dump, and site of an old hotel near the woolshed lies within the project development area. See EIS Appendix R, Figure 2-4. Arrow has committed to avoid known cultural heritage sites, where practical, through site selection (Commitment C403). Arrow has also committed to avoid visually sensitive locations and landscapes when siting facilities, where practicable. This will involve seeking backdrops to protect the skyline in

Table 19.21 Non-Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R21003	S162	thoroughness of the EIS document.		distant views and avoiding siting facilities within view of sensitive viewpoints, particularly the bird hide and camping area at Lake Broadwater, Captains Mountain, Jimbour House, the Cunningham Highway, towns, schools and private residences (Commitment C265).
R21004	S134	Provide details on why only significant heritage sites will be avoided (EIS Chapter 5, Section 5.4.2, Table 5.10), and not all heritage sites. How does Arrow intend to gain approvals and acceptance from the local groups for heritage sites not listed as "significant"?	EIS Chapter 24, Section 24.6	EIS Chapter 5, Project Description, Table 5.10 has been provided to briefly summarise the environmental and social design specifications of Arrow's health, safety and environmental management system (HSEMS). The table is not intended as an outline of Arrow's cultural heritage commitments. Non-Indigenous cultural heritage avoidance, mitigation and management measures are discussed in EIS Chapter 24, Non-Indigenous Cultural Heritage, Section 24.6. These include Arrow's commitment to avoid known cultural heritage sites, where practicable, through site selection (Commitment C403). Arrow has also committed to consult with the local community regarding the management of threatened historic sites and places (Commitment C408).
R21005	S159	Mitigated risk levels relating to non-Indigenous cultural heritage impacts assume compliance with policies and protocols.	–	Correct. Residual impact ratings assume that avoidance, management and mitigation measures described in the EIS are implemented.
R21006	S159	Adequate monitoring for compliance and identification of emergent issues over the life of a project may present challenges (e.g. recognition of new or additional information, sites or artefacts over the life of the project).	EIS Chapter 24, Section 24.6	EIS Chapter 24, Non-Indigenous Cultural Heritage, Section 24.6 sets out avoidance, management and mitigation measures to minimise impacts on non-Indigenous cultural heritage values over the life of the project. Arrow will develop a cultural heritage management plan prior to the commencement of ground disturbance works, which will include requirements for managing 'chance finds' (see Commitment C405 and Commitment C409). Additionally Arrow has committed to inspect known non-Indigenous sites identified as having the potential for being impacted by the project and subsequently acknowledged for avoidance, in accordance with the relevant approval and permit conditions including the cultural heritage management plan (Commitment C325).
R21007	S133	Commitments C405, C407, C412 mention consultation with the Queensland Heritage Office, if it is intended that the consultation is to be with the administering authority of the Queensland Heritage Act 1992 (QHA), then this should be clearer, there is no actual "Queensland Heritage Office". Also consultation with the administering authority over plans is not a requirement of the act; the act only requires notification of a find (s89 QHA). The Department of Environment and Heritage Protection is the agency responsible for non-indigenous heritage protection. Commitments	SREIS Attachment 4	Noted. Commitments have been reworded as follows: <ul style="list-style-type: none"> • Develop a cultural heritage management plan prior to the commencement of ground disturbance works that will mitigate and manage potential impacts on non-Indigenous cultural heritage sites (Commitment C405). • Develop site-specific cultural heritage management plans in consultation with the Department of Environment and Heritage Protection three months prior to construction, should project activities be planned within 100 m of sites listed on State and Commonwealth registers (Commitment C407). • Notify the relevant administering authority if any cultural heritage sites or items of significance are uncovered during construction, in accordance with section 89 of the <i>Queensland Heritage Act 1992</i> (Qld) (Commitment C412).

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Table 19.21 Non-Indigenous Cultural Heritage

Issue No.	Submission No.	Issue	Reference	Responses
R21007	S133	made regarding Queensland Heritage should be reworded in the supplementary report to the EIS to accurately take into account the requirements of the QHA.		

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Table 19.22 Preliminary Hazard and Risk

Issue No.	Submission No.	Issue	Reference	Responses
R22001	S079	What, and whose, safety requirements is the statement in Section 13.6 regarding well pad design referring to?	EIS Chapter 13, Section 13.6	EIS Chapter 13, Section 13.6 explains that the measures discussed fulfil the nominated environmental protection objectives. Arrow operations comply with Arrow's Health, Safety and Environment Management System. Safety requirements that relate to well pad design are specific to ensuring buffers are adequate and are consistent with risk assessments, and ensuring minimal community exposure to project related activities.
R22002	S011, S099	The likelihood of a bushfire is rated low to medium based on ratings that partly use historical incidence rates. Specifically, in areas of vegetation corridors (Jimbour Creek), floodplains (intensively cropped) and in areas of proposed wells, pipelines and flares. However, incidence rates will be changed for the increased activity levels, combustible materials and sources of ignition etc. Therefore these historical rates are not an appropriate reference for bushfire likelihood levels.	EIS Chapter 25, Section 25.6.3 Appendix G to Appendix A Appendix S SREIS Chapter 3 Figure 3.1 and Attachment 4	The likelihood of bushfire in the project development area is derived from the applicable local government planning scheme maps. The maps show that the project development area includes a mix of medium and low bushfire hazard areas (Appendix G to EIS Appendix A, Planning Assessment). As such, Arrow is required to take into account the requirements of State Planning Policy 1/03 on mitigation for bushfires (Commitment C538) when designing, construction and operating project facilities. In addition, the Preliminary Hazard and Risk Assessment (EIS Appendix S) identified a number of hazard scenarios that could lead to bushfires. These scenarios acknowledge that project activities, such as flaring, could cause fires. The level of risk associated with each scenario was assessed and additional measures identified to reduce these risks. Arrow has committed to a range of measures to reduce the fire risk associated with the project; see EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3 and SREIS Attachment 4, Commitments Update. Since the preparation of the EIS, further information has been gained on the gas reserves and the portion of the project development area encompassing the Jimbour Plain has been reduced. This change will result in a larger separation distance between Jimbour House and project activities. SREIS Chapter 3, Project Description, Figure 3.1.
R22003	S011, S130	Appendix S, Table 25 the likelihood of flooding causing restricted access to sites, and overflowing of dams has been rated as rare or practically impossible. However, according to the Department of Environment and Resource Management three such instances of overflow occurred in 2011, and an additional six instances required special arrangements outside the conditions of their Environmental Authorities to allow discharges of water in order to avoid overflow of dams. Therefore the likelihood level for this event should be rated as likely - having occurred in recent history. This would elevate the risk level from very low risk to medium risk, and would require a higher standard of specification and/or better protection measures to be put in place to manage this risk.	EIS Chapter 25, sections 25.6.2, 25.6.3 and Appendix S	Noted. EIS Chapter 25, Preliminary Hazard and Risk, summarises the preliminary assessment of potential hazards and risks associated with project activities (see Appendix S). As the design of the project progresses, Arrow will conduct further systematic risk assessments during design, construction and operations (which will include hazard identification, assessment, treatment and monitoring) in accordance with relevant legislation and standards (Commitment C455). As noted in EIS Chapter 25, Section 25.6.3, Dam safety is heavily controlled through dam safety guidelines and application of the State Planning Policy 1/03 for mitigating the adverse impact of flood, bushfire and landslide, which will apply for all facilities forming part of the project development (Commitments C211). Arrow will design and size dams to account for predicted flood conditions and determine the hazard category of the dam in accordance with the requirements of the most recent version of the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (DERM, 2011a) (Commitment C141). Mitigating features for avoiding overflow and a flood event include designing dams with

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Table 19.22 Preliminary Hazard and Risk

Issue No.	Submission No.	Issue	Reference	Responses
R22003	S011, S130			spare capacity and avoiding the placement of dams in areas of high flood risk.
R22004	S020	The EIS is full of phrases such as "under normal conditions", what is normal out here? Do "normal conditions" account for floods, decades of drought, heatwaves or freezing frosts or are they unforeseen events?	EIS Appendix S	Arrow will design and construct the production facilities in accordance with current Australian standards addressing climatic factors including wind, bushfires and floods (Commitment C026). The State Planning Policy 1/03 for mitigating the adverse impact of flood, bushfire and landslide will be taken into regard (Commitment 538). EIS Appendix S, Preliminary Hazard and Risk Assessment, discusses "normal operation" which occurs when the facilities are operating and producing within their designed operational envelopes. Outside of normal operation, the facilities will be managed under restricted conditions as defined by the facility emergency management plans which will enable a rapid and safe shut down if required.
R22005	S089	The EIS does not deal with the issue of increased likelihood of bushfires as a result of gas flares. With average temperatures projected to increase and average rainfall projected to decline, adding fugitive emissions and gas flares to the mix is increasingly incendiary. Although the EIS considers bushfires as part of the general risk associated with the regions, it does not state that the mining activities are potential causes of bushfires.	EIS Chapter 25, Section 25.7, Table 25.10 Appendix S, Section 3.3.2, Table 16	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.7 identifies the hazard scenarios and potential impacts involving gas or fire and explosion. Table 25.10 documents a hazard scenario where a bushfire results from an ignition source at a production facility such as a flare or hot works. Table 25.10 documents the hazard scenarios and mitigation measures where a bushfire results from external sources. The risk assessment concludes that such an event has a rare likelihood of occurring and a low overall risk given the application of a number of mitigation measures that Arrow will implement. Further detailed assessment of the hazard scenarios is provided in EIS Appendix S, Preliminary Hazard and Risk Assessment, Section 3.3.2. Table 16 identifies two potential incident scenarios relating to fire risk, including from inappropriate use of a site flare.
R22006	S121	A number of councils in the project area are listed in Annex 2.1 and 2.3 of State Planning Policy 1/03 and therefore the EIS must consider the requirements of State Planning Policy 1/03 with regards to bushfires and landslides.	EIS Chapter 25, Sections 25.1, 25.6.2 and 25.6.3 SREIS Chapter 2, Section 2.1	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.1 identifies and takes into account the legislation and associated regulations, standards and guidelines that are applicable to the project with respect to hazard and risk, including State Planning Policy 1/03. Arrow has committed to mitigate the adverse impacts of flood, bushfire and landslide in accordance with the requirements of State Planning Policy 1/03 (Commitment C538). Measures to achieve compliance with this policy will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities", as outlined in SREIS Chapter 2, Project Approvals, Section 2.1. Emergency response plans will be developed for all facilitates in consultation with the relevant emergency services organisations (Commitment 424).
R22007	S121	The EIS should provide mitigation measures in the Environmental Management Plan which address	EIS Chapter 25, Section 25.6.3	Noted. Specific controls for managing bushfire risk, including during rehabilitation activities, will be set out in the statutory information

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R22007	S121	the prevention and management of bushfire in areas in which vegetation rehabilitation is to be undertaken.	SREIS Chapter 2, Section 2.1	requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities" as outlined in SREIS Chapter 2, Project Approvals, Section 2.1. EIS Chapter 25, Section 25.6.3 details the commitments Arrow has already made to manage bushfire risk throughout the project. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.7 identifies the hazard scenarios and potential impacts involving gas or fire and explosion. Table 25.10 documents the hazards and includes a hazard scenario where a bushfire results from an ignition source at a production facility such as a flare or hot works. Table 25.10 documents the hazard scenarios and mitigation measures where a bushfire results from external sources.
R22008	S121	The EIS should include details of the location of temporary work camps during construction and operation and identify those areas as medium and high bushfire risk as defined in State Planning Policy 1/03.	EIS Chapter 5, Section 5.5.8	EIS Chapter 5, Project Description, Section 5.5.8 notes that the site selection process for construction camps will be guided by factors such as design, environmental, social and cultural heritage constraints and to reduce commuting times to the work fronts. As the project development area consists of a mixture of medium and low hazard areas only, areas of high bushfire risk will be avoided.
R22009	S121	The project should be compliant with the Fire and Rescue Service Act 1990 where necessary.	EIS Chapter 25, Section 25.6.2	Noted. The project will be undertaken in accordance with relevant legislative requirements including those detailed in the Fire and Rescue Services Act 1990. Emergency management planning will be undertaken in consultation with relevant Queensland government authorities and emergency services organisations (Commitment C424).
R22010	S121	The Queensland Fire and Rescue Services (QFRS) identified potential areas of concern in the EIS regarding wildfire mitigation strategies during construction and operational phases of the project in relation to the plant and other structures being proposed.	EIS Chapter 25, Section 25.6.2	Noted. Arrow has committed to consult with relevant emergency service organisations in the development of emergency response plans for the project (Commitment C424) (EIS Chapter 25, Section 25.6.2). Plans will include detailed controls required to manage bushfire risk at project sites.
R22011	S005	There are concerns that coal seam gas infrastructure becomes unsafe during flood events.	EIS Chapter 25, Section 25.7, 25.6.1, 25.6.3 and Table 25.11	The hazards and risks associated with flooding on the integrity of project facilities were assessed as part of the preliminary hazard and risk assessment completed for the project (Appendix S, Preliminary Hazard and Risk Assessment). The assessment considered flooding at production facilities, central gas processing facilities, integrated production facilities (gas and water facilities) and low pressure gas and water gathering systems. EIS Chapter 25, Section 25.7, Table 25.11 summarises the results of the assessment and identified a number of hazard scenarios that involve flooding. The level of risk posed to facilities affected by flooding events was assessed for a number of potential scenarios, as medium to very low, depending on the scenario considered.

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Issue No.	Submission No.	Issue	Reference	Responses
R22011	S005			Arrow will design and construct project infrastructure in accordance with appropriate industry codes and standards (Commitment C420) and with regard to State Planning Policy 1/03 that addresses the mitigation of adverse impacts of flooding. Flood risk can be managed through careful site selection for vulnerable facilities and by installing adequate drainage at facilities. (Commitments C433 and C538).
R22012	S011	There are concerns with Appendix S, 8.4.1 - from a bushfire point of view, that the developments in the Surat Gas Project development area are acceptable (low to medium) provided State Planning Policy 1/03, Mitigating the Adverse Impact of Flood, Bushfire and Landslide (R105) in managing bush fire risks is implemented.	EIS Chapter 25, Section 25.6.3 Appendix G to Appendix A Appendix S	Noted. The likelihood of bushfire in the project development area is derived from the applicable local government planning scheme maps. The maps show that the project development area includes a mix of medium and low bushfire hazard areas (Appendix G to EIS Appendix A, Planning Assessment). As such, Arrow is required to take into account the requirements of State Planning Policy 1/03 on mitigation for bushfires (Commitment C538) when designing, construction and operating project facilities. In addition, the Preliminary Hazard and Risk Assessment (EIS Appendix S) identifies a number of hazard scenarios that could lead to bushfires. These scenarios acknowledge that project activities, such as flaring, could cause fires. The level of risk associated with each scenario was assessed and additional measures identified to reduce these risks. Arrow has committed to a range of measures to reduce the fire risk associated with the project; see EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3 and SREIS Attachment 4, Commitments Update. Cooperation with the various regulatory authorities and local services such as the Rural Fire Service will be developed and maintained. Each site will form part of emergency response procedures (ERP), as part of the requirements in the Schedule of Onshore Petroleum Exploration and Production Safety Requirements (clause 210 of the Schedule). These safety measures will be developed using proper risk management protocols and procedures in full consultation with all stakeholders including the Rural Fire Service (refer to EIS Appendix S, Preliminary Hazard and Risk Assessment, Section 8.4.1.
R22013	S011, S014, S044	The supplementary report to the EIS should consider the risk associated with land management and mitigation measures for situations relating to agricultural activities and highly flammable raw cotton, stubble fires and hazard reduction controlled burning. Though uncommon these days, there are times when landholders deem it necessary to burn crop stubble. Situations when raw cotton, or other highly flammable material, ignites are usually caused by machinery. Significant increases in fire risk can also affect hens' welfare and health.	EIS Chapter 25, sections 25.4, 25.7, 25.6.3 and Table 2.11 Appendix S	EIS Chapter 25, Section 25.4 identified and assessed the hazards and risks associated with external events such as fire. Arrow recognises that specific controls are needed to reduce the potential impacts of fires on facilities and the surrounding environment. A range of mitigation measures will be adopted to manage these risks (EIS Chapter 25, Section 25.6.3 and Appendix S) and include designing facilities that can be shut down and isolated in the event of a fire and the creation of asset protection zones around the facilities through vegetation clearing (Chapter 25, Section 25.7, Table 2.11). Arrow has also committed to consulting with landholders on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (Commitment C084) to reduce potential impacts on existing and future uses of that land. Fire risk

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Issue No.	Submission No.	Issue	Reference	Responses
R22013	S011, S014, S044			and measures to manage this risk will be discussed on a case-by-case basis.
R22014	S048	There are concerns that by increasing the compensation received by landholders, some farmers may neglect their farms and live instead off their compensation payments, leading to grass build up and consequential fire risks.	EIS Chapter 25, Section 25.6.3	Noted. Vegetation around production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (Commitment C483).
R22015	S099	More information is required on the flow on impacts from use of fire fighting equipment on saline coal seam water and clay soil. Details should be provided on how Arrow will manage fire risks while still avoiding impacts to Strategic Cropping Land.	EIS Chapter 25, sections 25.6.3, 25.7, Table 25.11 Attachment 9, Section 2.2 and Appendix S	Coal seam water, in its saline state, will not be used for fire fighting purposes. EIS Attachment 9, Coal Seam Gas Water Management Strategy Section 2.2, states that coal seam gas water will be treated to the minimum standard before it is utilised in a beneficial use capacity. The beneficial use of this water is constrained by the salt content, often requiring treatment prior to use. As only treated saline water may be utilised, potentially negative impacts from flow-on effects towards strategic cropping land, are not present. A range of mitigation measures will be adopted to manage the risk of fires during the project (EIS Chapter 25, Section 25.6.3 and Appendix S, Preliminary Hazard and Risk Assessment). These measures include designing facilities that can be shut down and isolated in the event of a fire, and the creation of asset protection zones around the facilities through vegetation clearing (Chapter 25, Section 25.7, Table 2.11). Arrow has also committed to consulting with landholders on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (Commitment C084) to reduce potential impacts on existing and future uses of that land. Discussions will include consideration of fire risk on properties on a case by case basis and appropriate measures to manage this risk.
R22016	S104	Are some of the fittings used on the well heads made of plastic, and therefore melt as a result of a lightning strike or bushfire?	EIS Chapter 25, Section 25.6.3	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3, describes the design of project equipment and their ability to withstand a considerable heat load (Commitment C428). For example, heat resistant (fire-safe) isolation valves will be used on production facilities. For additional safety, the transition between the well head facilities and the polyethylene gathering systems will be underground at the well head location.
R22017	S136, S158	Facilities will be designed with the ability to shut down and be isolated in preparation for impending bushfires. It is requested that such plans include preparedness for other natural events such as flood, earthquake as well as potential disasters from man-made construction.	EIS Chapter 11, Section 11.6 Chapter 25, Section 25.6.3	Arrow is committed to complying with the requirements of State Planning Policy 1/03 Mitigating the Adverse Impact of Flood, Bushfire and Landslide and to designing and constructing production facilities in accordance with relevant Australian standard requirements on climatic factors such as wind, bushfire and floods (Commitments C026 and C538). Arrow's incident and emergency management system requires that plans, equipment, training and other resources are identified, documented and maintained for all foreseeable emergency and crisis situations. These situations would encompass emergencies arising from both natural events such as earthquakes, and from events caused by people (Chapter 25,

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Issue No.	Submission No.	Issue	Reference	Responses
R22017	S136, S158			Preliminary Hazard and Risk, Section 25.6.3).
R22018	S014, S044	The supplementary report to the EIS should consider the risk associated with landholders' water bores producing gas following the reduction of pressure in the coal seams. Management and mitigation measures should also be provided. Most landholders on the floodplain have groundwater supplied to their homes.	EIS Chapter 14, Section 14.6.3 and Figure 14.4	<p>Arrow will extract coal seam gas water from the Walloon Coal Measures to reduce the reservoir pressure in the coal seams to release adsorbed gas. Gas flow is proportional to the cone of depression created around a production well, the gas content of the coal within the cone of depression and the coal permeability. Proximity of groundwater bores to production wells will determine the extent to which the bore might be exposed to the cone of depression and therefore exposed to the potential for fugitive gas flows. The cone of depression around a production well will promote gas flow to the production well drawing it away from the peripheries of the cone of depression.</p> <p>Only wells within the Walloon Coal Measures are potentially exposed to this risk. This risk is partly managed through bore integrity requirements, which are designed to limit the potential for gas migration. Arrow has committed to 'Implement a well integrity management system during commissioning and operation of production wells' (Commitment C143). Such a system will include components addressing well construction, assessment of the effectiveness of well completion, and post construction monitoring and response to identified issues of well integrity.</p> <p>This risk is also managed through operation of the production wells which aims to achieve only a sufficient reduction in reservoir pressure to promote gas flow.</p> <p>As set out in EIS Chapter 14, Groundwater, Section 14.6.3, Arrow will undertake bore assessments (where possible) in accordance with the <i>Water Act 2000</i> (Qld), including:</p> <ul style="list-style-type: none"> • Having the Office of Groundwater Impact Assessment for the Surat Cumulative Management Area identify bores requiring assessment. • Developing make-good agreements that include the outcome of bore assessments and implementation of make-good measures in the event that impaired capacity occurs (Commitment C127).
R22019	S023, S112	There are problems with gas escaping from underground and bubbling up into the Condamine River. What is being done to find the cause of this?	-	<p>The cause of the presence of gas in the Condamine River has not been determined at the time of submission of the SREIS. Investigations carried out at the time of writing suggested that based on the information obtained by the DERM LNG enforcement unit (DNRM, 2012b), the cause of bubbles in the Condamine River was unlikely to be due to coal seam gas activities. Origin Energy has advised DNRM that the gas present may be naturally-occurring coal seam methane rising through the underlying geology in the area. Further investigations into the cause of gas in the Condamine River are continuing.</p> <p>Part 1 of the summary technical report of the Condamine River gas seep investigation (DNRM, 2012b) also concluded no apparent safety risk in the immediate are of the seeps, and no apparent evidence of environmental harm that can be attributed to the present gas seeps.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R22020	S079	With the de-watering and depressurisation of the Walloon Coal measures, could we expect coal seam gas emissions from uncapped irrigation bores in the Condamine Alluvium?	–	Arrow will extract coal seam gas water from the Walloon Coal Measures in order to depressurise the coal seams to release entrained gas. Depressurisation of the Walloon Coal Measures will cause a flux from the Condamine Alluvium to the Coal Measures. Hydrostatic pressure created by the flux will limit the potential for gas migration to bores which draw water from the Condamine Alluvium. Notwithstanding this, a number of gas migration investigations are currently proposed by Arrow and other parties. Work proposed by Arrow will consider the nature of the interface between the Condamine Alluvium and Walloon Coal Measures, and whether legacy coal and mineral exploration bores are conduits for fugitive gas emissions.
R22021	S079	What are the safety issues with coal seam gas emissions from any uncapped bores?	EIS Chapter 14, Section 14.6.6 Chapter 25, sections 25.4.2, 25.6, Table 25.10 Attachment 5	Arrow has committed to cap or fit wellhead equipment to wells at the completion of drilling to avoid any uncontrolled release of gas or water (Commitment C113). EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2 identifies scenarios that may involve a release of gas due, for example to physical damage to wellheads or an equipment failure, and that might create a hazard to people or property. Section 25.6 then presents the measures Arrow will implement to avoid, reduce or manage risks associated with these potential hazards. Table 25.10 provides a summary of the scenarios, mitigation measure and residual risks associated with each potential event. Arrow has also committed to decommission or repair all production wells and monitoring bores, either at the end of their operating life span or in the event of a failed integrity test in accordance with the minimum construction requirements for water bores in Australia (LWBC & NMBSC, 2003) and the <i>Petroleum and Gas (Production and Safety) Act 2004</i> and regulations to that act. Should production wells be converted into monitoring bores, Arrow will do so in accordance with relevant regulations (Commitment C150). Arrow will apply the Code of Practice for Constructing and Abandoning Coal Seam Gas Wells in Queensland (DEEDI, 2011b) when fulfilling the above commitments.
R22022	S104	There is concern that the expansion and contraction of black soils through differing weather conditions will cause possible splitting of the joints in underground gas pipes which could then create a possible safety issue.	EIS Chapter 12, sections 12.3.3 and 12.6.1	EIS Chapter 12, Geology, Landforms and Soils, Section 12.3.3 describes the properties of 'cracking clays', including black cracking clays which are of high value for agricultural production. These soils are dominant soil type along the Condamine River valley within the vicinity of Dalby, and to the south and east of Cecil Plains. Arrow recognises the need to design project infrastructure to suit the specific conditions in the project development area. As such, buried infrastructure will be designed, as a minimum, to withstand the differential shrink-swell ground movement, typical of black soil expansion and contraction (Commitment C042). Pipelines will be designed to include gas detection systems, automatic alarms, and emergency shutdown systems allowing operators to respond quickly to pipeline leaks caused by soil movement.

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Issue No.	Submission No.	Issue	Reference	Responses
R22023	S104	There are concerns over gas leakages given that methane gas is odourless and colourless, hence, it is harder to detect. There are fears that farm-harrowing, lightning, bushfires and/or sparks could light leaking gas from wells and compression stations.	EIS Chapter 25, sections 25.4.2, 25.6, 25.6.3 and Table 25.10 SREIS Chapter 3, Section 3.6.3	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2 identifies scenarios that involve a release of gas due, for example to physical damage to wellheads or an equipment failure, and that might create a hazard to people or property. These scenarios include gas release, ignition and fires. Section 25.6 details the measures Arrow will implement to avoid, reduce or manage the risks associated with these potential hazards. Table 25.10 provides a summary of the scenarios, the mitigation measures, and the residual risks associated with each event after the measures have been implemented. Production wells, pipelines and production facilities will be designed to include fire detection and suppression systems, gas detection systems, automatic alarm systems, and emergency shutdown systems. Facilities will also be regularly inspected by operations staff (SREIS, Chapter 3, Project Description, Section 3.6.3). Arrow will develop emergency response procedures in consultation with the relevant emergency services organisations so as required equipment, training and other resources are in place in the event of any foreseeable emergency and crisis situations (see Commitment C424).
R22024	S104	There are concerns for gas migrating through the ground and into surface water bodies (e.g., Condamine River) and suggests coal seam gas drilling is to blame, as the two events coincide.	–	The cause of the presence of gas in the Condamine River has not been determined at this point in time. It could result from a range of activities and natural phenomena.
R22025	S113	Areas where percolation of gas to the surface could occur must be mapped and displayed to landholders and public within a 200 km radius to prevent asphyxiation casualties.	–	Coal seam gas is predominately comprised of methane, which is lighter than air. Any gas migrating to the surface will quickly dissipate in the atmosphere and not pose a risk to human health.
R22026	S134	Arrow to take full responsibility for response and recovery in the event of an incident relating to potential explosive and flammable coal seam gas emissions.	EIS Chapter 25, sections 25.6 and 25.6.2	Arrow will implement a range of controls including engineering, procedural and behavioural controls to manage potential hazards and risks associated with the project as set out in EIS Chapter 25, Section 25.6. Several of the potential scenarios identified in the assessment relate to the accidental release of gas at production wells and compression facilities and associated explosions and fires. Emergency response procedures will be developed and then implemented in the event of an emergency (Commitment C171). Such plans will be developed in consultation with the relevant emergency services organisations so as the required equipment, training and other resources are in place in the event of any foreseeable emergency and crisis situations (see Commitment C424).
R22027	S146	Do the venting/drain points have any detection/alarm systems to determine if there is excessive gas venting/water draining from these points? That is, if something goes wrong?	EIS Chapter 25, Section 25.6.3	Production wells, pipelines and production facilities will be designed to include numerous safety systems that maintain the integrity of the facilities. These systems include gas detection systems and emergency shutdown systems which respond to the loss of containment of flammable gas (Chapter

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Issue No.	Submission No.	Issue	Reference	Responses
R22027	S146			25, Preliminary Hazard and Risk, Section 25.6.3).
R22028	S015	How low is a risk deemed to be 'as low as reasonably practicable?' with respect to the comment, "coal seam gas is comprised predominately of methane and residual risk is to be reduced to as low as reasonably practicable".	–	As low as reasonably practicable (ALARP) is a term used to describe the principle of reducing a risk to a level where the cost of reducing the risk further, would be disproportionate to the benefit gained. The process of reducing risks to ALARP on the Surat Gas Project will be ongoing throughout the design, operation and decommissioning phases.
R22029	S001	The EIS does not address the issue of the effect of wind on a fairly large area of brine and the salt air effect it gives downwind which can be destructive to plants and animals.	–	<p>Potential airborne effects of salt on land around the brine dams could feasibly occur through salt spray (aerosol) generated by strong winds across the dam surface.</p> <p>Salt from a saline water body escapes into the atmosphere as liquid droplets generated by the action of the wind and breaking waves. Surf action is a major source of sea spray on coastlines but is not significant on small dams and lakes. On a relatively small water body such as a brine dam, white caps are the only mechanism for causing spray.</p> <p>After being formed, some spray particles fall back onto the water surface and others are blown downwind, where they can deposit on soils, plants and animals.</p> <p>Evaporation from a brine dam will not generate airborne salt directly. Indirectly, if conditions were suitable, excessive evaporation could dry out a brine dam and leave behind a dry salt crust that could be a source of wind-blown emissions. However, this scenario is not expected to occur.</p> <p>Natural salt deposition resulting from oceanic wind and wave activity continues at low rates hundreds of kilometres from coastlines (Cole et al. 2003b, Foltescu et al. 2005). ISO 9223 (ISO, 2012) classifies sodium chloride (salt) deposition rates according to environmental conditions. Non-coastal Category S0 is considered to have a deposition of $S \leq 8 \text{ g/m}^2/\text{year}$.</p> <p>In Australia, measurements and models of airborne salinity indicate that natural salt deposition due to ocean spray formation is approximately $1.2 \text{ g/m}^2/\text{year}$ at a distance of 200 km from the coast in southern Queensland (Cole et al. 2003b). For comparison, measured and modelled salt deposition at Amberley, Queensland is $12 \text{ g/m}^2/\text{year}$.</p> <p>Salt emission modelling for a brine dam (size 2 km^2) using AUSPLUME and considering meteorological data from sites in the southern, central and northern parts of the project development area predicted a total annual emission of salt is 35 kg, using hourly data and equations developed by Piazzola et al., 2002. The predicted rates of salt deposition vary from a maximum of $2 \text{ g/m}^2/\text{year}$ around the southern edge of the dam to less than $0.1 \text{ g/m}^2/\text{year}$ at distances ranging from less than 500 m to about 2 km from the dam, depending on direction.</p> <p>When brine dam deposition rates are added to the estimated natural</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R22029	S001			background deposition of 1.2 g/m ² /year, total deposition rates at any distance from the brine dams will remain well within ISO category S0, typical of non-coastal locations. On the basis of these results, the predicted salt deposition around the brine dams is expected to have no adverse effect on surrounding land use.
R22030	S150	The information on impacts (informal hazard assessment) does not attempt to look at possible exposure [of drilling materials] to stock, native fauna or humans.	EIS Chapter 5, Section 5.5.1 Chapter 12, sections 12.4.4 and 12.7 Chapter 13, Section 13.6 Chapter 25, sections 25.4.2, 25.6.3 and Table 25.10	EIS Chapter 5, Project Description, Section 5.5.1 states that the mud and fluids used in the drilling of production wells will be collected at the surface in tanks or in pits and either removed from site for disposal at a licenced facility or stored in purpose built containment structures on the property. Arrow's preference is to use an inert, water based drilling fluid which is mostly water with 2 to 3% salts. A small amount of additives such as bentonite (a clay-based product) may be added. The preliminary hazard and risk assessment (EIS Chapter 25, Section 25.4.2) identifies exposure to harmful materials and liquids, including drilling fluids as a potential hazard. The loss of containment of hazardous materials (including drilling muds) is then identified as a credible hazard scenario (Table 25.10). The risks associated with this scenario are assessed and mitigation measures identified to manage the risk. Arrow will apply international, Australian and industry standards and codes of practice for the handling of all hazardous materials (Commitment C035). Chapter 12, Geology, Landform and Soils, Section 12.4.4 also considers the impacts of releasing potentially harmful contaminants during drilling and exposing members of the public, wildlife and stock. Section 12.7 details the specific measures Arrow has committed to avoid, reduce and manage potential impacts from contaminants used during the drilling of production wells. Measures specific to activities on agricultural land are included in Chapter 13, Agriculture, Section 13.6, including fencing off the exclusion zone around the production well sites to exclude unauthorised personnel, stock and wildlife from that area (Commitment C097) and maintaining a minimum separation, as agreed with the landholder, between animal enclosures and production wells and facilities (Commitment C104).
R22031	S002, S003, S009, S018, S020, S032, S037, S039, S050, S053, S055, S058, S059, S064, S065, S070, S071, S076, S085, S087, S088, S095, S096, S097, S098, S114, S121, S130, S139, S140,	The EIS should include evidence that adequate access for fire fighting / other emergency vehicles and safe evacuation will be provided during construction and operation, even during an irrigation event.	EIS Chapter 25, sections 25.2.4 and 25.6.2	Infrastructure and facilities will be designed to provide adequate access for fire fighting and other emergency vehicles along with safe evacuation for people. Arrow will also develop emergency response plans and maintain an emergency management plan in consultation with relevant emergency service providers (Commitment C389 and C424). Arrow will continue to consult with emergency services and the local disaster management groups as field development progresses and the locations of infrastructure are better understood (EIS Chapter 25, Preliminary Hazard and Risk, Section 25.2.4). Arrow has also committed to engage with landholders to develop a strategy for minimising potential impacts on land and existing agricultural activities (Commitment C369).

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Issue No.	Submission No.	Issue	Reference	Responses
R22032	S099	Remote control isolation of gas and water lines in the event of failure should be compulsory in Strategic Cropping Land and intensively cropped areas (not just a 'consideration' as stated in C427).	–	Noted. The design of all facilities and infrastructure will meet relevant Australian and international standards and seek to avoid, reduce or manage potential hazards and risks to people, property and the environment.
R22033	S121	Development of safety management plans and emergency response procedures should be done in consultation with state and regional emergency service providers.	EIS Chapter 22, Section 22.8.5 Chapter 25, Section 25.6.2	Noted. Emergency management planning, including the development of emergency response plans for the project, will be undertaken in consultation with relevant Queensland government authorities and emergency services organisations, as discussed in EIS Chapter 22, Social and EIS Chapter 25, Preliminary Hazard and Risk (Commitments C389 and C424).
R22034	S121	An adequate level of training should be provided to staff that will be tasked with emergency management activities.	EIS Chapter 25, Section 25.6.2	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 states that Arrow will develop and implement safety training programs for personnel and contractors, including induction training for new starters (Commitment C442). Emergency response plans will be developed in consultation with emergency services organisations. Training requirements will form a key part of these plans so that staff are able and adequately equipped to respond to emergency and crisis situations.
R22035	S121	The Queensland Fire and Rescue Services (QFRS) identified potential areas of concern in the EIS regarding response to chemical emergencies during construction and operational phases of the project in relation to the plant and other structures being proposed.	EIS Chapter 25, sections 25.2.4 and 25.6.3	Noted. Arrow will apply appropriate international, Australian and industry standards and codes of practice to the handling of hazardous materials used in the project (Commitment C035). EIS Chapter 25 Preliminary Hazard and Risk, Section 25.2.4, notes that Arrow has consulted with various emergency services and will continue to do so as field development progresses and the locations of infrastructure are better understood.
R22036	S121	The Queensland Fire and Rescue Services (QFRS) identified potential areas of concern in the EIS regarding an increase in industrial accidents during construction and operational phases of the project in relation to the plant and other structures being proposed.	EIS Chapter 25, Section 25.6.2	Noted. EIS Chapter 25, Preliminary Hazard and Risk, presents the preliminary assessment of potential hazards and risks associated with project activities. As the design of the project progresses, Arrow will conduct further systematic risk assessments (which include hazard identification, assessment, treatment and monitoring) in accordance with relevant legislation and standards during design, construction and operations (Commitment C455). EIS Chapter 25, Section 25.6.2 provides further details on the range of health and safety measures that will be implemented to manage potential incidents. Arrow will continue to consult with emergency service providers such as Queensland Fire and Rescue Services on the required controls to manage fire risk and involve them in the development of emergency response plans (Commitment C424).
R22037	S121	There are limited Queensland Fire and Rescue Service and Queensland Ambulance Service resources located in the project area which may cause delays in an emergency situation and require	EIS Chapter 25, Section 25.6.2	Noted. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 states that Arrow will continue to consult with relevant emergency service providers such as Queensland Fire and Rescue and Ambulance Services including in the development of emergency response plans. The plans will consider the

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Issue No.	Submission No.	Issue	Reference	Responses
R22037	S121	mitigation strategies around the provision of emergency care.		requirements for emergency response so that adequate resources are available in the event of an emergency or crisis situation (Commitment C424).
R22038	S121	Radio and telephone communications within the project area are limited which may cause delays/issues in an emergency situation.	EIS Chapter 25, Section 25.6.2	Noted. Arrow operations will require effective and reliable communication between personnel and infrastructure on the project. Given this requirement, Arrow will assess the capability of existing telecommunications networks and work with emergency services organisations as a part of emergency response planning (EIS Chapter 25, Section 25.6.2). The aim is to ensure that adequate communications are available in the event of an emergency (see Commitment C424).
R22039	S121	What actions will Arrow take to control and limit the effects of an emergency incident on their property and neighbouring properties?	EIS Chapter 25, sections 25.2.2, 25.6.1, 25.6.2 and 25.6	Arrow will implement a range of measures including engineering, procedural and behavioural controls to manage potential hazards and risks associated with the project (EIS Chapter 25, Section 25.6). Buffer zones have been identified as a part of preliminary quantitative risk assessments carried out for project facilities have been designed to manage potential risks to people and neighbouring properties so that adequate separation is maintained. Emergency response procedures will be developed and implemented in the event of an emergency (Commitment C171) and Arrow will develop emergency response plans in consultation with emergency services organisations so that appropriate resources, training and equipment is in place (see Commitment C424).
R22040	S121	What interaction would the Queensland Fire and Rescue Service expect from Arrow and its resources to control an emergency incident? Additionally, what resources would be available for use by Arrow to control an emergency incident on the company's property?	EIS Chapter 25, sections 25.2.4 and 25.6.2	Arrow will develop emergency response plans in consultation with emergency services organisations such as the Queensland Fire and Rescue Service (see Commitment C424). The details of how Arrow personnel and QFRS would interact, and the resources available, in the event of an emergency will be detailed in those plans and discussed with the Service. Arrow has committed to the continued provision of a medivac service to respond to community or project-related emergency situations (see Commitment C373). Arrow will continue to consult with emergency services and the local disaster management groups as field development progresses and infrastructure locations are identified and refined (EIS Chapter 25, Section 25.2.4).
R22041	S121	The project will increase the usage of the helicopter and fixed wind aircraft aeromedical responses.	EIS Chapter 25, Section 25.6.2	Noted. Arrow, in collaboration with Origin Energy, QGC and Santos, has funded since 2011 the Surat Gas Aero Medical Service in the region. The service is provided by CareFlight, one of only two fully integrated aero medical retrieval operations in the world. CareFlight employs its own full time emergency doctors, paramedics and flight crews. The Aero Medical Retrieval

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Issue No.	Submission No.	Issue	Reference	Responses
R22041	S121			Service provides 150 free hours to Queensland Health for community based aero medical recovery services (Commitment C373). EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 further states that Arrow will develop emergency response plans in consultation with emergency services organisations so that the required equipment and resources are available in the event of an emergency or crisis situation (Commitment C424). Arrow also contributes to the Royal Automobile Club of Queensland (RACQ) Central Queensland Helicopter Rescue Service, allowing the provision of timely medical assistance.
R22042	S134	Arrow to take full responsibility for response and recovery in the event of an incident relating to the transportation of toxic or flammable chemicals.	EIS Chapter 12, Section 12.6.3 Chapter 25, Section 25.6.2, Table 25.10	Arrow recognises its responsibilities in responding to emergency incidents, including those involving hazardous substances. EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.2 identifies scenarios associated with the project that involve accidental releases, including during transportation (Table 25.10). Arrow will apply appropriate international, Australian and industry standards and codes of practice for the handling of hazardous materials (such as chemicals, fuels and lubricants) (Commitment C035). Arrow will also develop emergency response plans in consultation with emergency services organisations so that the required equipment, training and other resources are available in any foreseeable emergency and crisis situations, including transport related incidents (Commitment C424).
R22043	S136	Develop and implement incident reporting, emergency response and corrective action systems or procedures. Include systems for reporting, investigation and communications of lessons learned. It is requested that such plans include preparedness for other natural events such as flood, earthquake as well as potential disasters from man-made construction.	EIS Chapter 15, Section 15.6.1 Chapter 25, Section 25.6.2	Noted. Arrow will develop and implement incident reporting, emergency response and corrective action systems or procedures for the project in accordance with its Health, Safety and Environmental Management System. Procedures will include systems for reporting, investigating and communicating lessons learned (Commitment C171). Arrow's emergency response plans will include response actions, training, resources and equipment requirements to respond to a range of crisis situations including for flooding, cyclones, and bushfire (see Commitment C424).
R22044	S146	Controlled discharge of coal seam gas water should be incorporated into the emergency response plan as it should not be allowed on Strategic Cropping Land as it will cause permanent alienation or diminished profitability.	EIS Chapter 15, Section 15.6.1 SREIS Chapter 3, Section 3.7 and Attachment 5	Noted. Arrow has revised its strategy for the management of coal seam gas water (SREIS Chapter 3, Project Description, Section 3.7 and Attachment 5, Coal Seam Gas Water and Salt Management Strategy). The strategy presents a range of options for management of coal seam gas water and salt, including beneficial use of treated coal seam gas water for agricultural purposes and discharge into watercourses. Alienation of strategic cropping land is not expected. Arrow has established a demonstration property at Theten on which it is and will conduct a number of trials into the use of coal seam gas water for irrigation, as well as management and rehabilitation of blacksoils. Arrow has committed to developing a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations

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Issue No.	Submission No.	Issue	Reference	Responses
R22044	S146			upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).
R22045	S024, S026, S034, S036, S069, S081, S083, S162	What are the occupational health and safety requirements on the proponent regarding all-weather access to production wellheads? It is assumed that for OHS reasons there must be all-weather access to the wells at all times. In areas where wells are constructed on soils that cause vehicles to bog in wet conditions, foundation aggregate covering the entire construction footprint will be essential.	–	Where required, Arrow is proposing to construct permanent all weather access to significant facilities, such as central gas processing facilities and temporary workers accommodation facilities (EIS Appendix F, Agricultural Report, Section 6.5). All weather access to production wells will be determined on a case-by-case basis.
R22046	S024, S026, S036, S081, S083, S162	What are Arrow's occupational health and safety obligations regarding the erection of statutory signposts to identify the location of decommissioned wells?	–	The production wells will be decommissioned in accordance with environmental authority conditions and the Queensland Code of Practice for Constructing and Abandoning Coal Seam Wells in Queensland. The code requires that a signpost be erected on a nearby fence or other suitable location detailing the location of the well.
R22047	S042	There is concern over the safety of operating (harvesting) in proximity to the gravel access roads that will be constructed in the fields (due to cracking clay soils), as it can cause serious damage to machinery and people if a rock is harvested.	EIS Chapter 13, Section 13.6.1	EIS Chapter 13, Agriculture, Section 13.6.1 states that where infrastructure is proposed on private property, Arrow will consult and agree with landholders on the appropriate location for infrastructure and access routes (Commitment C084) with terms set out in conduct and compensation agreements with affected landholders. Arrow aims to accommodate landholders' requirements and undertake activities considering existing land uses. Arrow will be flexible in the location of wells and infrastructure.
R22048	S067, S079, S139	Due to the lack of advance warning to the owners regarding Arrow employees coming on to the property, there may be issues/consequences e.g., from spraying chemicals. From this, will landholders have restrictions (carrying out normal farming practices) placed on them because of the safety issues?	EIS Chapter 13, Section 13.6, 13.6.2 and 13.6.5 Chapter 22, Section 22.8.3 Appendix B, Appendix 28	Arrow will negotiate and agree access arrangements to properties with the landholders and site and construct access tracks to minimise disruption to cultivation paddocks (see Commitments C088 and C095). Construction and operations activities will also be planned to integrate with farm operations including the timing of harvesting, spraying and withholding periods (Commitment C080). Arrow will engage landholders to develop a strategy for minimising impacts on land and existing agricultural activities (e.g., through strategic siting of project facilities) (Commitment C369). Arrow has implemented 12 land access rules with guidelines for their staff on operating respectfully and cooperatively with landholders. One such rule requires that property is only entered once access has been cleared with the landholder (EIS Appendix B, Report Appendix 28).

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Issue No.	Submission No.	Issue	Reference	Responses
R22049	S079	What are the safety requirements for the shut-down and flaring events?	EIS Chapter 25, Section 25.6.3 Appendix F, Section 6.7.4	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6.3 identifies specific controls to manage the hazards and risks associated with the project. These measures include establishing radiation zones around flares in accordance with relevant industry standards. These zones must be free of combustible material and uncontrolled entry is prohibited. The radius of the zone may range from 50 m to 80 m. Further details are provided in EIS Appendix F, Agricultural Report, Section 6.7.4. Emergency shutdown features will be designed into gas infrastructure to allow shut down for example, during extreme fire periods (Commitment C468).
R22050	S099	Workplace health and safety risks arising from normal day to day intensive cropping operations have been omitted from the list of personal safety hazards in Section 25.4.2.	EIS Chapter 13, Section 13.6.1 Chapter 25, Section 25.6.1	EIS Chapter 13, Agriculture, Section 13.6.1 details the actions Arrow will take to reduce disruption to normal farming operations. Arrow will consult with landholders to agree on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (Commitment C084) and to reduce potential hazards and risks to third parties. Sites will be selected with full consideration of and allowance for the minimum buffer zones indicated by the quantitative risk assessment (Commitment C419). The buffer zones are designed to manage potential risks to people and property and reduce the interaction between project infrastructure and the public. The minimum size of the buffer zones is dependent on the type of adjacent land use and the acceptability of risk for occupants of that land.
R22051	S130	Data sheets of chemicals brought on the properties must be provided to each landholder. The list of chemicals should also include the quantity of each chemical taken on the property. The quantity of waste chemicals that are removed from that property should also be provided to the landholder.	–	Noted. Hazardous substances will be handled in accordance with applicable legislation, regulations, standards and codes of practice. Arrow will continue to engage with landholder to develop a strategy for minimising impacts on land and existing agricultural activities (e.g., through strategic siting of project facilities) (Commitment C369).
R22052	S147	If a relationship between project infrastructure and Ergon Energy infrastructure exists, it is recommended that the proponent make application to Ergon Energy, raising a recoverable works project to have an electrical system designer review this relationship between existing electrical infrastructure and the proposed development. This is to ensure a safe distance is maintained between the pipeline and wells and the high voltage power lines and associated poles. The following legislation and code should be consulted for working in the vicinity of electrical infrastructure: - Electrical Safety Act 2002	–	Noted. Arrow will liaise with utility providers as required to ensure that a safe distance is maintained between electrical infrastructure and project facilities and infrastructure in accordance with applicable legislation, regulations, standards and codes of practice.

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Issue No.	Submission No.	Issue	Reference	Responses
R22052	S147	- Electrical Safety Regulation 2002 - Code of Practice Working near Exposed Live Parts.		
R22053	S134	There are concerns over hazard and risk management.	EIS Chapter 25, Section 25.6.2	Noted. EIS Chapter 25, Preliminary Hazard and Risk, presents the preliminary assessment of potential hazards and risks associated with project activities. As the design of the project progresses, Arrow will conduct further systematic risk assessments (which include hazard identification, assessment, treatment and monitoring) in accordance with relevant legislation and standards during design, construction and operations (Commitment C455). EIS Chapter 25, Section 25.6.2 provides further details on the range of health and safety measures that will be implemented to manage potential incidents.
R22054	S003, S009, S018, S019, S020, S032, S037, S039, S050, S053, S055, S059, S064, S065, S070, S071, S076, S085,	There are concerns about safety issues related to any new overhead transmission lines installed across farming properties due to crop-dusting practices used in the area and other safety issues.	–	Noted. Transmission lines will be constructed and operated by a third party transmission network service provider. An easement will be established around the transmission lines in accordance with applicable electricity line safety clearance requirements. Transmission infrastructure will be subject to separate risk assessment and environmental approvals processes by the transmission network service provider.
R22055	S079, S116	There is concern it is not possible to conduct controlled traffic methods with gas wells placed within intensive farming areas as; it could be potentially hazardous when travelling at speed across a paddock, while operating a self-propelled sprayer, where a gas pipeline has been laid. How is it possible to operate safely with gas infrastructure in the paddocks?	EIS Chapter 13, Section 13.6.1 Chapter 25 Section 25.6.1 Appendix S, sections 4.1 and 4.2	Arrow recognises that landholders have concerns about their ability to operate safely and normally with the presence of gas wells on their properties. The risk assessments carried out for the project to date aim to identify and then assess the risks associated with potential third party damage to well and gathering line infrastructure (EIS Chapter 25, Preliminary Hazard and Risk). Damage might be caused by the impact of machinery and vehicles or through excavations and result in the release of gas leading to fire and in certain circumstances explosion. Further details are provided in EIS Appendix S, Sections 4.1 and 4.2. The risk of this event occurring was assessed as medium, following the implementation of a range of controls and measures to reduce or eliminate this risk. Arrow has committed to implement these controls which include selecting locations for project infrastructure with full consideration of and allowance for the minimum buffer zones indicated by the quantitative risk assessment (Commitment C419). The buffer zones are designed to manage potential risks to people and property and minimise the interaction between project infrastructure and the public. The minimum size of the buffer zones is dependent on the type of adjacent land use and the acceptability of risk for persons occupying the land. Arrow will consult with landholders and agree on the appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (Commitment C084) to reduce potential impacts on existing and future uses of that land and risks to property owners.

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Issue No.	Submission No.	Issue	Reference	Responses
R22056	S099	Incident reporting must also include reporting to landowners and business operators, to minimise risks to landowners, families, employees and contractors (related to C171).	EIS Chapter 26, Section 26.6.2	Noted. Arrow has established incident reporting, emergency response and corrective action systems and procedures which will be further developed and implemented for the Surat Gas Project (Commitment C171). The Petroleum and Gas (Production and Safety) Act 2004 requires Arrow to report any incidents in writing to landholders within 24 hours of the incident occurring. Arrow will meet its legislative obligations for incident reporting.
R22057	S121	It has been difficult to locate some of the reported emergency incidents for similar type projects.	EIS Chapter 15, Section 15.6.1	Noted. Arrow will develop and implement systems and procedures for incident reporting, emergency response and corrective action (Commitment C171).
R22058	S108	The movement of gathering lines to the surface due to heaving (common when installed in vertosols) will result in buckling and the potential for tilling machinery to rupture the pipes creating an explosion risk and uncontrolled release of very saline coal seam water.	EIS Chapter 12, Section 12.6.1	Arrow recognises the need to design project infrastructure to suit the specific conditions in the project development area. As such, buried infrastructure will be designed, as a minimum, to withstand the differential shrink-swell ground movement, typical of black soil expansion and contraction (see Chapter 12, Geology, Landform and Soils, Section 12.6.1 and Commitment C042). High pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Section 6.6). Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444).
R22059	S121	Hazard analysis and risk assessment should be undertaken in accordance with Australian Standard/New Zealand Standard ISO 31000:2009 Risk Management – Principles and guidelines and Australian Standards Handbook - HB203:2006 Environmental Risk Management Principles and Processes.	EIS Chapter 25, Section 25.2 Appendix S	The preliminary hazard and risk assessment (EIS Appendix S) was undertaken in accordance with Australian/New Zealand Standard ISO 31000:2009 Risk Management – Principles and guidelines, the Hazardous Industry Planning Advisory Papers number 4 - Risk Criteria for Land Use Planning and the requirements of the Final Terms of Reference for the EIS (EIS Chapter 25, Section 25.2).
R22060	S136	Consultation for risk assessments should include Executive Officers of the Dalby and Roma Disaster District Management Groups.	EIS Chapter 25, Section 25.2.4	Noted. The hazard and risk assessments presented in the EIS (and summarised in Chapter 25, Preliminary Hazard and Risk) included consultation with Emergency Management Queensland and representatives of the various emergency services responsible for the project development area (Section 25.2.4). Arrow will continue to consult with emergency services and the local disaster management groups as field development progresses and the locations of infrastructure are determined.
R22061	S156	What does Arrow define as hazardous material? Refers to Commitment C036.	EIS Chapter 25, Section 25.4.2 and Tables 25.6 to 25.9	Hazardous materials (sometimes used interchangeably with 'hazardous substances') are discussed in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2. Hazardous substances are generally defined as materials that have the potential to cause injury or harm to people and/or the environment.

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Issue No.	Submission No.	Issue	Reference	Responses
R22061	S156			Specific details of the hazardous material to be used during construction, operations, including water and brine treatment are summarised in tables 25.6 to 25.9.
R22062	S162	There are no risk analyses or controls with regards to third parties working in close proximity to the wells, inclusive of agricultural activity. Arrow also needs to define within the Preliminary Hazard and Risk chapter what type of activity agriculture belongs to, as this is very unclear. There is no risk assessment done for the interaction of agricultural activities in the area around the site. Indemnity working around production wells is a major issue when you have intensive cropping.	EIS Chapter 25, Section 25.4, Figure 25.1 and Table 25.3 Appendix S	Arrow recognises that landholders have concerns about their ability to operate safely and normally with the presence of gas wells on their properties. The risk to people and property, including agricultural workers, associated with production wells was identified and assessed in the EIS (Chapter 25, Preliminary Hazard and Risk). Section 25.4 discusses the risks and notes that these are best represented as risk transects, whereby the risk is shown as a function of the distance of the receptor from the centre of the wellhead. Risk reduces with increasing distance from the wellhead and the transect can therefore be applied equally in all directions. The risk transect for wells is shown in Figure 25.1 and informs the buffer that is required around the wellhead for the protection of people and property. The buffer is dependent on the type of adjacent land use and the acceptability of risk for persons occupying that type of land use (generally dependant on the amount of time spent in that land use). The buffers for each land-use type (i.e., industrial, active open space, business, residential and sensitive) are presented in Table 25.3. Agricultural land use would fit under “active open space, business or industry” category of land use. Where multiple land uses are located in the vicinity of a well, the largest of the applicable buffers would be considered appropriate. Further details of the risk assessment completed for the production wells can be found in Appendix S, Preliminary Hazard and Risk Assessment).
R22063	S015	If Arrow plans to implement buffer zones around facilities to minimise risks to the community and the surrounding environment, does this mean that buffer zones will further reduce areas of good land and damage the environment?	EIS Chapter 13, Section 13.6.1 Chapter 25, Section 25.6.1	Arrow will select locations for project infrastructure with full consideration of and allowance for the minimum buffer zones indicated by the quantitative risk assessment (Commitment C419). The buffer zones are designed to manage potential risks to people and property and minimise the interaction between project infrastructure and the public. The minimum size of the buffer zones is dependent on the type of adjacent land use and the acceptability of risk for persons occupying that land. Arrow will consult with a landholders to agree on the most appropriate location for infrastructure and access routes (to well sites and to and along pipelines) (Commitment C084) to reduce potential impacts on existing and future uses of that land (Chapter 13, Agriculture, Section 13.6.1).
R22064	S121	All dangerous goods, explosives and hazardous substances used, stored and handled in accordance with relevant legislation.	EIS Chapter 25, Section 25.6.3	Noted. As set out in Chapter 25, Preliminary Hazard and Risk, Section 25.6.3, Arrow will apply the requirements of appropriate international, Australian and industry standards and codes of practice for the handling of hazardous materials (such as chemicals, fuels and lubricants) (Commitment C035) and in the design and installation of infrastructure associated with the storage of

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Issue No.	Submission No.	Issue	Reference	Responses
R22064	S121			hazardous materials (Commitment C048).
R22065	S134	Arrow to provide details and reference how Arrow will ensure that all detection systems, shut down systems, pressure release systems and fire suppression systems will be constructed, designed and maintained according to relevant standards and/or policies.	EIS Chapter 25, sections 25.1, 25.6.3, 25.8	The design, construction and operation of all project facilities will need to comply with applicable Australian laws, regulations, standards, codes and guidelines and/or internationally recognised standards. These requirements are described in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.1. Arrow's Health, Safety and Environmental Management System provides the basis for implementing these requirements through design, construction and operations. Arrow has also made commitments to include specific design features as part of facilities, including for example Commitment C421, which pertains to the ability to shut down and isolate facilities ahead of impending bushfires (section 25.6.3). Section 25.8 provides details of the inspection and monitoring requirements for project facilities and infrastructure under the Petroleum and Gas (Production and Safety) Act 2004. Arrow will prepare project safety management plans (Commitment C416) which will be compliant with the act and its regulations. The plan will include requirements for monitoring and inspections. Arrow will schedule inspections and develop the monitoring program to ensure that the safety management systems are functioning properly and that they are appropriate to address the hazards identified (Commitment C326).
R22066	S147	Arrow is required to design a pipeline to Australian Standard 4853, responsibility for application of this standard is Arrow's.	EIS Chapter 25, Section 25.4.1 Appendix S, Section 6.6 and Appendix 1	EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.1 notes that the high pressure gas pipelines will be designed to comply with AS 2885.1-2012. This standard is specific to the design and construction of gas and liquid petroleum pipelines (EIS Appendix S, Section 6.6). Arrow will design, construct, maintain and rehabilitate the gathering system network in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444). AS 4853:2000 applies to electrical hazards on metallic pipelines and will be applied as required to the design of metal pipelines constructed as part of the project.
R22067	S150	The number of intersecting barriers the pipelines may be both impacting on and be impacted by is likely to increase the risks associated with the construction of the pipelines.	EIS Chapter 25, sections 25.1, 25.6.2 and 25.7.	The gas gathering lines and high pressure pipeline will be designed and installed in accordance with applicable Australian Standards as described in Chapter 25, Preliminary Hazard and Risk, Section 25.1). Chapter 25, Section 25.7 summaries the potential hazards associated with the construction of pipelines. The risk assessment was based on credible hazard scenarios, including for pipeline construction, identified at this stage of project development. As the design of the project progresses, Arrow will conduct further systematic risk assessments (which include hazard identification, assessment, treatment and monitoring) in accordance with relevant legislation and standards during design, construction and operations (Commitment C455).

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Issue No.	Submission No.	Issue	Reference	Responses
R22068	S156	The proponent must not be allowed to proceed with this project when they clearly have no proposed measures to avoid spills and contamination to our land and waterways. In regards to commitments C037, C069 and C038, what does Arrow consider to be appropriate spill response equipment?	EIS Chapter 12, Section 12.6.3 Chapter 25, Table 25.10 Appendix S, Table 13	Noted. EIS Chapter 12, Geology and Soils provides an assessment of the potential impacts of contamination and spills in the project development area. Section 12.6.3 lists a range of measures that Arrow will implement to avoid, mitigate and manage potential contamination of soil and groundwater (including commitments C037, C038 and C069). The likelihood, consequence and residual risks associated with different scenarios for spills of hazardous materials are identified and assessed in EIS Chapter 25, Preliminary Hazard and Risk and are summarised in Table 25.10. Risks were assessed as low to medium after the mitigation measures are implemented. Further details of potential spill scenarios are included in EIS Appendix S, Table 13. The specific details of spill response equipment to be provided at each location will be determined through the application of relevant guidelines and consultation with government agencies as part of the development of emergency response plans for the project. Typically, the equipment held at a location will be determined by considering the level of risk of the hazard posed by potential contaminants to people and the environment, the volume likely to require containment, and the compatibility of response equipment with the properties of the potential contaminant (i.e., able to clean up different types of chemicals). Further detail of procedures will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R22069	S146	Concerned that nearby gasfield dewatering may have reduced pressure under the river to exacerbate pre-existing natural connections between the Walloon Coal Measures and the Condamine River, allowing increased fugitive gas emissions to both water and land surface. Arrow Energy should identify any areas in its Surat Gas Project development area where the coal measures are shallow, gassy and naturally leaking, and restrict gas-field development in these areas when there are greater population densities. ater population densities.	-	The preferential path for gas flows as a result of coal seam gas development is via the production wells as a reduction of the reservoir pressure in the Walloon Coal Measures will cause a cone of depression around the well that promotes gas flow to the well. Notwithstanding this, a number of gas migration investigations are currently proposed by Arrow and other parties. Work underway by Arrow will better quantify the nature of the interface between the Condamine Alluvium and Walloon Coal Measures, and whether legacy coal and mineral exploration bores are conduits for fugitive gas emissions. As part of make good measures, Arrow will consider plugging and abandoning those wells where a significant gas migration risk exists.
R22070	S088	Will Arrow be conditioned to provide a safety barrier for the households that would be impacted by the project?	EIS Chapter 25, Section 25.6.1	Noted. Arrow will select locations for project infrastructure with full consideration of, and allowance, for the minimum buffer zones indicated by the quantitative risk assessment (Chapter 25, Section 25.6.1 and Commitment C419). The buffer zones are designed to manage potential risks to people and property and reduce the interaction between project infrastructure and the public. The minimum size of the buffer zones is dependent on the type of adjacent land use and the acceptability of risk for

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Issue No.	Submission No.	Issue	Reference	Responses
R22070	S088			persons occupying that land.
R22071	S021	Commitment (C106) 'Stockpile cleared or mulched vegetation along the inside edge of the work sites (separate from soil stockpiles), to aid the control of runoff and ensure stockpiled vegetation does not pose a bushfire hazard.' How will Arrow stockpile soils on a floodplain?	EIS Chapter 12, Section 12.6.2, Chapter 15, Section 15.6.1	EIS Chapter 12, Surface Water, Section 12.6.2 describes the mitigation measures that Arrow will implement for all activities with the potential for land degradation. Commitment C106, in that section, relates to cleared or mulched vegetation only. EIS Chapter 15, Surface Water, Section 15.6.1 identifies the measures Arrow will implement to manage potential impacts on surface water. These include controlling sediment runoff from soil stockpiles (Commitment C107) and siting facilities to take account of flooding regimes and areas subject to inundation (Commitment C151).

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Table 19.23 Waste Management

Issue No.	Submission No.	Issue	Reference	Responses
R23001	S123	In relation to EIS Chapter 26, Table 26.2, greater detail is required on percentages of waste that will be recycled or disposed of.	EIS Chapter 26, sections 26.6.3, 26.6.4 and 26.6.7	The approximate quantity and types of waste generated (solid, liquid and gaseous wastes) are detailed in EIS Chapter 26, Waste Management, Section 26.6.7 and Table 26.2. Estimates were produced based on Arrow's knowledge and experience of the quantities of wastes generated at the company's existing operating facilities. Arrow will review and revise its waste estimates for the Surat Gas Project prior to construction. Arrow's preference is to recycle rather than dispose of waste. Arrow will maximise marketable volumes of recyclable waste to local and regional businesses to as high as practicable.
R23002	S124	Provide greater detail on the capacity of waste facilities to handle the projected volumes of salt.	EIS Chapter 26, Table 26.1 and Chapter 28, Section 28.3.13 SREIS Chapter 3, Section 3.7.5	As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow's preferred strategy for the disposal of salt. The discussion in EIS Chapter 26, Waste Management, Table 26.1 and Chapter 28, Cumulative Impacts, Section 28.3.13 assumes waste management infrastructure within the region is able to cope with new developments. Should this not be the case, the EIS stated that the project would transport waste to another facility with adequate capacity.
R23003	S134	Remove references to old legislation (Environmental Protection (Waste Management) Policy 2000) in EIS Chapter 26 and reference new legislation (Waste Reduction and Recycling Act 2011 and associated regulations).	SREIS Attachment 7, Section 1.1	Noted. SREIS Attachment 7, Legislation and Policy, Section 1.1 includes a reference to the Waste Reduction and Recycling Act 2011.
R23004	S015	The EIS states that 'project activities plan to manage the potential impacts of waste'. The aim might be to minimise the release of any harmful substances to the air, water or the land through the responsible management of its wastes, but already there have been worries over contamination of water supplies.	EIS Chapter 26, Section 26.6.4	Arrow understands the community is concerned about the potential for the project to impact on water quality within the region. Arrow has committed to manage contaminated soil or groundwater that cannot be avoided through physical investigation; manage quantification of the type, severity and extent of contamination; and remediate or manage in accordance with the Queensland Government's Draft Guidelines for the Assessment and Management of Contaminated Land (DE, 1998) (Commitment C065).
R23005	S158	No mention is made of the proposed responsible disposal or re-utilisation of the filters and chemical containers listed among the project's wastes.	EIS Chapter 26, Section 26.6.7 and Table 26.2	EIS Chapter 26, Waste Management, Table 26.2, identifies the range of waste filters and containers generated by the project, along with the proposed disposal and management options for these waste streams.
R23006	S022	Provide information on what happens to the by-products of reverse osmosis and where by-products will be stored.	EIS Chapter 5, sections 5.2.4 and 5.6.4 and Attachment 9 SREIS Chapter 3, Section 3.7.5 and Attachment 5, Section 3.3	By-products of the water treatment process include concentrated brine (salt) and process water containing reverse osmosis treatment chemicals. EIS Chapter 5, Project Description, Section 5.2.4 and 5.6.4, and Attachment 9, Coal Seam Gas Water Management Strategy, Section 2.7.4 describe the proposed handling and disposal options of concentrated brine. Arrow's salt disposal strategy has been updated since the publication of the EIS, with changes described in SREIS Chapter 3, Project Description, Section 3.7.5 and Attachment 5, Coal Seam Gas Water and Salt Management Strategy,

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Issue No.	Submission No.	Issue	Reference	Responses
R23006	S022			Section 3.3. Brine will initially be stored in brine storage dams, with Arrow's preference to transport the brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, brine can be transformed into commercial products including salts and soda ash. Process water containing reverse osmosis chemicals will be piped from the water treatment facilities to a process water tank or dam. The process water will then be reused or removed by licensed tanker or carrier to a licensed commercial waste facility.
R23007	S150	Provide sufficient data on eco-toxicity and bioaccumulation risks, potential for environmental contamination with persistent heavy metals, salt, hazardous drilling fluids and other contaminants such as radioactive substances.	EIS Chapter 12, Section 12.4 and Chapter 25, Section 25.4.2, and Chapter 26, Section 26.4	As set out in EIS Chapter 26, Waste Management, Section 26.4, chemicals that can potentially bioaccumulate within the environment will not be present in any of the project discharges which include hydro-test water, sewage, coal seam gas water and runoff. Hazardous substances that will be used during construction and operation of the project are outlined in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2, tables 25.6 and 25.7. The potential for the project to cause environmental contamination is described in EIS Chapter 12, Geology, Landform and Soils, Section 12.4.
R23008	S134	Concern over proposed waste disposal and storage methods.	EIS Chapter 26, Section 26.6	Noted. EIS Chapter 26, Waste Management, Section 26.6 outlines the proposed avoidance, mitigation and management measures to achieve environmental protection objectives in regard to waste.
R23009	S158	All impacts and all aspects of waste and its re-utilisation must be thoroughly documented and addressed by Arrow. A further imperative is that the proposed waste re-utilisation process must be phrased in terms of certainty with real options investigated and established prior to the proposal.	EIS Chapter 26, Table 26.2 SREIS Chapter 3, Section 3.7.5 and Attachment 5, Section 3.3	EIS Chapter 26, Waste Management, Table 26.2 identifies waste materials generated by the project, and outlines necessary disposal and management measures. Arrow's strategy for the disposal of brine, produced as a by-product of the coal seam gas water treatment process, is described in SREIS Chapter 3, Project Description, Section 3.7.5 and SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, Section 3.3.
R23010	S011	Prior to project approval Arrow should update the waste management plan and develop a viable waste disposal strategy. Both should be presented for review prior to project approval.	EIS Chapter 26 and Attachment 8, Table 1 SREIS Attachment 4	Arrow will review and revise its waste estimates prior to construction. Contractors will be required to produce and implement waste management plans in accordance with Arrow Energy's Health, Safety and Environmental System and the specific waste management commitments as set out in SREIS Chapter 17, Waste Management and SREIS Attachment 4, EIS Commitments Update. These specific commitments include: <ul style="list-style-type: none"> • Develop and implement waste management procedures in accordance with the Queensland Environmental Protection (Waste Management) Policy 2000 (Commitment C281). • Handle, store and dispose of regulated wastes in accordance with relevant standards and the Environmental Protection (Waste Management) Regulation 2000 (Commitment C494).

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Issue No.	Submission No.	Issue	Reference	Responses
R23011	S011, S014, S044, S046, S069, S134, S161	<p>EIS does not assess the ability of Swanbank to handle the disposal of huge amounts of brine that will be generated over the project's lifespan. What are the relations between Arrow and Swanbank? Is there an agreed procedure for disposal? For how long will Swanbank have capacity to accept the brine? How will brine be transported (wet or dry)? The volumes of salt quoted are 4 to 5 million tonnes in the first 5 to 10 years of the project. This equates to 500,000 to 1 million tonnes per annum, according to the website of Thiess (owners/operators of the Swanbank Waste disposal facility), the facility currently handles a total of 500,000 tonnes of waste per annum, and the facility has a project lifespan of 50 years at this level. Addition of the coal seam gas salt will at least double the amount of waste handled by this facility, thus dramatically shortening its lifetime, and making it imperative that other safe disposal options are available before this level of waste is produced.</p> <p>There is also concern that Swanbank is too distant from the project development area to be considered 'in the region'.</p>	<p>SREIS Chapter 3, Section 3.7.5</p>	<p>Noted. As set out in SREIS Chapter 3, Project Description, Section 3.7.5, landfill is not Arrow's preferred strategy for the disposal of salt. Brine will initially be stored in brine storage dams, with Arrow's preference to transport the brine to a selective salt recovery plant via pipeline for treatment. Should disposal to landfill prove to be required in the future, a full scope of investigations of available waste facilities (considering transport distances and available capacity) will be undertaken.</p>
R23012	S130	<p>Payments should be made to local council for waste generated in the council area, \$72 per tonne below 10,000 tonnes towards capital costs; above 10,000 tonnes a separate agreement will be required between the council and Arrow. Normal user fees will remain applicable for all waste being disposed of at Council facilities.</p>	-	<p>Arrow will work with the regional councils with regard to the management of project waste. Arrow will discuss these requirements, including the payment of user fees, prior to construction.</p>
R23013	S011, S133, S161	<p>EIS does not adequately address the disposal of solid waste and the impacts it will have on regional landfill facilities. Local landfills have already found to be under stress.</p> <p>The proponent should undertake research into the actual capacities of local landfills and update the waste management plan.</p> <p>A reduction in the lifespan of local landfills could also lead to illegal dumping and stockpiling of waste, which may be of detriment to human health. The proponent should also assess whether human</p>	<p>EIS Chapter 28, Section 28.3.13</p>	<p>EIS Chapter 28, Cumulative Impacts, Section 28.3.13 describes the potential cumulative impacts of waste. The potential for permanent reduction in available landfill and treatment capacity is acknowledged. This potential impact already exists taking into account all proposed developments for the region, irrespective of whether the Surat Gas Project proceeds. Arrow will apply a hierarchy of waste management options (Commitment C058) and consult with waste facilities during the preparation of detailed waste management strategies prior to construction.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R23013	S011, S133, S161	health and wellbeing factors are also affected and develop appropriate mitigations.		
R23014	S034, S069, S134	EIS Chapter 26, Table 26.1 shows Millmerran and Cecil Plains as viable options for solid waste disposal. Arrow should remove these as they may not accept hazardous materials. Arrow not to rely on Bedford St for solid waste disposal as they do not accept hazardous materials. Arrow to provide details of alternative waste disposal measures. Arrow needs to re-evaluate its waste options, as waste facilities discussed in the EIS aren't currently licenced to accept commercial waste.	EIS Chapter 26, Table 26.1	EIS Chapter 26, Waste Management, Table 26.1 identifies multiple facilities and the types of waste each facility accepts. Not all solid waste will be hazardous. Hazardous and controlled wastes will only be sent to facilities licenced to accept those wastes.
R23015	S158	It is to be assumed that existing landfill stations exist because they are filling other domestic and commercial needs and may not be able to cope long term with the volume and hazard level of waste the project will generate even in the short to medium term. In the event that new waste facilities are needed, what are the related impacts?	EIS Chapter 28, Section 28.3.13	EIS Chapter 28, Cumulative Impacts, Section 28.3.13 describes the potential cumulative impacts of waste. The potential for permanent reduction in available landfill and treatment capacity is acknowledged. While Arrow will employ measures to manage its impacts through a waste management hierarchy and developing a communication strategy to help waste facilities plan for expected volumes of waste, long-term planning will be undertaken by regional councils and waste service providers. The development of any new waste facilities would be subject to a separate environmental assessment and approvals process, which will consider specific impacts related to any new or expanded waste facilities.
R23016	S011	Concerned if waste facilities are required to be upgraded or more staff employed, the local governments will pass costs onto local residents.	–	Noted. Arrow will work with the regional councils with regard to the management of project waste. Arrow will discuss these requirements, including the payment of any user fees, prior to construction.
R23017	S130	Alternative waste handling arrangements should be considered for all waste types, including the reuse or recycling of timber packaging waste. Information on waste projections should be provided to the local council to meaningfully gauge the full impact of waste generation.	EIS Chapter 26, Section 26.1, Figure 26.1 and Table 26.2	EIS Chapter 26, Waste Management, Figure 26.1 identifies Arrow's waste hierarchy, with reuse and recycling preferred over disposal for all waste types. Table 26.2 outlines the typical waste streams and projected quantities of waste likely to be generated by the project. Arrow will work with regional councils with regard to the management of waste associated with the project. Arrow will discuss these requirements with regional councils prior to construction.
R23018	S011, S105, S124, S133	Cumulative impacts from other projects operating in areas adjacent to Arrow's have not been examined in the EIS. This includes the reduction of lifespan of existing landfills. The cumulative impacts should be examined and used to inform the waste management plan/waste disposal strategy. Arrow is required to consider the other projects in the area which are also producing brine as a waste	EIS Chapter 26, Section 26.6 and Chapter 28, Section 28.3.13 and Attachment 5	EIS Chapter 28, Cumulative Impacts, Section 28.3.13 describes the potential cumulative impacts of waste. The potential for permanent reduction in available landfill and treatment capacity is acknowledged. This potential impact already exists taking into account all proposed developments for the region, irrespective of whether the Surat Gas Project proceeds. To manage its impact, Arrow will apply a hierarchy of waste management options as set out in EIS Chapter 26, Waste Management, Section 26.6, and also develop a communications strategy with waste facilities, to help facilities plan for expected volumes of waste.

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R23018	S011, S105, S124, S133	product. Disposal of salt to landfill will compound existing issues with waste disposal to landfill in Australia.		The potential cumulative impacts of brine are acknowledged. Arrow's Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5) has been updated since the publication of the EIS. Arrow's preference is to transport brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, the brine can be transformed into commercial products including salts and soda ash. Disposal to landfill is not Arrow's preferred option.
R23019	S123	Arrow expects that treatment of coal seam gas water will generate in the order of 4.5 tonnes of salt per mega litre of coal seam gas water. Page 45 of the EIS Executive Summary shows predicted coal seam gas water production from all four proponents. Over a 10 year period based on 4.5 tonnes of salt, this could roughly translate to roughly 657,000 tonnes of salt per annum, or 6.5 million tonnes of salt that decade. Perhaps there should be a maximum limit of on ground salt storage before it has to be piped out to sea (and marine experts would obviously have to have detailed look at where the salt is piped out to sea and whether it would mix or sink or flow to somewhere like the Great Barrier Reef and do more damage there).	EIS Chapter 5, Section 5.6.4 SEIS Chapter 3, Section 3.7.5 and Attachment 5, Section 3.3.2.3	Noted. SREIS Chapter 3, Project Description, Section 3.7.5 provides details of a potential selective salt recovery plant to provide a beneficial use for the salt generated by the project. Beneficial use is Arrow's preferred option, however disposal of salt to the sea via an ocean outfall pipeline remains under consideration as part of Arrow's Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5, Section 3.3.2.3).
R23020	S090, S150	Concern that Arrow is relying on dams to store coal seam gas water (treated, untreated and brine). The EIS fails to fully assess the ongoing liability and cumulative impact these dams create in respect of increasing the contaminated sites in the region, the risks associated with flooding and other climate change impacts, leakage, salinity impacts, etc. Storage of brine in dams is fraught with risk, with flooding and leakage being major and ongoing concerns.	EIS Chapter 14, Section 14.6 and Chapter 25, Section 25.6 SREIS Chapter 3, Section 3.1 and Attachment 4	Noted. The number of water treatment facilities has been revised in the SREIS from six facilities to two facilities; see SREIS Chapter 3, Project Description, Section 3.1. Each water treatment facility will comprise: <ul style="list-style-type: none"> • Untreated coal seam gas water dam • Treated water dam • Two brine dams This will equate to eight new dams in total. As set out in EIS Chapter 14, Groundwater, Section 14.6 and EIS Chapter 25, Preliminary Hazard and Risk, Section 25.6, Arrow will develop construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and determine the hazard category of the dam in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (DERM, 2011f). Dams will be constructed under the supervision of a suitably qualified and experienced person in accordance with the relevant EHP schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141).
R23021	S106	All coal seam gas operations planned to occur in	SREIS	Refinements have been made to the project's sequence of development since

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Issue No.	Submission No.	Issue	Reference	Responses
R23021	S106	the Surat Basin should be staged so that once one area of Walloon Coal Seam Formation has been dewatered and had the majority of gas extracted from it, coal seam gas water from a newly developing neighbouring area can be injected with little or no treatment, thereby avoiding significant greenhouse gas production and proponents costs including storage and treatment facility construction, operation and maintenance costs.	Chapter 3, Section 3.5 and Attachment 5	the publication of the EIS. The revised sequence is set out in SREIS, Chapter 3, Project Description, Section 3.5. The need to extract gas from different areas of the Walloon Coal Measures concurrently is driven by the need to supply contracted quantities of gas to domestic and export markets. Arrow will continue to investigate all viable options for coal seam gas water injection as part of its Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5).
R23022	S123	EIS Chapter 26, Table 26.1 identifies Hermitage Road, Toowoomba and End Short St, Roma as sites for hazardous waste but does not seem to have any description of what hazardous waste they accept or acceptable quantities the facilities can manage. The EIS needs to be more specific about how much hazardous material will be taken to these facilities and clarify their descriptions. EIS Chapter 26, Table 26.1 shows Millmerran and Cecil Plains as viable options for solid waste disposal. Arrow should remove these as they may not accept hazardous materials. Arrow not to rely on Bedford St for solid waste disposal as they do not accept hazardous materials. Arrow to provide details of alternative waste disposal measures. Arrow needs to re-evaluate its waste options, as waste facilities discussed in the EIS aren't currently licenced to accept commercial waste.	EIS Chapter 26, Section 26.6.4, Table 26.1	EIS Chapter 26, Waste Management, Section 26.6.4, Table 26.1 outlines potential waste facilities that may be used by the project and the types of waste each facility accepts. Decisions about the use of particular waste facilities will be informed by the type and quantity of waste they accept. Arrow will adopt the principles of the waste hierarchy by avoiding the generation of waste in the first instance where possible and only disposing of waste to landfill as a last resort. Hazardous waste will be removed to appropriately licensed facilities.

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Issue No.	Submission No.	Issue	Reference	Responses
R24001	S024, S026, S036, S057, S079, S081, S083, S162	Standard operating procedures, in general and in relation to contamination are not present in the EIS however are described as in use. Some environmental values have been incorrectly described and therefore the standard operating procedures may be inappropriate. Please provide the standard operating procedures for review.	EIS Chapter 8, Section 8.5 and Attachment 5	Arrow has developed a range of procedures to cover existing activities in the Surat Basin and will develop new procedures as required to cover proposed activities. All procedures will be consistent with the relevant legislation, regulations and standards covering the particular activity or site. EIS Chapter 8, Environmental Framework, Section 8.5 provides further detail on this process and notes that procedures will incorporate procedural environmental management controls that will apply to all project activities, specific procedures that respond to particular issues such as contamination, and site specific management measures where project activities occur in a highly constrained area. Procedures will also incorporate the mitigation measures presented as commitments in EIS Attachment 5, Environmental Management Plan. Procedures will be included as applicable in accordance with statutory requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24002	S081	What incident reporting procedures exist to ensure incidents likely to result in contamination are identified, investigated and rectified in a timely manner with 'learnings' used to refine procedures in the interest of continuous improvement?	EIS Attachment 5, Section 2.5 and 2.7	EIS Attachment 5, Environmental Management Plan, Section 2.5 states that requirements for incident reporting and management will be set out in environmental management plans, including specific procedures and reporting guidelines. The procedures will be included and emphasised during training of personnel. Environmental incidents are managed in accordance with Arrow's Incident Reporting, Recording and Investigation Procedure. This procedure has been developed to support the effective management of incidents, guide internal and external notification and reporting requirements and address learning to avoid recurrence. EIS Attachment 5, Environmental Management Plan, Section 2.7 describes the approach Arrow takes to continuous improvement. The components of the Arrow Health, Safety, and Environmental Management System (HSEMS), including relevant management plans, procedures and guidelines, will be reviewed and updated as a result of audit outcomes, subsequent corrective actions, changes in activities, procedures or improved technology. Updates will also reflect legislative amendments together with relevant project changes or issues that arise during petroleum project activities.
R24003	S079	What are "spill containment controls"?	EIS Chapter 12, Section 12.8	Spill containment controls are systems and infrastructure designed to contain a spill within a barrier or wider drainage system. These systems both prevent and reduce the potential of spilt materials or liquids from being absorbed into the ground or from entering a waterbody and thereby limiting potential contamination. Examples of controls include physical barriers such as moveable absorbent berms and booms and secondary containment on storage tanks. Numerous monitoring and control systems have been designed into the project facilities. Remote equipment telemetry systems will be used in

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Issue No.	Submission No.	Issue	Reference	Responses
R24003	S079			conjunction with information from the central gas processing facilities to meter gas and water flow, and alert operators to faults within the gathering network. EIS Chapter 12, Geology, Landform and Soils, Section 12.8 outlines a number of spill containment commitments. Spill containment controls will be further detailed in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24004	S079	What are "spill response kits"?	EIS Chapter 12, Section 12.8	Spill response kits are a package of tools (shovel, personal protective equipment etc.) and materials used to contain, reduce and prevent any chemical, liquid or oil spill. Materials include: absorbents, containment, drain protection (drain mats) and waste collection materials. Kits are located both on vehicles/machinery and facilities where a risk of spills has been identified and are of appropriate size to respond to the likely spill volume. Kits can also be located at construction camps or at central locations and can be deployed to a range of locations to support an initial response to a spill (e.g., on refuelling trucks). EIS Chapter 12, Geology, Landform and Soils, Section 12.8 outlines a number of commitments relating to spills of potential contaminants. Arrow will locate spill response kits at its facilities and in vehicles taking into account the likely risk and size of spills at particular project locations and areas. Kits will contain materials appropriate to the substances handled and/or stored on the site. Arrow has committed to routinely inspect spill containment controls and spill response kits (Commitment C516).
R24005	S157	The Environmental Management Plan is required to satisfy the requirements of section 5 of the terms of reference, and therefore also Section 310B – 310Q of the Environmental Protection Act. The Environmental Management Plan presented in the EIS is deficient in the following areas: The description of the land on which the activities are to be carried out. Description of the environmental values likely to be affected. Contain enough other information to allow the administering authority to decide on the application. The Environmental Management Plan prepared for the Dalby Expansion Project presents a comparatively more meaningful approach to that presented in the EIS. This indicates that Arrow is able to provide more relevant information when required, but chose not to do so for the EIS. The Environmental Management Plan does no	EIS Chapter 8 and Attachment 5 SREIS Chapters 5 to 16 and Attachment 2	EIS Chapter 8, Environmental Framework describes the widespread development required to recover coal seam gas. For this project, the type of development, construction, operation and maintenance activities are known, however locations for the majority of infrastructure is not currently defined. EIS Attachment 5, Environmental Management Plan (EMP) aims to identify the high level controls that need to be implemented in subsequent plans for construction and operations activities. Additional field studies have been undertaken to inform the SREIS and provide greater detail on the existing environmental values of the four known central gas processing facilities and proposed temporary worker accommodation facilities. The findings of additional specialist studies completed for the SREIS are presented in Chapters 5 to 16. Arrow will continue to provide more details of the other facilities as the locations become known. SREIS Attachment 2, Strategic EMP provides an update to the EMP which identifies high level management controls for the project. These controls, and any additional site-specific controls, will be set out in the statutory information requirements to support the application for an environmental authority (EA) or

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Issue No.	Submission No.	Issue	Reference	Responses
R24005	S157	more than regurgitate limited passages of the EIS, and adopts exactly the same conceptual approach as the EIS.		an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24006	S012, S013, S016, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S164	The Environmental Management Plan has not been publically released.	EIS Attachment 5 SREIS Attachment 2	EIS Attachment 5, Environmental Management Plan (EMP) which forms part of the EIS, was placed on public exhibition in 2012. details of the other facilities as the locations become known. SREIS Attachment 2, Strategic EMP provides an update to the EMP which identifies high level management controls for the project. These controls, and any additional site-specific controls, will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". The application for an EA or an EA amendment will be publically notified and interested persons will be able to obtain a copy from EHP.
R24007	S081	Owing to the inaccuracies and omissions in the EIS, and the lack of rigour in Arrow's proposed commitments, it is not possible at this time to conclude that the proposed development activities are compatible with best practice environmental management.	EIS Chapter 8 SREIS Chapters 5 to 15	The framework approach used in the EIS and described in EIS Chapter 8, Environmental Framework allows for the planning and development of the coal seam gas fields which will occur in an orderly manner through the application of best practice environmental management controls (avoidance, mitigation and management) that are reflective of the level of sensitivity of environmental values. The approach allows detailed environmental controls to be developed at specific sites to supplement the high level constraints. The EIS provides information to support the management approach, including a description of the environmental values of the project development area. Further specialist studies have been undertaken since the EIS was published. The findings of these studies are included in the Supplementary Report to the EIS (SREIS). Studies include but are not limited to groundwater, terrestrial ecology, aquatic ecology, surface water and roads and transport. Arrow will provide further information on its environmental management measures in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24008	S150	A regional National Resources Management Plan is integral to Arrow's environmental responsiveness and will help to align any future associated environmental management plans to regional resource conditions and aspirational targets.	–	Noted. Relevant regional environmental initiatives will be considered when developing the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24009	S034, S069	An environmental authority must provide minimum conditions for minimising traffic movements, noise	–	Noted. Details of thresholds proposed to protect relevant environmental values such as air quality and noise, and any additional site-specific controls,

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Issue No.	Submission No.	Issue	Reference	Responses
R24009	S034, S069	pollution and light pollution.		will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". Thresholds will be compliant with applicable standards and regulations.
R24010	S012, S013, S016, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S164	Department of Environment and Resource Management guideline 'Preparing an Environmental Management Plan for coal seam gas activities' lists a hierarchy of management options for coal seam gas water. The EIS contains no discussion of the hierarchy and justifications around why higher level options in the hierarchy are not considered suitable for the project.	SREIS Attachment 5	SREIS Attachment 5, Coal Seam Gas Water and Salt Management Plan provides further information on the proposed management of coal seam gas water for the project. The strategy adopts the hierarchy of management options for coal seam gas water. Further details will be provided in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24011	S137	The EIS should ensure that the development is done in an environmentally responsible way.	-	oted. The project, and its component activities, will adhere to relevant environmental legislation, standards, and guidelines and to the conditions of its approvals. In particular, Arrow will also be required to adhere to the conditions of its environmental authority(s). Performance criteria and objectives, prevention, minimisation and mitigation strategies or action programs, monitoring, responsibilities, timing, reporting , auditing and corrective actions will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". Monitoring and review procedures will be developed to check for compliance of activities and personnel with the conditions of all approvals and environmental authorities for the project.
R24012	S017	The mitigation and management measures defined will rarely be successful because of the unpredictable weather and the nature of intensive cropping on the Condamine Flood Plains.	EIS Chapter 11, Section 11.6, Chapter 15, Section 15.6.1 and Chapter 18, Section 18.6.2 SREIS Attachment 2	Arrow has taken into account the climatic conditions in the project development area throughout the design of the project and the EIS process including developing the mitigation and management measures. Arrow has also made various commitments to manage climatic extremes including for example commitments C025 to C030 (Chapter 11, Climatic Adaptation), Commitment C157 (Chapter 15, Surface Water) and Commitment C274 (Chapter 18, Landscape and Visual Amenity). details of the other facilities as the locations become known. SREIS Attachment 2, Strategic Environmental Management Plan (EMP) provides an update to the EMP which identifies high level management controls for the project. These controls, and any additional site-specific controls, will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".

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R24013	S050, S079, S086, S162	The proposed decommissioning consists of filling the pipelines with inert gas/water which is unlikely to be sufficient to prevent future subsidence, EIS Section 5.7.2 nor Chapter 12, Geology, Soils and Landform, Section 12.4.3 (the EIS does not mention potential subsidence). If the old pipeline were to subside after decommissioning, this would create a safety hazard across intensively farmed lands and in particular floodplains and leave the onus on the landholder to fix this and any erosion caused, due to the subsidence. Does the state compensate for any remedial action or re-instatement of the environment after decommissioning, keeping in mind that the coal seam gas companies are foreign owned? As this is not addressed, it is of concern to landholders.	EIS Chapter 9, Section 9.6, Chapter 13, Section 13.6.4 and Attachment 5, Section 5.3 and Section 5.4.2	Arrow has made various commitments related to decommissioning and associated rehabilitation of pipelines. These include to minimise the disturbance footprint and vegetation clearing (Commitment C020) and to compact padding material and subsoils used to backfill pipeline trenches to reduce settling, and limit compaction to no deeper than 0.5 m below natural surface level (Commitment C119). The density of soils used in backfilling activities will be determined by the level of compaction required to restore the original surface profile. Arrow has committed to conduct inspection and monitoring in accordance with environmental authority conditions and regulatory requirements (Commitment C518). These programs will be implemented following backfilling activities to check that rehabilitation objectives have been met, and the agreed land use is restored. EIS Attachment 5, Environmental Management Plan, Section 5.3 states rehabilitation of the land involves a final reinstatement of topography and reprofiling, returning the land to as near as practicable to the predisturbance state. Section 5.4.2, Gas and Water Gathering Systems and High-pressure Gas Pipelines, follows the requirements of Australian Standard AS 2885 for gas and liquid petroleum pipeline abandonment. The removal of all pipelines is deemed further unnecessary environmental impact. To prevent subsidence under roads, utilities or railway lines, the pipe is filled with a stabilising material such as concrete. Surface deformation may be discussed, if deemed a potential impact, when the detailed rehabilitation plan is developed in consultation with landholders. The Queensland Government regulates the industry and prescribes appropriate financial assurance so that adequate progressive rehabilitation is undertaken by proponents and that funds are available to government to rehabilitate the site if a company goes into liquidation. The administering authority requires financial assurance to be lodged as a condition of an environmental authority (EA) (chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). Financial assurance is held as security so that adequate progressive rehabilitation is undertaken by proponents and that funds are available to government to rehabilitate the site if a company goes into liquidation.
R24014	S002, S003, S009, S018, S020, S026, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076, S085, S088, S095, S096,	Financial assurances shouldn't be calculated by Arrow, but should instead be calculated by an independent assessor appointed by the Queensland government.	EIS Attachment 5, Section 1.9	Noted. The administering authority requires financial assurance to be lodged as a condition of an environmental authority (EA) (chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). Financial assurance for the project is required by the EHP (previously DERM) guideline for Financial Assurance for Petroleum Activities (DERM, 2011c) as part of the application for an EA or an EA amendment as described in EIS Attachment 5, Environmental Management Plan, Section 1.9. The level of financial assurance will require acceptance by EHP.

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R24015	S099	Financial assurance or bonds should be guaranteed by shareholders.	–	Noted. Financial assurance for the project is required by the EHP (previously DERM) guideline for Financial Assurance for Petroleum Activities (DERM, 2011c). It is a security held to meet any potential costs or expenses incurred by the Queensland Government in taking action to rehabilitate or restore the environment. Financial assurance acceptable to the Queensland Government will be put in place by Arrow.
R24016	S099	The Department of Environment and Heritage Protection should impose environmental conditions with prohibitive bonds and penalties	EIS Attachment 5, Section 1.9 SREIS Chapter 3, Section 2.7.10	Noted. Compliance will be enforced by the relevant agencies of the Queensland Government. The conditions of the environmental authority (EA) will be determined by EHP and will enforce compliance and any associated penalties. Financial assurance for the project is required by the EHP (previously DERM) guideline for Financial Assurance for Petroleum Activities (DERM, 2011c) as part of the application for an EA or an EA amendment application (EIS Attachment 5, Environmental Management Plan, Section 1.9). The level of financial assurance will require acceptance and approval by EHP. Arrow will calculate financial assurance required for the project in accordance with regulatory requirements. The financial assurance will be provided to EHP and reviewed throughout the life of the project.
R24017	S099	Legacy issues (such as economic impacts) to landowners are of concern if Arrow Energy goes into liquidation.	–	The administering authority requires financial assurance to be lodged as a condition of an environmental authority (EA) (Chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). Financial assurance is held as security so that adequate progressive rehabilitation is undertaken by proponents and that funds are available to government to rehabilitate the site if a company goes into liquidation.
R24018	S150	The “commercial-in-confidence nature of financial assurance” is not supported in that proponents do not have to disclose what that assurance is.	EIS Attachment 5, Section 1.9	The administering authority requires financial assurance to be lodged as a condition of an environmental authority (EA) (Chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). Financial assurance is held as security so that adequate progressive rehabilitation is undertaken by proponents and that funds are available to government to rehabilitate the site if a company goes into liquidation. EIS Attachment 5, Environmental Management Plan, Section 1.9, notes that the calculation of financial assurance for the construction and operation phases will be part of the application stage of the EA for the project. The calculation will be in accordance with EHP (previously DERM) guidelines. The commercial in confidence aspect of the financial assurances for the project will be determined during this application stage.
R24019	S150	Should the fiscal amount of Arrow’s assurance be deemed confidential, then Arrow should disclose the full description of the operational activities it proposes the financial assurance for.	–	Noted. The administering authority requires financial assurance to be lodged as a condition of an environmental authority (Chapter 5A activities) under the Environmental Protection Act 1994 (EP Act). The lodgement process of financial assurances requires the proponent is to disclose what activities the assurance is for.

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R24020	S157	Arrow should assess its capacity to comply with 'make-good' arrangements in regard to groundwater. Once the project ceases, how will Arrow fund 'make-good' measures? Arrow (and all other coal seam gas proponents) should be required to pay the government a monetary bond in order to compensate landholders should the 'make-good' obligations of a particular company in the structure fail. The establishment of a fund of this nature would alleviate pressures associated with continued operation after production ceases, and associated pressures from shareholders.	–	Financial assurance for the project is required by the EHP (previously DERM) Guideline for Financial Assurance for Petroleum Activities (DERM, 2011). It is a security held to meet any potential costs or expenses incurred by the Queensland Government in taking action to rehabilitate or restore the environment. Arrow will calculate financial assurance required for the project in accordance with regulatory requirements. The financial assurance will be provided to EHP and reviewed throughout the life of the project.
R24021	S011	EIS Appendix K, Terrestrial Ecology Impact Assessment, Section 4.5.2 reaches conclusions regarding the significance of impacts that presupposes that mitigation is successful. How will the selection and application of mitigation measures be monitored and enforced?	EIS Attachment 5, Table 5.4 SREIS Attachment 2	EIS Attachment 5, Environmental Management Plan, Table 5.4 identifies the requirements for inspections and monitoring, auditing, reporting and guidance on actions to prevent an incident recurring (corrective actions). SREIS Attachment 2, Strategic Environmental Management Plan presents the updated plan that includes any changes to these requirements made as a result of changes to the project description and the outcomes of the additional studies completed for the SREIS. Further specific details of monitoring, including the frequency at particular sites, will be included in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". As a minimum, annual verification will be undertaken to check that mitigation measures are working as planned so that necessary action can be taken early, should the objectives of mitigation measures not be achieved. The Queensland Government may also carry out compliance checks at its discretion.
R24022	S014, S044, S130	In relation to coal seam gas infrastructure (dams, compressor stations, lay-down areas, and camps), will on-going monitoring and testing be undertaken in regards to environmental monitoring at specific sites? And if so, how often?	EIS Attachment 5, Table 5.4 SREIS Attachment 2	Arrow will undertake inspection and monitoring at its facilities and other locations in accordance with the conditions its environmental authority. Proposed inspection and monitoring is outlined in SREIS Attachment 2, Strategic Environmental Management Plan, which provides an update to EIS Attachment 5, Environmental Management Plan.
R24023	S015	Past performances regarding large mining operations have shown very grey areas have arisen with regard to the establishment of the policy. Whilst Arrow incorporates an environmental policy setting out a Health, Safety and Environment Management System, only recently an incident was reported a long time after it occurred, suggesting	–	Arrow's Environmental Policy aims to promote sustainable environmental practices as part of their commitments, beliefs and values. In addition to this policy, Arrow has a Health, Safety and Environment Management System and Rules and Guidance Handbook. Arrow personnel, inclusive of contractors, are required to demonstrate competency through Arrow's prequalification system and are required to adhere to Arrow's systems and policies.

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R24023	S015	the policy is in place but not followed. This causes alarm for many people. Will the environmental policy be strictly adhered to or will the grey areas continue?		As described in EIS Attachment 5, Environmental Management Plan, Section 2.5, incident reporting within Arrow is reinforced through environmental management plans, procedures and incident reporting guidelines and are included and emphasised during training of personnel. Environmental incidents are reported up through Arrow's management line, responded to immediately and investigated. Root causes are assessed to establish corrective actions to prevent recurrence. Arrow's environment and approvals managers must fulfil external environmental reporting requirements in the event of any incident. Arrow has plans and procedures for preparedness and response to emergencies. These are applied to both environmental and safety events.
R24024	S069	How will Arrow personnel know there has been a breakage or damage to underground infrastructure?	EIS Chapter 5, Section 5.6.6 and Attachment 5	As described in EIS Chapter 5, Project Description, Section 5.6.6, pipeline pressure and gas volumes in the pipe will be remotely monitored. Pipelines will be constructed with automatic inlet valves that shut off or isolate sections of pipe if a large pressure change is detected. A large pressure change can be caused by the inflow of external air, potentially arising from a breakage or damage to the underground pipe. Underground infrastructure will be subject to integrity and maintenance programs in accordance with relevant standards for project life. SREIS Attachment 2, Strategic Environmental Management Plan (which updates EIS Attachment 5, Environmental Management Plan) aims to identify high level management controls for the project. Comprehensive monitoring requirements, and any additional site-specific controls, will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24025	S075, S077, S089, S104	The monitoring proposed by Arrow should be undertaken by a substantial independent body and a comprehensive, failsafe, long-term monitoring network should be set up. This body should be independently administered, as the thoroughness of monitoring the hundreds of conditions found is questioned, while not being funded by the public purse.	EIS Attachment 5, Section 2.6	Noted. Monitoring and reporting will be carried out by Arrow in accordance with the high level management controls for the project set out in SREIS Attachment 2, Strategic Environmental Management Plan (which updates EIS Attachment 5, Environmental Management Plan). These controls, and any additional site-specific controls, will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". Monitoring will include assessing the implementation of mitigation measures, regular inspection of construction and operational activities, environmental monitoring of impacts over time, reporting and analysis of regulated discharges, emissions and waste disposal, as well as any other prescribed monitoring in accordance with the conditions of the EA. External audits will be undertaken at least once every two years and when required to evaluate compliance with environment authority conditions and Arrow's Health, Safety and Environmental Management System (see EIS Attachment 5, Environmental Management Plan, Section 2.6). The regulator

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R24025	S075, S077, S089,			may also undertake audits against the conditions of Arrow's environmental authority.
R24026	S079	Water and soil quality tests should be performed downstream from coal seam water releases and these results should be made available to the public. How far downstream (of the releases) will monitoring be performed?	EIS Attachment 5 SREIS Chapter 9, Section 9.6.2 and Attachment 2	Arrow has carried out further field studies at potential release points and downstream of these points for the SREIS. SREIS Chapter 9, Surface Water presents the findings of these studies and updates the monitoring activities proposed at watercourses where releases have been identified (Section 9.6.2). Surface water and soil monitoring requirements are also discussed in SREIS Attachment 2, Strategic Environmental Management Plan which identifies the high level management controls for the project.
R24027	S079	How long (time period in days, weeks, months etc.) are each of the inspections mentioned in Section 13.8 performed for and at what intervals (weekly, monthly)?	EIS Attachment 5, Section 2.4 and Table 5.4 SREIS Attachment 2	As per EIS Chapter 13, Section 13.8, erosion and sediment control measures will be inspected following significant rainfall events and repaired and/or maintained as required to retain their effectiveness. (Commitment C505). Pipeline right of ways (ROWs) will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (Commitment C506). Arrow will seek to work with industry and regulators to establish appropriate monitoring programs for soil characteristics and potentially visual crop health on disturbed areas, but will also work to reduce disturbance and thereby reduce the need for ongoing monitoring.
R24028	S111	The idea that the degree of methane escaping, heavy metal contamination and aquifer depletion will be either accurately predicted or reported is laughable.	EIS Chapter 10, Section 10.2, Chapter 12 and Chapter 14, Section 14.7.4 SREIS Chapter 6, Chapter 8 and Attachment 2	Methane levels, heavy metal contamination and aquifer depletion are discussed in EIS Chapter 10, Greenhouse Gas Emissions, Section 10.2; Chapter 12, Landform, Geology and Soils outlines potential contamination for the project development area; and Chapter 14, Groundwater, Section 14.7.4 discusses reduced aquifer recharge and the alteration of groundwater flow patterns, respectively. Further studies have been completed since the EIS was published. The findings of these studies are included in SREIS Chapter 6, Greenhouse Gas Emissions and Chapter 8, Groundwater, respectively. Arrow will implement a range of measures to record and monitor its activities throughout the life of the project. This includes water quality and for emissions to air. Further details of monitoring are included in SREIS Attachment 2, Strategic Environmental Management Plan.
R24029	S123	It is assumed that some existing wells (Tipton) would have been subjected to floods in the past and protocols would be in place. Information regarding any maintenance programs/schedules that highlight works that need to be undertaken after a natural disaster event is requested.	EIS Chapter 11, Section 11.6, Chapter 15, Section 15.6.1, Chapter 18, Section 18.6.2, Chapter 25, Attachment 8 and Appendix S	Noted. Arrow has taken into account the climatic conditions (including flood risk) in the project development area throughout the design of the project and the EIS process. The EIS also includes measures that aim to mitigate and manage the impacts of natural disasters (see for example Commitments C025 to C030, Chapter 11, Climatic Adaptation, Commitment C157, Chapter 15, Surface Water and Commitment C274, Chapter 18, Landscape and Visual Amenity). Arrow will also develop appropriate emergency response plans (including for natural disaster response)(see Commitment C424) which will include details of actions to be taken following a natural disaster such as

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R24029	S123			flooding as required by State Planning Policy (SPP) 1/03. Further information relating to SPP 1/03 can be found in EIS Chapter 25, Preliminary Hazard and Risk and EIS Appendix S, Preliminary Hazard and Risk Assessment. Detail about maintenance and rehabilitation undertaken after a natural disaster event will be included with the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24030	S150	It is recommended that the EIS describes what long-term monitoring program Arrow will use to measure environmental change and generate information on: the direction and magnitude of change, the rate of change, and the pattern of the change response.	EIS Attachment 5 SREIS Attachment 2	EIS Attachment 5, Environmental Management Plan summarises the monitoring identified in the EIS for specific environmental impacts. The requirements have been updated in SREIS Attachment 2, Strategic Environmental Management Plan. Arrow will undertake monitoring and testing at its facilities and other locations including the monitoring of implementation of specific environmental management plans and procedures, regular inspection of construction and operational activities, environmental monitoring of impacts over time, reporting and analysis of regulated discharges, emissions and waste disposal as well as any other prescribed monitoring in accordance with the conditions of the relevant environmental authority (EA). Performance criteria and objectives in relation to environmental impacts with measurable indicators and standards to be met and verified through appropriate monitoring will be proposed in the statutory information requirements to support the application for an EA or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24031	S081	Has the impact on environmental values been considered of the process of removing bulk water remaining in the gas (referred to as slug catcher in the EIS).	EIS Chapter 5, sections 5.4.1 and 5.6.2 SREIS Attachment 5	EIS Chapter 5, Project Description, sections 5.4.1 and 5.6.2 describes the various stages where water needs to be removed from the coal seam gas. Further details are provided in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy. Water produced through the gas production process, including through the gas gathering network and at field facilities will be 'captured' and diverted to the water treatment facilities which will be co-located with central gas processing facilities (CGPFs) in drainage area (DA) 2 or 9. The gas will be dehydrated at the CGPFs and any water produced will enter the water system for treatment. If the water is produced during the dehydration process at any of the other facilities, it will enter the water gathering system and be transferred to CGPFs in DA2 or DA9 for treatment.
R24032	S011	Analysis conducted into the environmental impacts of the project is vague and often relies on modelling that has been based on minimal or irrelevant data.	EIS Chapter 9, Chapter 12, Chapter 18, and Attachment 5, Section 4 SREIS	EIS Attachment 5, Environmental Management Plan (EMP), Section 4 summarises the environmental values, impacts and management actions for the environmental aspects considered in the EIS. The EIS presents each of these environmental aspects as a separate chapter, e.g., Chapter 9, Air Quality; Chapter 12, Geology, Landform and Soils and Chapter 18,

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R24032	S011		Chapters 5 to 15	Landscape and Visual Amenity. Further technical studies have been completed for the SREIS, including field studies in the project development area. The findings of these studies are included in chapters 5 to 15 of the SREIS. Attachment 2, Strategic Environmental Management Plan presents an update to the EMP.
R24033	S081	The environmental management plan is not compatible with the standard criteria for an integrated environmental management system. It does not provide enough detail regarding Arrow's Health Safety, Security and Environment management system. There is also a lack of standard operating procedures or an environmental management plan.	EIS Attachment 5 SREIS Attachment 2	Noted. SREIS Attachment 2, Strategic Environmental Management Plan (which is an update to EIS Attachment 5, Environmental Management Plan (EMP)) identifies the high level management controls for the project that will be further detailed in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24034	S011	Increased costs and impacts to the environment, from assessment of cumulative impacts and landfill capacities should be assessed and reported.	EIS Chapter 9, Chapter 12, Chapter 26, Chapter 28 and Attachment 5, Section 4	SREIS Attachment 2, Strategic Environmental Management Plan, Section 4 (which updates EIS Attachment 5, Environmental Management Plan) outlines the environmental values, impacts and management actions for the environmental aspects considered in the EIS. The EIS presents the findings of the assessment of impacts on each of these environmental aspects in separate chapters, e.g. Chapter 9, Air Quality; Chapter 12, Geology, Landform and Soils, Chapter 28, Cumulative Impacts, and Chapter 26, Waste Management (specifically Table 26.1 showing offsite waste disposal facilities). Each chapter identifies the potential project impacts on the environmental values in the project development area.
R24035	S081	Site-specific objectives (or objectives for each land use if site-specific is too unwieldy), indicator and completion criteria must be developed for land occupied by wellhead and gas and water gathering infrastructure.	EIS Chapter 13, Section 13.5 and Chapter 14, Section 14.5	Noted. These details will be included in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities". The application for an EA or an EA amendment will include proposed performance criteria and objectives, prevention, minimisation and mitigation strategies or action programs, monitoring, responsibilities, timing, reporting requirements and auditing responsibilities, corrective actions and will also be required to incorporate site-specific features and environmental characteristics. Environmental protection objectives are provided in the EIS aimed at avoiding or reducing adverse impacts to, for example, agricultural production and practices (EIS Chapter 13, Agriculture Section 13.5) and groundwater levels and quality (EIS Chapter 14, Groundwater, Section 14.5).
R24036	S137	An Environmental Management Plan must be developed for the construction, operation and overall management. This must be a living document that has input from the community and is subject to scrutiny.	EIS Attachment 5 SREIS Attachment 2	EIS Attachment 5, Environmental Management Plan and the updated plan in SREIS Attachment 2, Strategic Environmental Management Plan, aim to identify high level management controls for the project. These controls will be further detailed in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in

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R24036	S137			accordance with EHP Guideline “Application requirements for petroleum activities”. The application for an EA or an EA amendment will be publically notified and interested persons will be able to obtain a copy from EHP. It is expected that environmental management plans will be updated as the project progresses, consistent with field development.
R24037	S157	Certain sources of impact do not stop at the property boundary (e.g., air, noise, dust and groundwater). The regulator must have an understanding of the existing environment to allow informed comment on the potential impacts on sensitive receptors.	EIS Chapter 9, Chapter 12, Chapter 18 and Attachment 5, Section 4 SREIS Chapters 5 to 15	Noted. EIS Attachment 5, Environmental Management Plan, Section 4 outlines the environmental values, impacts and management actions for the environmental aspects considered in the EIS. Chapters in the EIS presents baseline information on each of these environmental aspects, e.g. Chapter 9, Air Quality; Chapter 12, Geology, Landform and Soils and Chapter 18, Landscape and Visual Amenity. The technical studies which inform these chapters included study areas that were not constrained by property values, but where appropriate to the nature and extent of potential impacts. Further studies have been completed for the SREIS and provide further baseline information to inform the development of mitigation and management measures (SREIS chapters 5 to 15). In addition, specific-site investigations will be undertaken prior to construction at each site. Depending on the type of infrastructure, investigations may address terrestrial ecology, aboriginal cultural heritage, soils, noise and air quality requirements. The study area for the investigations will include the likely area of influence of an impact, irrespective of property boundaries.
R24038	S146	What are the reporting requirements to ascertain if Section 312E of the Environmental Protection Act is triggered or otherwise. How is this information validated by the administrating authority?	–	Any reporting requirements required by the <i>Environmental Protection Act 1994</i> (EP Act) will be specified by the administrating authority as part of the environmental authority process and included as conditions to that authority.
R24039	S130, S133	Arrow must incorporate and reference the Western Downs Regional Council Pest Management Plan and meet the requirements of it. The EIS did not consider pest control strategies within occupied environments such as camps and other areas likely to attract pests such as landfill/waste storages.	EIS Chapter 13, Section 13.6.3 and Chapter 16, Section 16.6.3	Arrow will inspect work sites and access routes for notifiable weeds and pest plants and animals prior to accessing the site; and if detected, manage in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008) (Commitment C098) and develop a declared weed and pest management plan in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008)(Commitment C188). Inspections to identify declared species or species identified by regional pest management plans will be completed in accordance with state legislation, local pest management plans and Arrow policies, standards and guidelines. This will include all areas Arrow intends to work around (including camp sites). If pests are detected, actions will be taken in accordance with the declared weed and pest management plan. The plan will include

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R24039	S130, S133			management strategies around all vehicle inspections and weed clean downs. Arrow's Health, Safety and Environmental Management System will also be implemented within work sites, including camps, and will include procedures for managing and controlling pests.
R24040	S130	A contribution should be made to the Western Downs Regional Council of \$250,000 for vehicle wash down facilities, and weed wash down for all vehicles leaving and entering construction sites in the region to reduce spread of noxious weeds.	EIS Chapter 22, Section 22.8	Arrow has committed to provide developer contribution and head works charges for infrastructure (Commitment C377). Arrow has also committed to consult with councils and the regional community consultative committee for their views on which social, community or recreational infrastructure in the Western Downs region is being directly impacted by the project and the extent of this. Arrow will liaise with the relevant body to coordinate efforts across all proponents and identify opportunities that may potentially ease or mitigate impacts (Commitment C366). As part of the project, various solutions will be implemented for weed washdowns, including mobile, portable and permanent facilities, based on activities and machinery hygiene requirements.
R24041	S133	Management of vermin and pests on site must adhere to the Public Health Act 2005, Division 3 of the Public Health Regulation 2005 and be carried out in accordance with the Pest Management Act 2001.	EIS Chapter 16, Section 16.6.3	Noted. Arrow will comply with all relevant legislation and associated regulations. A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008) (Commitment C188) and applicable legislation.
R24042	S079	Rehabilitated areas (mentioned in Section 12.8) will be monitored regularly for short and long term adverse impacts – What is classed as “short” term and what is classed as “long” term?	EIS Chapter 12, Section 12.8	EIS Chapter 12, Geology, Landform and Soils, Section 12.8 sets out the framework for monitoring in relation to impacts on soils. As noted in that section, implementation of the strategy, including monitoring of rehabilitated areas, will be controlled procedurally. Inspection and monitoring will be conducted in accordance with environmental authority conditions and regulatory requirements (Commitment C518). Specific monitoring requirements are expected to include timeframes for monitoring of rehabilitated areas.
R24043	S099	Permanent impacts to strategic cropping land have not been addressed. Proposed rehabilitation and decommissioning on strategic cropping land is not proposed in enough detail (require objectives, criteria and performance indicators). Concern that Arrow will do the minimum required legally to save costs.	EIS Chapter 13, Section 13.5 SREIS Chapter 8	EIS Chapter 13, Agriculture, and SREIS Chapter 8, Agriculture identify and address the impacts to strategic cropping land within the project development area. Arrow will comply with the requirements under the Strategic Cropping Land Act and will provide further details applicable to the project development area, with the application for an environmental authority (EA) or EA amendment, prepared in accordance with EHP Guideline “Application requirements for petroleum activities”. Arrow has committed to develop rehabilitation plans based on the environmental sensitivities at different sites. Details will be provided as the field development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plans will address ground

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R24043	S099			<p>preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landholder requirements (Commitment C070).</p> <p>The project, and its component activities, will adhere to relevant environmental legislation, standards, and guidelines and to the conditions of its approvals. In particular, Arrow will be required to adhere to its EA(s). Proposed performance criteria and objectives, prevention, minimisation and mitigation strategies or action programs, monitoring, responsibilities, timing, reporting requirements and auditing responsibilities and corrective actions will be set out in the statutory information requirements to support the application for an EA or an EA amendment.</p>
R24044	S134	<p>Arrow to adequately address terms of reference 3.2.15, which states that the EIS should detail the strategic approach and typical measures to be taken regarding decommissioning and rehabilitation.</p>	<p>EIS Chapter 5, Section 5.4.3 and Attachment 5, Tables 5.1 to 5.3</p>	<p>The strategy for decommissioning and rehabilitation is set out in EIS Chapter 5, Project Description, Section 5.4.3 and in EIS Attachment 5, Environmental Management Plan, sections 4 and 5. Further details are provided in separate chapters of the EIS which present the findings of technical studies. Tables 5.1 to 5.3 in EIS Attachment 5, set out the proposed rehabilitation management of project facilities and infrastructures. Rehabilitation goals and objectives, indicators and criteria for completion are also detailed in the table. Detailed decommissioning and rehabilitation plans for each site or group of sites will be developed in consultation with landholders to meet the rehabilitation goals and criteria.</p>
R24045	S134	<p>Arrow to develop and make public for comment a rehabilitation plan, taking into account:</p> <ul style="list-style-type: none"> • Previous land use and desired land use after rehabilitation • To what extent is full rehabilitation possible and for what disturbance levels? • How often is it possible? • If full rehabilitation is not possible, to what extent will the site be able to be rehabilitated? • What monitoring will be undertaken? • Addressing timeframes and priority areas. <p>Rehabilitation is not adequately defined or discussed in the EIS.</p>	<p>EIS Chapter 5, Section 5.4.3, Attachment 5, sections 4 and 5, tables 5.1 to 5.3</p>	<p>The strategy for rehabilitation activities is set out in EIS Chapter 5, Project Description, Section 5.4.3 and in EIS Attachment 5, Environmental Management Plan, sections 4 and 5. Further details are provided in separate chapters of the EIS which present the findings of technical studies. Tables 5.1 to 5.3 in EIS Attachment 5, set out the proposed rehabilitation management of project facilities and infrastructures. Rehabilitation goals and objectives, indicators and criteria for completion are also detailed in the table.</p> <p>The rehabilitation approach recognises that there will be progressive rehabilitation undertaken post construction, to stabilise the land and reduce the construction footprint for operations. The period of time between construction and rehabilitation will be reduced to prevent degradation and loss of exposed soils. Surface structures, equipment and waste materials from the construction area will be removed prior to rehabilitation.</p> <p>Final rehabilitation will involve the reinstatement of topography, re-profiling and revegetation of the site (where required) to return the disturbed land to as near as possible the predisturbance state. Compacted areas will be ripped or scarified and topsoil will be respread to encourage natural revegetation. In some cases, stabilisation measures will be used so that topsoil remains intact. Site-specific rehabilitation plans will be developed for areas where natural vegetation regeneration may be problematic.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R24045	S134			A detailed rehabilitation plan for each site or group of sites will be developed in consultation with landholders. Monitoring requirements for rehabilitated areas will be in accordance with environmental authority conditions and relevant regulatory requirements. Specific monitoring requirements are expected to include timeframes for monitoring of rehabilitated areas.
R24046	S134	Arrow to include areas previously identified as low to medium in conservation value in their rehabilitation plan as they are potential opportunities for inclusion as offsets or possibly decommissioning stages. Arrow to include existing areas of moderate to highly disturbed aquatic environments as part of their rehabilitation plan.	–	Where avoidance is not possible, and significant residual impacts remain to endangered, vulnerable and near threatened (EVNT) species and threatened communities, Arrow has committed to implement an offset strategy approved by a relevant government agency and comply with reporting conditions of an offset plan (Commitment C219). As part of this strategy, Arrow may investigate opportunities for improving habitat condition in areas identified as having low to medium conservation value.
R24047	S095	Co-mingling that results from a percentage of the wells not sealing has even more of a certainty of happening as we know that there is no "on the ground" checking on drilling practice with bores already drilled being sealed with normal concrete (instead of the correct grade).	EIS Chapter 25, Section 25.6.3	Production wells will be designed and constructed so that the well is cased or concreted through aquifers other than the coal seam to prevent transmission of water and gas between strata. (Commitment C537). Arrow will carry out inspections and audits of project activities as required by its Health, Safety and Environmental Management System, conditions of the environmental authority throughout the project.
R24048	S158	'Abandonment' of wells upon decommissioning, is not acceptable. Current legislation should require that any malfunction with the capping and plugging or with any other mishap associated with the well be attended to by the company in perpetuity, as well as supplying clean-up, regeneration, re-stabilisation or compensation associated with said mishap.	EIS Attachment 5, sections 5.3 and 5.4	When production and monitoring wells reach the end of their production life (approximately 15 to 20 years), they will be decommissioned in accordance with the Petroleum and Gas (Production and Safety) Act 2004 requirements. These requirements include the removal of all surface equipment, including fencing; cutting off the well casing and the gathering line connections below the ground surface; and using a drilling rig to plug the well with concrete to isolate formations and prevent gas leakage to the surface. A statutory signpost will be erected on a nearby fence or other suitable location. Well sites will then be rehabilitated to a standard consistent with the surrounding land use or as agreed with the landholder. Rehabilitation may involve recontouring, replacing topsoil, and re-establishing drainage lines and pasture species (EIS Attachment 5, Environmental Management Plan, Section 5.3 and 5.4).
R24049	S134	The project phase could pan out further if decommissioning is additional to the 35 year timeframe, as discussed in EIS Chapter 1, Section 1.2.3. Is the proposed monitoring program sufficient, will it meet the needs well after the project has finished? Arrow should provide sufficient detail regarding how long the monitoring program will continue after the project has finished.	–	Arrow will carry out project monitoring as required by the conditions of its environmental authority. The duration of monitoring post decommissioning will likely vary from site to site and for different rehabilitation objectives.

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Issue No.	Submission No.	Issue	Reference	Responses
R24050	S017	The EIS suggests that the initial disturbed area should be rehabilitated back to its pre-existing condition. However a well work over will be carried out every three years. From experience, the compaction from the first exercise will still be evident without trying to correct the next compaction event.	SREIS Chapter 3	The layout, design and construction methods used to install production wells and access tracks in areas containing vertosols will consider site specific conditions and the outcomes of consultation with the landholder. These considerations include appropriate placement of infrastructure so as to reduce impacts, and reductions in the disturbance footprint through multi-well pad designs (SREIS Chapter 3, Project Description). Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks. Landholders will be consulted about the proposed methods and extent of rehabilitation on their land. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities which address requirements regarding impacts on soils, when operating on strategic cropping land.
R24051	S121	Mitigation measures should be provided in the environmental management plan which ensure the long term stability of areas with a slope of 15% or greater.	SREIS Chapter 8 and Attachment 2	Noted. Further information on the management of activities, including mitigation measures is included in SREIS Chapter 8, Agriculture and the updated EMP in SREIS Attachment 2, Strategic Environmental Management Plan. The EMP aims to identify high level management controls for the project. Proposed monitoring and any additional site-specific controls will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24052	S079	How or who determines what the predisturbed conditions were and if they have been achieved, if the landowner or the stakeholder does not agree with the coal seam gas company (referring to EIS, Chapter 13, Section 13.8)?	EIS Chapter 5, Section 5.7 and Chapter 13, Section 13.6.4	EIS Chapter 5, Project Description, Section 5.7 details Arrow's general approach to rehabilitation. The final rehabilitation requirements will be determined in conjunction with the landholder, with general requirements stipulated in the environmental authority. On strategic cropping land, Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities. Monitoring of rehabilitation will be undertaken to confirm relevant performance objectives have been met. Other specific commitments that Arrow has made regarding rehabilitation activities on agricultural land are included in EIS Chapter 13, Agriculture, Section 13.6.4.
R24053	S024, S025, S026, S036, S057, S081, S083, S150	All disturbed lands must be returned to their previous use and suitability class and rehabilitation can only be considered successful where the disturbed lands have the same productive capacity as they did prior to disturbance.	EIS Chapter 5, Section 5.7 and Chapter 13, Section 13.6.4	EIS Chapter 5, Project Description, Section 5.7 details Arrow's general approach to rehabilitation. Prior to decommissioning, detailed objectives, criteria and performance indicators for rehabilitation of sites will be developed in consultation with the appropriate regulatory agency and landholders. The rehabilitation process will involve the final reinstatement of topography, re-profiling and revegetation of the site (where required) to return the disturbed land to as near as possible the predisturbance state. Compacted areas will be ripped or scarified and topsoil will be respread to encourage natural revegetation. In some cases, stabilisation measures will be used so that

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R24053	S024, S025, S026, S036, S057, S081, S083, S150			topsoil remains intact. Other specific commitments that Arrow has made regarding rehabilitation activities on agricultural land are included in EIS Chapter 13, Agriculture, Section 13.6.4. Site-specific rehabilitation plans will be developed for areas where natural vegetation regeneration may be problematic. The final rehabilitation will be determined in conjunction with the landholder. Monitoring of rehabilitation will also be undertaken to confirm performance objectives have been met.
R24054	S017, S025, S082	It is deemed necessary that a field trial be carried out to demonstrate the successful rehabilitation of compaction in vertosol and dermosol soils. If successful, a field day to demonstrate such practices would be appreciated by local landowners. If unsuccessful it would appear the projects should not proceed on such soils until otherwise demonstrated successful. There is adequate crown land with vertosol soils available for such trial work.	EIS Attachment 5, Section 4.16.3	Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. The layout, design and construction methods used to install production wells and access tracks on vertosols will consider site specific conditions and the outcome of landholder negotiations on particular farming practices. Arrow is reviewing best methods to limit and manage soil compaction around project-related infrastructure. These methods will include avoidance where possible, and alternative access and vehicle specifications such as swamp matting or caterpillar tracks are being assessed.
R24055	S079	How will Arrow rehabilitate a 75 m by 75 m footprint down to a 10 m by 10 m footprint on intensively cropped black soil land after 50 heavy vehicles and 91 light vehicles (as per table 19.2 - Estimated traffic generation by key project activities) during the construction phase have travelled over the area and compacted the soil heavily? If the site is not rehabilitated back to its original state then this should also be included as part of their footprint.	–	Landholders are compensated for the area required for construction and workover of wells, not the rehabilitated area. Arrow recognises the need to assess the effectiveness of the proposed environmental management controls in addressing impacts to soils in the project development area. Arrow has shown at consultation and on its website that vertosols (black soils) can and have been successfully rehabilitated and restored to their former use. The example used is the Roma to Brisbane pipeline, which passes through vertosols for part of its length between Dalby and Gatton. The disturbed area along this alignment has been successfully rehabilitated and has been farmed for over 20 years. Rehabilitation requirements for specific areas will be detailed in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline “Application requirements for petroleum activities”. Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities when operating on strategic cropping land, which address requirements regarding impacts on soils.
R24056	S079	Will the top soil layer be removed, before the aggregate is placed for well sites and access tracks?	EIS Chapter 12, Section 12.6.2	EIS Chapter 12, Geology, Landform and Soils, Section 12.6.2, states that Arrow will strip, salvage and stockpile topsoil near work sites separately to subsoils (in consultation with landholders). Topsoil stockpiles will be designed in accordance with best practise principles and will have a maximum height of

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R24056	S079			2.5 m, and are protected from erosion by wind, rain and floods. The maximum retention time for stockpiles will be two months where the future use is rehabilitation. (Commitment C062).
R24057	S079	How will the stockpile of topsoil be managed to maintain fertility? And where?	SREIS Attachment 4	Arrow has committed to seed and fertilise long-term stockpiles as soon as possible (Commitment C542). In addition, Arrow has committed to maintain the surface of soil stockpiles in as coarsely structured a condition as possible to promote infiltration and reduce erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming. (Commitment C543).
R24058	S150	Protection thresholds must be determined for assets within the project development area, and that these thresholds also define the point at which impacts are no longer acceptable.	SREIS Attachment 2	Noted. Details of proposed thresholds will be included with the application for an environmental authority (EA) or an EA amendment. Thresholds will be based on applicable criteria, standards and guidelines and the findings of the studies and assessments completed for the EIS and SREIS, and any site specific surveys and assessments carried out during site selection process.
R24059	S134	Arrow should propose a standard methodology for rehabilitation, or a tested methodology in the absence of a standard, before any activity proceeds that may require rehabilitation.	EIS Attachment 5	Rehabilitation programs will be determined through conditions set out in the environmental authority approved by the Department of Environmental Heritage Protection (EHP). Arrow will work closely with landholders to identify site-specific rehabilitation requirements. On strategic cropping land, Arrow will be required to comply with the Strategic Cropping Land Standard Conditions Code for Resource Activities. Rehabilitation plans will be based on the environmental sensitivities at different sites. Details will be provided as the field development progresses, and infrastructure locations are determined and negotiated with landholders. The rehabilitation plans will address ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, rainfall frequency and intensity, potential flow magnitudes, vegetation cover, land use and landholder requirements (Commitment C070). SREIS Attachment 2, Strategic Environmental Management Plan (which updates EIS Attachment 5, Environmental Management Plan) aims to identify the high level controls that need to be implemented during construction, operations and decommissioning.
R24060	S055	Prior to approval, all environmental values within the project area must be properly described otherwise the nature and severity of impacts may be underestimated and environmental controls may not be appropriate.	EIS Chapters 9 to 26 SREIS Chapters 5 to 15	Noted. The existing environment and environmental values are detailed in the relevant chapters within the EIS for Air Quality (Chapter 9, Section 9.3), Greenhouse Gas Emissions (Chapter 10, Section 10.3). Climatic Adaptation (Chapter 11, Section 11.3), Geology, Landform and Soils (Chapter 12, Section 12.3), Agriculture (Chapter 13, Section 13.3), Groundwater (Chapter 14, Section 14.3), Surface Water (Chapter 15, Section 15.3) and so forth. Further investigations have been undertaken as part of the SREIS i.e., groundwater modelling, terrestrial ecology, aquatic ecology, surface water and roads and transport studies, the findings of which are summarised in

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Issue No.	Submission No.	Issue	Reference	Responses
R24060	S055			SREIS Chapters 5 to 15. Specific site investigations will be undertaken prior to construction at each site. Depending on the type of infrastructure, investigations may address terrestrial ecology, indigenous cultural heritage, soils, noise and air quality requirements.
R24061	S046	Proper procedures are required when the land is at stake and condensed quantities of brine are not an easily managed product. Government bodies should be trusted to inform potentially impacted parties as well as manage, monitor and produce a properly transparent management plan that explains the reasons for a selection of options.	SREIS Attachment 5	Noted. SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy provides details of Arrow's updated strategy for managing coal seam gas water and salt. Specific requirements will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".
R24062	S108	Arrow should be conditioned to provide the landowners with any land management plan conditioned under an environmental authority so that landowners can determine its appropriateness. Arrow should also be conditioned to obtain the landholders agreement in writing to approve the rehabilitation program, not merely for it to be "determined in conjunction with the landowner."	–	Queensland's land access laws which came into effect on 29 October 2010 require that a conduct and compensation agreement be negotiated before a petroleum authority holder comes onto a landholder's property to undertake 'advanced activities' that are likely to have a significant impact on business or land use. Rehabilitation requirements will be included in the conditions of the environmental authority approved by the Department of Environmental Heritage Protection (EHP). Arrow will work closely with landholders to identify site-specific rehabilitation requirements.
R24063	S021, S108, S123, S134, S162	The commitment included in the section for land degradation is too broad. Words such as minimise, consider, manage, where practicable, if possible. These are not binding commitments. Arrow to follow the SMART principle – Specific, Measureable, Attainable, Realistic, Timely. Specifically for mitigation strategies.	–	Commitments have been developed on the basis that in the majority of cases, these management measures can be implemented. The use of 'where practicable' or 'consider' is included to cover those circumstances where management measures may not be feasible or able to be implemented as stipulated, due to other constraints; for example, weather or seasonality issues, or specific land use on properties that requires a different approach. Further detail of the measures Arrow will implement to manage the impacts of its activities will be set out in the statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with the EHP Guideline "Application requirements for petroleum activities". Measures will be further refined as the field is developed. Conditions of the EA set by the Queensland Government will be binding and enforceable.
R24064	S162	The list of commitments does not make a clear strategy especially when landholders are forced to trust Arrow to do this correctly once approval is granted. The list of commitments are not helpful to the EIS and should be spelt out entirely so more confidence can be given to the company in doing	–	The commitments set out in the EIS have been reviewed and revised where required in the SREIS. Further detail will be provided in statutory information requirements to support the application for an environmental authority (EA) or an EA amendment, in accordance with EHP Guideline "Application requirements for petroleum activities".

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R24064	S162	the right thing.		
R24065	S150	In relation to the infrastructure mapping, environmental site assessments and regional ecosystems and regrowth, these are not adequately addressed in the EIS. The submissions indicate that there would be scope to adapt the planning for the associated infrastructure to avoid impacts on environmentally sensitive areas as mapped.	EIS Chapter 8 and Chapter 17, Section 17.6 SREIS Chapter 3, Attachment 6	EIS Chapter 8, Environmental Framework describes the widespread development required to recover coal seam gas. For this project, the type of development, and construction, operation and maintenance activities are known, however, locations for most infrastructure is currently undefined. As such, constraints mapping will form the basis for the sensitive locating of infrastructure, and decisions regarding the appropriate implementation of site specific management actions. Site selection will be informed by the constraints mapping which allows for highly sensitive areas to be avoided and can also inform the need for highly site-specific management measures to protect sensitive areas. For example, proposed constraint zones and recommended management procedures for terrestrial ecology are identified in EIS Chapter 17, Terrestrial Ecology, Section 17.6. Constraints mapping shown in the EIS was also informed by aquatic ecology, surface water, roads and transport and cultural heritage. Additional field studies will be used to update constraints mapping and provide greater detail on the existing environmental values of the four known central gas processing facilities (CGPFs) and proposed temporary workers accommodation facility (TWAfs); refer to SREIS Chapter 3, Project Description and SREIS Attachment 6, Constraints Mapping Update. The findings of additional specialist studies completed for the SREIS are presented in SREIS chapters 5 to 16. Arrow will continue to provide more details of the other facilities as the locations become known. Since the preparation of the EIS, further knowledge of the gas reserves has been gained and preliminary site selection of CGPFs and TWAfs has been undertaken, see SREIS Chapter 3, Project Description, Figure 3.1.
R24066	S002, S003, S009, S018, S020, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076, S085, S088, S095, S096, S097, S098, S114, S139,	Based on concerns regarding the uncertainty of infrastructure locations, the methodology of relying on area of disturbance may not be the most appropriate method for calculating financial assurances and bonds. This method should be reviewed.	–	Financial assurance for the project is required by the EHP (previously DERM) guideline for Financial Assurance for Petroleum Activities (DERM, 2011c) as part of the application for the environmental authority (EA) or an EA amendment (EIS Attachment 5, Environmental Management Plan, Section 1.9). The level of financial assurance will require acceptance and approval by EHP. Arrow will calculate financial assurance required for the project based regulatory requirements. The financial assurance will be provided to EHP and reviewed throughout the life of the project.
R24067	S133	The EIS has not considered vector borne disease risks associated with mosquitoes or the potential for the project to create breeding sites for biting insects. Mosquito control on site needs to be managed in accordance with, the Public Health Act 2005 and Division 2 of the Public Health Regulation	–	Noted. Arrow will comply with all relevant legislation and associated regulations and will develop a declared weed and pest management plan in accordance with the Petroleum Industry – Minimising Pest Spread Advisory Guidelines, Queensland Department of Primary Industries and Fisheries, June 2008 (Biosecurity Queensland, 2008) (Commitment C188).

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Issue No.	Submission No.	Issue	Reference	Responses
R24067	S133	2005.		

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Issue No.	Submission No.	Issue	Reference	Responses
R25001	S014, S044	The suggestion in EIS Attachment 7, that the energy resource is the only resource that will be diminished by the Surat Gas Project, is a conclusion that will not be reached when the region's true environmental values are identified and the project's impacts on them are explored in detail.	EIS Attachment 7, Section 4.3	Noted. EIS Attachment 7, Ecologically Sustainable Development, Section 4.3 notes that the residual impacts of the project are acceptable and that future generations will not be affected by the project activities to any greater extent than the current generation, with the exception of the diminishment of energy resources. This does not imply that other resources in the region will not be diminished, but that this will not affect future generations any more than the current generation. The assessments carried out for the EIS, which included analysis of the environmental values in the project development area and potential impacts on these values well into the future (e.g., to the year 2071 for groundwater resources), support this conclusion.
R25002	S027	The project is not in the interests of sustainable development. Some resources should be left in the ground for future generations.	EIS Attachment 7, Section 4.3	Noted. EIS Attachment 7, Ecologically Sustainable Development, describes how the core principles of sustainable development have been incorporated into the planning and design of the project and into the assessment of impacts and identification of measures to avoid and reduce these impacts. Intergenerational impacts are specifically discussed in Section 4.3.
R25003	S081	Arrow's commitment to ecologically sustainable development is a position statement, not a 'detailed description' as to how the project is compatible with the principles of ecologically sustainable development.	EIS Attachment 7, Section 6, Table 6.1	EIS Attachment 7, Ecologically Sustainable Development, describes how the core principles of sustainable development have been incorporated into the planning and design of the project and into the assessment of impacts and identification of measures to avoid and reduce these impacts. Section 6, Table 6.1 provides a detailed description of the compatibility of the project (from construction through to decommissioning) with the standard criteria as defined under the <i>Environmental Protection Act 1994</i> (Qld). The criteria include the principles of sustainable development as defined in the National Strategy for Ecologically Sustainable Development and other relevant policy instruments.
R25004	S124	The project does not meet principles for environmentally sustainable development and should be refused.	EIS Attachment 7, Section 6, Table 6.1	Noted. EIS Attachment 7, Ecologically Sustainable Development, provides detailed information on how the project has taken into account the principles of ecologically sustainable development. In particular, Section 6, Table 6.1 provides a detailed analysis of the compatibility of the project (from construction through to decommissioning) with the standard criteria as defined under the Environmental Protection Act. The criteria include the principles of sustainable development as defined in the National Strategy for Ecologically Sustainable Development and other relevant policy instruments.
R25005	S134	Arrow should add a section to Attachment 7 on cumulative impacts and refer to current publications and guidelines to undertake a detailed cumulative impacts assessment.	EIS Chapter 28, sections 28.1 and 28.2	Cumulative impacts have been assessed as part of the EIS process and are presented EIS Chapter 28, Cumulative Impacts. Section 28.1 and 28.2 detail the legislative context and methods used to assess the cumulative impacts of the project together with other relevant developments. Publications and guidelines used in the cumulative impact assessment include the <i>Water Act 2000</i> (Qld) and the Queensland Sustainable Resources Community Policy.

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Issue No.	Submission No.	Issue	Reference	Responses
R25006	S150	By examining gas resources and reserves growth without examining the other natural resources associated with that gas is unacceptable. It paints a biased picture that promotes an economic driven science in a silo ignoring the principles and values associated with ecological sustainable development.	EIS Chapter 12, 14 and 15, and Attachment 7, Section 6, Table 6.1	The EIS includes assessment of other environmental values of the project area besides economic issues. These include natural resources such as water and soils resources. The values of these resources were identified and their vulnerability to change through the course of project activities was assessed (see for example EIS Chapter 12, Geology, Landform and Soils; EIS Chapter 14, Groundwater; and EIS Chapter 15, Surface Water). Where the magnitude of impacts on these values was predicted to be moderate or high, actions to avoid or reduce these impacts were identified. Arrow has committed to implement these measures and to review the effectiveness of these measures in managing project impacts throughout the life of the project. This adaptive management approach is fully consistent with the principles of sustainable development. EIS Attachment 7, Ecologically Sustainable Development, Section 6, Table 6.1 details the compatibility of the project with the standard criteria for ecological sustainable development as defined by the Environmental Protection Act. The definition of the standard criteria includes the principles of ecologically sustainable development as defined in the National Strategy for Ecologically Sustainable Development and other relevant policy instruments.
R25007	S027, S134	Up to 49% of the project development area is contained within strategic cropping land. Arrow should acknowledge the loss of food production potential from Queensland as well as from the local region, which could affect the sustainability of communities. Priority should be given to sustainable food and fibre production over coal seam gas.	EIS Chapter 13, Chapter 21, sections 21.3, 21.4 and 21.5 SREIS Chapter 7	EIS Chapter 13, Agriculture, discusses the impacts on agricultural productivity as a result of the project and describes the measures Arrow will take to work with landholders to reduce these impacts as much as possible. Chapter 7 of the SREIS, Agriculture, provides further information about Arrow's work with the Arrow Intensively Farmed Land Committee on initiatives including Area Wide Planning, access protocols, compensation and the demonstration of coal seam gas activities with agriculture at Theten. Arrow has also made 12 commitments regarding coexistence on intensively farmed land (IFL) in the Surat Basin which it has published on its website. Commitments include: 1. No permanent alienation. 2. Minimised operational footprint – less than 2% of total intensively farmed land area. 3. Flexibility on CSG well locations, but all wells located by the edge of farm paddocks. 4. Pad drilling (up to 8 wells from a single pad) used where coal depth and geology allows. (Note: Advancement in pad drilling technology now indicate a reduction in impacts by placing additional wells on multi-well pads. As such there may be increased advantages such as a reduction in disturbed area by placing up to 12 wells on a single pad.) 5. Spacing between wells maximised (between 800 m – 1.5 km). 6. Pitless drilling only. 7. No major infrastructure facilities on intensively farmed land (dams, compression facilities, gas gathering stations, water treatment). 8. Treated coal seam gas water used to substitute existing user's allocations

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Issue No.	Submission No.	Issue	Reference	Responses
R25007	S027, S134			<p>on IFL. 9. No brine/salt treatment or disposal on intensively farmed land. 10. Flexibility on power supply option – above or below ground. 11. Fair compensation – including elements of ‘added value’. 12. Continued proactive engagements with community and transparency of coexistence field activities. These commitments will reduce impacts on IFL. While it is currently not possible to fully quantify the impact on agricultural production (as the final location of all facilities is not known), the economic impact assessment carried out for the EIS on the impacts of reduced agricultural production (EIS Chapter 21, Economics, sections 21.3 to 21.5) concludes that the relatively low percentage of land likely to be disturbed due to the development of the resources sector in the Darling Downs is unlikely to result in any material impact on Australian or global food security. The assessment refers to the contribution of agriculture to the gross regional, state and national product.</p>
R25008	S150	Should EHP (formerly DERM) not require Arrow to reconsider the EIS then EHP’s decision should manage changes in land use and environmental management and practices by requiring stringent conditions for Arrow to adopt sustainable gas production practices.	–	Noted.
R25009	S012, S013, S016, S045, S047, S084, S100, S101, S102, S103, S107, S151, S164	The precautionary principle should be applied. The present proposal places an unacceptable risk to the community, its infrastructure and the environment including flora and fauna, and accordingly should be rejected.	EIS Attachment 7, Section 4.2	<p>Noted. The precautionary principle is integral to the methods used to assess environmental and social impacts in the EIS. These include significance based assessments that assume all identified impacts will occur. This worst case scenario is then examined to determine what measures are required to avoid or reduce the magnitude of impacts. Key project risks to the environment have been identified as well as compliance of project activities (and their emissions) with statutory limits and guidelines. These assessments were informed by extensive studies carried out by technical specialists to inform project planning and design. In adopting these methods and approaches, the EIS has effectively integrated the key provisions of the precautionary principle including putting in place mitigation measures to effectively avoid and reduce serious environmental impacts as well as providing for monitoring of impacts and review of measures as more information becomes available. EIS Attachment 7, Ecologically Sustainable Development, Section 4.2 provides further details of how the precautionary principle has been taken into account through the EIS process.</p>
R25010	S055	EIS does not alleviate concerns relating to environmental, social and economic impacts of poorly regulated coal seam gas expansion in the	EIS Chapter 2 and Attachment 4 SREIS	Noted. The project will be subject to numerous approvals as outlined in EIS Chapter 2, Project Approvals and Attachment 4, Project Relevant Legislation, and SREIS Chapter 2, Project Approvals. Arrow must comply with the

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Issue No.	Submission No.	Issue	Reference	Responses
R25010	S055	Darling Downs.	Chapter 2	conditions of these approvals. The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state, national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined.
R25011	S075, S077, S089	Insufficient research has been undertaken into the long-term effects of coal seam gas mining and its environmental, health and social effects to warrant such a massive scale operation in Queensland for the short term gain of overseas investors and overseas markets.	–	Noted. The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined.
R25012	S077	Concerned about the wider implications as well as the effect of coal seam gas will have on the Australian environment and economy.	–	Noted. The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state, national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined.
R25013	S075, S089	There needs to be a moratorium on coal seam gas until research and planning can properly take into account the impacts (not only the immediate effects but the impact on Australia's food production, water supply and biodiversity for centuries to come).	–	Noted. The EIS and SREIS provide an assessment of the impacts of the project based on extensive environmental and socio-economic technical specialist studies. The studies include assessment of project impacts at regional, state, national and sometimes global level. The outcomes of these studies have informed the design of the project and the measures Arrow has committed to in order to avoid, reduce and manage the identified impacts. In many cases, further studies, monitoring, and review of mitigation measures will take place, including when final sites for the facilities are determined. Currently, Arrow has a demonstration project underway at its Theten property, the purpose of which is to demonstrate the sustainable use of treated coal seam gas water for agricultural purposes.
R25014	S111	The two most important aspects of a food-producing area's environmental health, soil and water, may be under threat for a number of generations due to the project.	EIS Chapters 12, 14 and 15 SREIS Chapters 9 and Chapter 10	Noted. The EIS process included an assessment of the environmental values associated with the project area, including the values of soil and water resources and the potential impacts on those values from project activities (see EIS Chapter 12, Geology, Landform and Soils; Chapter 14,

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Issue No.	Submission No.	Issue	Reference	Responses
R25014	S111			Groundwater; and Chapter 15, Surface Water). Arrow has made significant commitments to avoid, reduce and manage identified impacts over the life of the project, including for the ongoing monitoring of groundwater and surface water quality. Further technical studies have also been completed for the SREIS on groundwater (Chapter 9) and surface water (Chapter 10) resources, and proposed mitigation and monitoring measures have been reviewed and revised where necessary to take into account new findings. Measures will be implemented in a site specific manner to reduce any long term environmental and social impacts of the project.
R25015	S158	Acknowledgement must be made by Arrow of the fundamental nature of Australia as a dry continent with ancient and infertile soils, resulting in minimal viable agricultural land and limited water. This and the reality of drought effects from climate change should highlight that this gargantuan project is not feasible.	EIS Chapter 11, sections 11.3, 11.4 and 11.5	Noted. Arrow has conducted numerous feasibility studies of the project including taking into account the climate and other factors in the project development area. Climate change costs have been included in business cost projections. Studies carried out for the EIS, specifically relating to potential impacts of future climate change are summarised in Chapter 11, Climatic Adaptation. The chapter describes the existing climate of the project area and the potential future impacts of climate change (sections 11.3 and 11.4). This includes discussion of the changes relating to reduced rainfall, higher rates of evaporation and subsequently more prevalent drought conditions, and the specific implications for the Surat Gas Project of these changes (Section 11.4.1). Arrow is aware of the need to plan for climate change in this area of Australia and has taken a proactive approach that considers the effects of climate change in the planning and design, construction, operation and decommissioning of the project. Arrow's intention to substitute water in lieu of landholder allocations will reduce the current demand on groundwater resources, where substitution takes place. Arrow will also seek ways to lower water consumption through water-efficient technologies and practices and/or by installation of water-efficient devices in recognition of the importance of this valuable resource and its potential to be affected by changes in the current climate (see also EIS Chapter 14, Groundwater and Chapter 15, Surface Water).
R25016	S161	The only reasonable way of maintaining stability in the region is to extend the project's duration at least five fold to allow extensive monitoring to be done and a higher level of understanding to be reached.	SREIS Chapter 3 and Attachment 4	Noted. The revised project timeframe and development schedule is detailed in SREIS, Chapter 3, Project Description. Further assessment of the environmental and social values of the project development area and potential impacts has been undertaken for the SREIS. In some cases, this has involved additional technical studies, including field surveys. Study results have informed the review of potential impacts and the measures Arrow will implement to avoid or reduce these impacts. In some cases, the mitigation measures and commitments Arrow has made have been revised or expanded (see SREIS Attachment 4, Commitments Update). Arrow will implement site specific management and mitigation measure to reduce long term environmental and social impacts. For example, Arrow will

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Table 19.25 Ecologically Sustainable Development

Issue No.	Submission No.	Issue	Reference	Responses
R25016	S161			implement an adaptive approach to managing groundwater, designed to identify adverse trends early and enable intervention to address concerns.

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26001	S119	Theoretically, the use of brackish and saline waters resulting from coal seam gas production for the production of aquatic food for human consumption through aquaculture is possible, but to date has not been viable in this region. Provide information that supports the viability of brackish and saline waters for use in aquaculture.	–	Arrow is not currently proposing to use coal seam gas water for aquaculture. If in the future, Arrow does supply water for aquaculture, the water supplied will meet the quality specified in the relevant approval and the aquaculture activity would be regulated through approvals for that industry.
R26002	S130	Consideration should be given to the use of coal seam gas water to augment town water supplies.	EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.7 Attachment 5	As discussed in EIS Chapter 5, Project Description, Section 5.6.4, Arrow has undertaken a preliminary analysis for augmentation of the Dalby town water supply. The SREIS Chapter 3, Project Description identifies the revised management options for coal seam gas water for the project. Management options of coal seam gas water during operations, include: • Distribution to existing or new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Distribution to existing or new users does not discount augmentation of town water supplies. Further details of the possible management options are provided in SREIS Chapter 3, Project Description, Section 3.7 and in Attachment 5, Coal Seam Gas Water and Salt Management Strategy. Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174).
R26003	S157	There is a concern that each well drilled may be done so under different corporate names. If there was a significant event, there is a risk that these companies could fail to make good, and instead elect to fall into insolvency. This is a risk that could be managed by requiring the ultimate holding company to indemnify all stakeholders against risk.	–	The administering authority requires financial assurance to be lodged as a condition of an environmental authority (chapter 5A activities) under the Environmental Protection Act 1994. The environmental authority will be held by one corporate entity that is responsible for compliance with the conditions of that environmental authority (EA). Financial assurance is a security held to meet any costs or expenses (or likely costs or expenses) incurred by the administering authority in taking action to prevent or minimise environmental harm or rehabilitate or restore the environment in relation to the activity (e.g., petroleum activities) for which financial assurance has been given.
R26004	S014, S044, S079, S134	Arrow to detail any water quality criteria applied to the water to be used for dust suppression. Arrow to clarify where the water used for dust suppression is sourced, and to demonstrate that it will be of suitable quality not to cause negative impacts on surrounding environment (land and water quality). If the project is approved, we request the administering authority impose conditions that limit	EIS Chapter 15, Section 15.6.4	As identified in EIS Chapter 15, Section 15.6.4, Arrow has made a commitment that, where used for dust suppression on roads or for construction and operations activities coal seam gas water quality will be, in accordance with relevant permits and/or consents (Commitment C176).

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26004	S014, S044, S079, S134	the sodium adsorption ratio of coal seam water used for dust suppression to a level no higher than irrigation water accessed from the Condamine Alluvium in order to prevent permanent damage to vertosol soils.		
R26005	S133	The EIS states that the water for gas field worker camps, including potable water, may be supplied from treated associated water however the potential short-term, long-term, direct and indirect human health impacts have not been assessed. It is recommended that the proponent assesses the potential human health impacts of the beneficial uses of associated water proposed by the project. The scope of assessment should include the potential for direct and indirect human health exposure to contaminants in treated and untreated water. This should include the potential impacts from other contaminants (e.g., heavy metals such as lead, cadmium and any organic material) in the associated water.	SREIS Chapter 3, Section 3.4.6	The potable water used at camps etc., for human consumption will be sourced from existing town water supplies, groundwater bores or from reticulated supply; see SREIS Chapter 3, Project Description, Section 3.4.6.
R26006	S134, S146, S150, S157, S158	<p>The statement, 'depending on the water quality requirements of the end user' leaves the ultimate safe disposal of the water, especially the untreated water, in question. How can the community be assured that the end user will utilise the water responsibly?</p> <p>Concerned that Coal Seam Gas companies are keen to pursue options which shift legal responsibility for the management of coal seam gas water to third parties, most likely farmers seeking water for irrigation and agricultural purposes and who are eager to mitigate the effects of drought on their businesses.</p> <p>Arrow's proposal to discharge environmental obligations to beneficial users of coal seam gas water should be more transparent. Arrow Energy should describe in detail how they intend to supply a continuous and quality product from treated coal seam water to third party users.</p> <p>Arrow should disclose the relevant companies and the financial capacity of those who will be responsible for the liability that arises.</p>	–	<p>Arrow will deliver agreed volumes of coal seam gas water at an agreed quality under a water supply agreement with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow to ensure that the water complies with the relevant approval.</p> <p>The water supplied by Arrow will be fit for purpose and meet the prescribed water quality for supply. The use of this water for irrigation, industrial or other uses will be conducted under the regulatory framework that applies to that industry. This water will therefore be applied in accordance with current land use practices (e.g., irrigation or stock watering) undertaken by the third party. It is neither reasonable nor practical for Arrow to monitor or seek to gain assurance around the activities of third party recipients of the water beyond the terms of the parties' agreement. Arrow's focus will be to meet relevant water quality guidelines at monitoring points within Arrow's control.</p>

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26006	S134, S146, S150, S157, S158	What justification is there for Arrow's presumed relinquishing of responsibility for the ultimate use of the water once it has been passed on to the end user? Arrow to clarify responsibility for the quality of coal seam water and its impacts (including cumulative) on receiving waters, environments and third parties.		
R26007	S075, S117, S145, S161	Irrigators will be using treated coal seam water, not bore water, and the effects of treated coal seam water on the productivity of soil and the health of catchments is unknown, and the EIS does not adequately describe or assess impacts of using treated coal seam water for irrigation. In regards to the currently considered disposal methods by Arrow, landholders are most concerned about the disposal of coal seam gas water and the impact it may have on the use of their land. At a community meeting in Millmerran, the community was told that water released is being purified and made available for irrigation but they were not given any idea of how this pure water affects the soil it irrigates.	–	Arrow will deliver agreed volumes of coal seam gas water at an agreed quality under water supply agreements with third parties. Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow to ensure that the water complies with the relevant approval. This may involve, for example, treatment through reverse osmosis and then adding nutrients to demineralised water to ensure that quality characteristics such as the sodium adsorption ration comply with the approval. This water, through its subsequent use, will then be applied in accordance with current land use practices (e.g., irrigation or stock watering) undertaken by the third party.
R26008	S150	The limitation of water resources must be recognised within an environmental best practice planning framework. Coal seam gas water is not an opportunity without inherent risks and impacts.	–	Noted.
R26009	S158	Admission is made that 'there is limited demand' for re-utilisation options for Arrow's waste water, yet Arrow's case for project approval is allowed in this EIS to rest heavily on the government's ability to re-define its waste water as a 'resource'.	–	The Queensland Government's Coal Seam Gas Water Management Policy (2012) states that beneficial use of coal seam gas water should be maximised and that other management options should only be considered when beneficial use is not feasible. There is a high demand for good quality water such as that produced by Arrow in the Surat Gas Project Area. Water can be supplied to third parties for use providing the appropriate government approvals are in place to authorise the supply of water for a particular purpose. EHP provide approval for supply of water and in doing so include conditions that prescribe the water quality.
R26010	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055,	The numerous issues and gaps in understanding, associated with substitution and injection must be resolved prior to their adoption. To date, appropriate solutions for the reuse of coal seam gas water are not scientifically or technically	EIS Attachment 5	The Queensland Government's Coal Seam Gas Water Management Policy promotes substitution or 'virtual injection' as a recognised water management option. There is currently no regulatory framework to facilitate substitution and therefore Arrow has developed a commercial framework to support the supply of coal seam gas water to existing groundwater users who hold allocations

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26010	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076, S085, S087, S088, S095, S096, S097, S114, S116, S139, S140, S150, S152, S154, S167	proven, and indeed much of that water may end up creating contaminated sites.		<p>from the Condamine Alluvium. Under the proposed framework, end users would receive and utilise water supplied by Arrow in lieu of utilising their existing groundwater allocations from the Condamine Alluvium. It is expected that third-party users will accept responsibility (legally and practically) for the impacts of their use of the water. It is also recognised that in many cases, Arrow will be supplying water which is of better quality than that already used by the third party it will supply. Arrow will however, take responsibility for ensuring that water provided to third party users meets relevant water quality guidelines prior to use (with quality to be confirmed at representative monitoring points within Arrow's control).</p> <p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection pilot trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the results from the pilot trials will be used to generate an amendment to the environmental authority (EA).</p> <p>Disposal to watercourses will be considered in the event that beneficial uses of coal seam gas water are temporarily unavailable, beneficial use approvals are not granted, significant or prolonged wet weather events occur or the demand for water decreases and alternative disposal options are required to maintain dam integrity and safety.</p> <p>Disposal of coal seam gas water to the sea via an ocean outfall pipeline is recognised as a feasible option; however it is not the preferred option. In the event that preferred coal seam gas water management options do not eventuate, the feasibility of an ocean outfall, as an emergency or alternative disposal option for coal seam gas water, will be evaluated. This evaluation will be conducted at the time of detailed design of the field and facilities.</p> <p>Disposal to watercourses and/or the ocean is a management option that addresses the variability of supply to existing and new users due to seasonal variations, farm operation and production constraints, cyclical commodity markets and significant weather events.</p> <p>The feasibility of these potential management strategies are still under investigation. Statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany EA or EA amendment application(s).</p>
R26011	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055, S059, S064, S065,	Coal seam gas water should be treated and used beneficially in areas as close to the extraction points as possible. Disposal of coal seam water to watercourses or the ocean should not be considered viable options.	SREIS Chapter 3, Section 3.7.4	<p>As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is possible that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal) including:</p> <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26011	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076, S085, S087, S088, S095, S096, S097, S098, S114, S116, S139, S140, S149, S152, S154, S167			<p>watercourses forming part of manage schemes.</p> <ul style="list-style-type: none"> • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. <p>Disposal to watercourses and the ocean are not preferred options but variability in rainfall between seasons and from year to year and demand for coal seam gas water over time will determine the volumes of coal seam gas water that can be managed through application of the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two proposed water treatment facility sites will dictate how the management options may be utilised at each site. It should be noted that disposal to watercourses and the ocean are only preferable when there is low alternative demand for coal seam water.</p>
R26012	S081	<p>Provide further details about a network of distribution pipelines to transport treated water to end users, i.e., to what depth would the pipes be buried? What is the diameter of the pipes in question? What is the width of the right of way required for these pipes? How frequently will these pipes be monitored? How long will the project take to construct? Is the water in the pipes under pressure? Will risers, lifts etc. be required? Will the pipeline routes follow right of ways used for gathering lines? Describe the environmental values, their sensitivity, the magnitude and extent of impacts, mitigation strategies?</p>	-	<p>Further details on Arrow's distribution pipelines, including specific construction details, inspection and monitoring and management options are still under investigation. Statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s).</p> <p>Arrow must comply with the conditions of the EA for the project. These conditions will enforce protection of environmental values, and incorporate communication procedures and feedback mechanisms for inspection, monitoring and reporting.</p> <p>Water gathering lines and the substitution network present similar potential impacts, which can be addressed through similar management measures. It should however be recognised that the installation of water piping for irrigation and beneficial use is an activity that is 'normal' within an agricultural environment and that controls applied should be similar to those applied to water pipelines installed for agricultural purposes.</p>
R26013	S022	<p>Requesting information on how demineralised (treated) water returned to farmers will be redistributed and at what cost to the farmers.</p>	<p>SREIS Attachment 5</p>	<p>The Queensland Government's Coal Seam Gas Water Management Policy (2012) promotes substitution or 'virtual injection' as a recognised management option. There is currently no regulatory framework to facilitate substitution and therefore Arrow has developed a commercial framework to support the supply of coal seam gas water to existing groundwater users who hold allocations from the Condamine Alluvium. Under the proposed framework, end users would receive and utilise water supplied by Arrow in lieu of utilising their groundwater allocations. It is expected that the third-party users will accept responsibility (legally and practically) for the impacts of their use of the water. Arrow will however take responsibility for ensuring that water provided to third party users meets relevant water quality guidelines prior to use (with quality to be confirmed at monitoring points within Arrow's control). Additional details of this commercial framework are contained in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy.</p>

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26014	S106, S134	Arrow to identify how water will be managed in wet years when land owners don't require Arrow's treated coal seam water. No reference is made to the production of water being restricted to the physical capacity of end user take up plus injection, so this "physical" aspect of the Terms of Reference (TOR) Section 3.4 has not been satisfied.	SREIS Chapter 3, Section 3.7.4	As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is possible that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal) including: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year, will determine the volumes of coal seam gas water that can be managed under each identified option. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two proposed water treatment facility sites will dictate the management options that can be utilised at each site. Disposal to watercourses and/or the ocean are not preferred options, however exercising either of these options would ensure that coal seam gas water produced during times of low demand could be managed.
R26015	S157	Arrow should disclose its ability to provide monetary compensation in the event that replacement water or alternative sources are unavailable.	SREIS Attachment 5, Section 3.2.4	As described in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, Section 3.2.4, the availability of make good measures will be evaluated considering: <ul style="list-style-type: none"> • The existing infrastructure used to pump water from the bore. • The existing construction of the bore. • The predicted decline in groundwater level in the bore. • The current and authorised use of the bore. • The geology in the vicinity of the bore. • Other existing or potential sources of water in the vicinity of the bore. The make good measures to be implemented will be negotiated between Arrow and the bore owner depending on the aforementioned factors and may include: <ul style="list-style-type: none"> • Modifying the pumping infrastructure of the bore. • Modifying or deepening the bore. • Installing a new bore into the same aquifer. • Installing a new bore into another aquifer. • Supplying an alternative source of water. • Monetary compensation.
R26016	S158	Reliance on 'New Uses' of toxic water is a very large uncertainty, and while appropriately aspirational, should be discounted as a factor in waste management for this project.	-	Filtration and reverse osmosis are proposed for the treatment of coal seam gas water produced through Arrow's operations. This technology is broadly recognised for the removal of a wide range of ions and toxins. Water treated through reverse osmosis may be described as demineralised upon completion of the reverse osmosis process. Balancing of the water after the treatment ensures it is nontoxic and chemically and physically suitable for multiple uses, such as water sourced directly from other water resources. Over the course of the project, it is anticipated that new uses of treated and

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26016	S158			<p>untreated coal seam gas water will emerge and be investigated including agricultural, industrial, and domestic and urban uses. While the volume of coal seam water to be distributed to new uses over the life of the project cannot be determined at this time, it will form an option for Arrow to pursue in conjunction with distribution to known existing uses.</p> <p>In the event that a new use is identified, Arrow will enter in to a water supply agreement with the third party. Arrow will ensure that coal seam gas water provided under individual agreements meets specified water quality requirements of the relevant approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and testing will be performed by Arrow to ensure that the water complies with relevant approval.</p>
R26017	S025, S026, S036, S069, S081, S083, S145, S146, S162	<p>There is no indication given as to whether the trials on Theten (farm used for beneficial-use trials) have commenced or whether Theten is considered good quality agricultural land. When will Theten trials commence if they have not already? The trial results (of beneficial-uses) must be made available regardless of outcomes to ensure transparency. Concerned that the 'showcase' farming operation developed on Theten over the next three to five years using treated coal seam water as a substitute for water allocation will not provide an indication of long-term water or land resource impacts in the region from the Surat Gas Project.</p>	-	<p>The Theten property is located on land classified as good quality agricultural land. Arrow has developed a demonstration project on its Theten property. The purpose of the project is to demonstrate the beneficial use of coal seam gas water and the effective integration of coal seam gas infrastructure with farming operations. Arrow commenced irrigation at Theten in December 2012. Arrow is collecting meteorological data, and data on soil indicators to inform future development and refinement of water management procedures. Arrow will provide updates on work at Theten on its website and has invited numerous research organisations to review and participate in understanding the responsible use of coal seam gas water and development of coal seam gas infrastructure.</p>
R26018	S024, S025, S143, S145	<p>There is no confidence in proposed beneficial uses (such as irrigation or groundwater substitution/re-injection) as no concrete results have been provided from trials at this time. Further trials and research are needed before these proposed beneficial uses can be considered an appropriate management strategy for coal seam gas water.</p>	<p>EIS Chapter 14, Section 14.6.3 Attachment 5 SREIS Chapter 8</p>	<p>Arrow has developed a demonstration project on its Theten property. The purpose of the project is to demonstrate the beneficial use of coal seam gas water and the effective integration of coal seam gas infrastructure with farming operations. Arrow commenced irrigation at Theten in December 2012. Arrow is collecting meteorological data, and data on soil indicators to inform future development and refinement of water management procedures. Arrow will provide updates on work at Theten on its website and has invited numerous research organisations to review and participate in understanding the responsible use of coal seam gas water and development of coal seam gas infrastructure. As described in EIS Chapter 14, Groundwater, Section 14.6.3, Arrow has committed to verify the preferred water management strategy by modelling the effectiveness of substitution ('virtual injection') and injection (if conducted) in offsetting depressurisation impacts in the Condamine Alluvium (Commitment C134). SREIS Chapter 8, Groundwater, outlines the further</p>

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26018	S024, S025, S143, S145			<p>modelling conducted to support the SREIS, and to provide greater detail on the effectiveness of substitution ('virtual injection').</p> <p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority amendment applications to conduct deep aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection pilot trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the required details will be used to prepare an application for an environmental authority (EA) or EA amendment.</p>
R26019	S015, S026, S036, S054, S069, S081, S083, S105, S123, S158, S162	<p>What is the quality of the 'coal seam gas water' referred to in this section since this EIS has acknowledged the extreme variability of this water quality? Requests that chemical composition of water is considered in re-use of water for livestock watering in addition to salinity monitoring. Excessive chemicals can result in birth defects or other husbandry issues.</p> <p>If toxic, what responsibility does Arrow envisage taking for treatment before passing on to the end user? There are concerns that infrastructure is not in place to treat this water in order for it to be fit for reuse.</p> <p>Will the treated coal seam gas water for use by third parties, be able to be used safely by stock? Does this mean that treated water can be safely used for domestic use including for drinking purposes and cooking?</p> <p>The water quality data of treated coal seam water has been requested on several occasions and has not been received. Therefore, water users have no confidence that the water will be of a suitable quality for their purposes.</p>	-	<p>Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). Beneficial uses of coal seam gas water include agricultural uses (irrigation and livestock watering), industrial uses (dust suppression, drilling and construction water supply, and power station cooling), and domestic or urban uses (augmentation of town water supplies). Arrow will ensure that coal seam gas water provided under individual agreements meets relevant water quality guidelines. Water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow (at monitoring points within Arrow's control) to ensure that the water complies with the relevant water quality guidelines.</p> <p>Infrastructure to treat and store coal seam gas water will be constructed as part of the overall project construction.</p> <p>Water quality data has been made available through a number of processes including the environmental authority application process, EIS, coal seam gas water management plans and it has also been provided directly to individuals who have made specific requests.</p>
R26020	S146	<p>Given that EHP (formerly DERM) has listed the use of untreated coal seam gas water in its Coal Seam Gas Water Management Policy, the administering authority should insist that the proponent provide evidence of how such use of the coal seam water will not have a detrimental impact on the environment, before approval of such use.</p>	-	Noted.

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26021	S036, S143	Impact assessment should be undertaken on all potential options (water or salt/brine disposal).	–	<p>The nature of the development is such that at the time of writing the EIS, Arrow was yet to determine all the options for coal seam gas water management and the location of infrastructure. The EIS presented a high level assessment of the coal seam gas water impacts within the project development area.</p> <p>A coal seam gas water and brine management plan will be prepared as part of the environmental authority (EA) or EA amendment application process. The management options for coal seam gas water and brine will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves.</p>
R26022	S002, S003, S007, S009, S012, S013, S014, S016, S018, S019, S020, S025, S027, S030, S032, S035, S036, S037, S039, S041, S044, S045, S047, S053, S054, S055, S059, S062, S064, S065, S066, S069, S070, S071, S076, S081, S084, S085, S086, S087, S088, S090, S095, S096, S097, S098, S100, S101, S102, S103, S104, S107, S114, S116, S123, S124, S130, S134, S137, S139, S140, S141, S143, S144, S145, S146, S149, S150, S151, S152, S154, S156, S158, S164, S167	<p>Concern that the EIS does not provide a final management plan for the disposal of coal seam gas water and brine. The details provided are very brief or unknown. There is too much uncertainty regarding water production and disposal and the level of information provided within the EIS is inadequate.</p> <p>Specifically:</p> <ul style="list-style-type: none"> • Trials for injections have not been undertaken and therefore Arrow has no basis to conclude that injection would be a satisfactory water management strategy. • Disposal of coal seam water to watercourses should not be considered given that impacts to watercourses and water quality have not been assessed. • Impacts from the ocean outfall option have not been evaluated. • Uncertainty of whether coal seam gas water will have a beneficial use or if it will be a waste product. <p>The project should not be approved when there is much uncertainty present (e.g., assumptions, options, unidentified target formations, ongoing/future research or investigations, unknown factors, unproven technologies) and no confirmed and approved method of disposing of coal seam gas water, brine/salt.</p> <p>Arrow needs to do more research on and have answers to the issues relating to coal seam gas water management options, beneficial uses of coal seam gas water and brine management options. The proposed water treatment and storage facilities in context of the amount of coal seam gas water production and the likely impacts on both human</p>	<p>EIS Attachment 5 SREIS Chapter 3, sections 3.7.4 and 3.7.5 Chapter 8</p>	<p>The nature of the development is such that at the time of writing the EIS, Arrow was yet to determine all the options for coal seam gas water management, and the location of infrastructure. The EIS presented a high level assessment of the coal seam gas water impacts within the project development area.</p> <p>As described in SREIS Chapter 3, Project Description, Section 3.7.4, it is expected that the full range of coal seam gas water management options will need to be utilised. These include:</p> <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. <p>Variability in the demand for coal seam gas water over time, and the variability in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two proposed water treatment facility sites will dictate the management options that can be utilised at each site.</p> <p>Disposal to watercourses will be considered in the event that:</p> <ul style="list-style-type: none"> • Beneficial uses of coal seam gas water are temporarily unavailable. • Beneficial use approvals are not granted. • Significant or prolonged wet weather events occur. • The demand for water decreases and alternative disposal options are required to maintain dam integrity and safety. <p>Disposal of coal seam gas water to the sea via an ocean outfall pipeline is recognised as a feasible option; however it is not the preferred option. In the event that preferred coal seam gas water management options do not eventuate, the feasibility of an ocean outfall, as an emergency or alternative disposal option for coal seam gas water, will be evaluated. This evaluation will be conducted at the time of detailed design of the field and facilities.</p> <p>Arrow has developed a demonstration project on its Theten property. The purpose of the project is to demonstrate the beneficial use of coal seam gas water and the effective integration of coal seam gas infrastructure with</p>

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26022	S002, S003, S007, S009, S012, S013, S014, S016, S018, S019, S020, S025, S027, S030, S032, S035, S036, S037, S039, S041, S044, S045, S047, S053, S054, S055, S059, S062, S064, S065, S066, S069, S070, S071, S076, S081, S084, S085, S086, S087, S088, S090, S095, S096, S097, S098, S100, S101, S102, S103, S104, S107, S114, S116, S123, S124, S130, S134, S137, S139, S140, S141, S143, S144, S145, S146, S149, S150, S151, S152, S154, S156, S158, S164, S167	communities and natural ecosystems do not offer any real or concrete solution to the region.		<p>farming operations.</p> <p>Arrow is collecting meteorological data, and data on soil indicators to inform future development and refinement of water management procedures.</p> <p>Arrow's website contains updates on the demonstration project at Theten.</p> <p>Numerous research organisations have been invited to review and participate in understanding the responsible use of coal seam gas water and development of coal seam gas infrastructure.</p> <p>Arrow has committed to verify the preferred water management strategy by modelling the effectiveness of substitution ('virtual injection') and injection (if conducted) in offsetting depressurisation impacts in the Condamine Alluvium (Commitment C134).</p> <p>SREIS Chapter 8, Groundwater outlines the additional groundwater modelling conducted to support the SREIS, and to provide greater detail on the effectiveness of substitution.</p> <p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection pilot trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the results from the pilot trials will be used to prepare the application for an environmental authority (EA) or EA amendment.</p> <p>SREIS Chapter 3, Project Description, Section 3.7.5 re-iterates that as the project progresses, brine management options are still under investigation, and will be assessed under a separate approvals process if pursued (i.e., a selective salt recovery plant, injection or ocean outfall pipeline).</p> <p>The section describes Arrow's investigation of a collaborative approach (with the other coal seam gas proponents in the region) for the development of a selective salt recovery plant for the management of brine, as well as the further research that has been undertaken to refine the strategy for Arrow to progress this option on its own, which would be assessed under a separate approvals process.</p> <p>The feasibility of these potential management strategies will be investigated and the chosen management options detailed in the Coal Seam Gas Water Management Plan for the EA or EA amendment application process. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies. The management options for coal seam gas water and/or brine/salt will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves.</p>
R26023	S015	Queensland's coal seam gas water treatment policies sound good (with respect to water that is	SREIS Attachment 5	The Queensland Government's Coal Seam Gas Water Management Policy (2012), was released following the submission of the EIS. SREIS Attachment

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26023	S015	saline, highly turbid), but remember, already we have had 'mishaps' with water management and treatment and people are not happy.		5, Coal Seam Gas Water and Salt Management Strategy has subsequently been revised and aligns with the priorities described by EHP in the policy. In the case of coal seam gas water storage, Arrow will develop the construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and determine the hazard category of the dam in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Arrow will construct the dams under the supervision of a suitably qualified and experienced person in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141). Arrow will have a suitably qualified person routinely monitor the integrity and available storage of dams (Commitment C532).
R26024	S078	Salt extraction from heavy clay soils is an unsolvable problem.	–	Arrow has committed to excavate any saline material during rehabilitation of coal seam water dams or brine dams and select an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill) (Commitment C073).
R26025	S082, S150	This EIS must consider whether the region's communities are prepared to have an accumulation of contaminated sites or 'stockpiles' of by-product to be dealt with once a future solution is found, or washed away in floods, or untreated coal seam gas water released for emergency disposal. Concerned with the 'mountains of salt' and lack of solution.	–	Arrow is not proposing to permanently store brine on site. Arrow intends to only store brine on Arrow owned (or leased) properties and the by-products will be moved to third party locations licensed to accept the waste.
R26026	S086	Coal seam gas water should not be treated as a by-product, and the extraction of this water should be treated the same way as other groundwater users.	–	Noted.
R26027	S012, S013, S016, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S164	Under the Environmental Protection (Waste Management) Regulation under the EP Act, a coal seam gas water management plan is required (including a brine management plan). The EIS refers to a coal seam gas water management plan, but has not released it as a public document.	–	A coal seam gas water and brine management plan will be prepared as part of the environmental authority (EA) or EA amendment application process. The management options for coal seam gas water and/or brine/salt will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use are determined.
R26028	S133	The EIS has not identified that the provisions of the Water Supply (Safety and Reliability) Act 2008 (Qld) will apply to any proposed release to	EIS Attachment 9, Section 2.7.3.3	EIS Attachment 9, Coal Seam Gas Water Management Strategy, Section 2.7.3.3 states that on 25 November 2010, the Water Supply (Safety and Reliability) Act 2008 (Qld) was amended to include the requirement that coal

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Issue No.	Submission No.	Issue	Reference	Responses
R26028	S133	groundwater (via aquifer recharge) and/or surface waters if the release is deemed to have a 'material impact' on an urban community's drinking water supply. Arrow has not identified the need for a Coal Seam Gas Recycled Water Management Plan (RWMP) if the release of waters is determined (by the Office of Water Supply Regulator) to have a 'material impact' on a drinking water source. Recommends that the EIS be amended to account for the above points.		seam gas producers must develop an approved recycled water management plan if they propose to release water into a watercourse, aquifer or town drinking water supply and the release will cause a material impact. Recycled water management plans are designed to integrate into council drinking water management plans and deal principally with monitoring and communication. Arrow will comply with the Water Supply (Safety and Reliability) Act 2008 (Qld).
R26029	S100, S133	The EIS has not identified that an Exclusion Decision will be required when there is a release to groundwater and/or surface water where the release is NOT deemed to have a material impact on a community's drinking water whether the water is provided commercially or not. Arrow must ensure that an Exclusion Decision is obtained and included in the EIS whether or not the water is provided commercially.	–	Arrow is aware of the requirements of the Water Supply (Safety and Reliability) Act 2008 (Qld). Following submission of the EIS, Arrow has subsequently submitted an Exclusion Decision Application, in accordance with the Water Supply (Safety and Reliability) Act 2008, for the Daandine Scheme; and has been granted an exclusion decision for watercourse discharge. This decision was made on the basis that the quality of the treated coal seam gas water contributes sufficiently small amounts to background water quality, such that it does not have a material impact on the relevant drinking water supply. A detailed risk management system (i.e., a recycled water management plan) was not required for this watercourse discharge. Arrow will comply with the Water Supply (Safety and Reliability) Act 2008 (Qld).
R26030	S134	Arrow to place greater emphasis on Queensland's Coal Seam Gas Water Management Policy (June 2010) when addressing design of water treatment and storage facilities regarding the statement 'The design of water treatment and storage facilities will consider ...the policy'.	SREIS Attachment 5	The Queensland Government released its Coal Seam Gas Water Management Policy in 2012, after Arrow's submission of the EIS. SREIS, Attachment 5, Coal Seam Gas Water and Salt Management Strategy was subsequently revised to align with the priorities described in the EHP policy.
R26031	S046	The objective to treat coal seam gas water, supply for use by third parties and safely dispose of brine is not dealt with adequately.	SREIS Chapter 3, Figure 3.8 Attachment 5	The revised SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, was informed by the Queensland Government's Coal Seam Gas Water Management Policy (2012). The strategy is represented in the revised conceptual coal seam gas water overview included in SREIS Chapter 3, Project Description, Figure 3.8, which identifies the preferred and potential management options for coal seam gas water and brine/salt, including treatment, storage, beneficial use and disposal.
R26032	S105	Concerns over better utilisation of 770 giga-litres of water. To waste it does not take recent drought conditions and the need for water to produce food into consideration.	–	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). Beneficial uses of coal seam gas water include agricultural uses (irrigation and livestock watering), industrial uses (dust suppression, drilling and construction water supply, and power station cooling), and domestic or urban uses (augmentation of town water supplies).

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Issue No.	Submission No.	Issue	Reference	Responses
R26032	S105			The management options for coal seam gas water will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves.
R26033	S001	The Coal Seam Gas Water Management Strategy is unclear whether we are dealing with coal seam gas water or brine.	SREIS Chapter 3, Figure 3.8 Attachment 5	SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy has been developed to address both coal seam gas water and brine management in line with the Queensland Government's Coal Seam Gas Water Management Policy (2012). SREIS Chapter 3, Project Description provides conceptual water and brine management overviews (see Figure 3.8).
R26034	S146	Approval should not be given until a clear plan for coal seam gas water disposal has been determined, which prioritises both the use of water in the area the gas is extracted, as well as the need to mitigate long-term impacts.	–	The nature of the development is such that at the time of the EIS, Arrow was yet to determine the exact details of management options, and locations of infrastructure. The EIS presents a high level assessment of the coal seam gas water impacts within the project development area. A coal seam gas water and brine management plan will be prepared as part of the environmental authority (EA) or EA amendment application process.
R26035	S150	Arrow's planning for the project development area must address disposal of coal seam gas water "by-products". Infrastructure and industrial operations associated with disposal of "by-products" should be defined against specific criteria and limitations that mitigate the risks associated with the storage, transport, destination and cumulative and long-term impacts of such volumes of water.	SREIS Chapter 3, Section 3.7.5 and Attachment 5	The EIS identified that the significant by-product of the production of coal seam gas water is brine. SREIS Chapter 3, Project Description, Section 3.7.5 identifies recovery for beneficial use as the preferred brine management option (while disposal of brine to landfill has been assessed as representative of a worst case). Arrow is consulting with commercial enterprises to investigate viable opportunities for the beneficial use of brine. The brine management options being considered in the SREIS are as follows: <ul style="list-style-type: none"> • Selective salt recovery at a joint industry facility. • Selective salt recovery at an Arrow-only facility. • Injection into a suitable formation. • Discharge to the ocean. • Disposal to landfill. SREIS, Attachment 5, Coal Seam Gas Water and Salt Management Strategy, provides further details on the management framework for brine to be implemented for the Surat Gas Project. The SREIS assumes that where management strategies that involve third party operators (such as licenced treatment or disposal facilities) are used then those facilities will be required to operate in accordance with the conditions of their own (separately approved) environmental authorities. Where management strategies involve development of additional infrastructure or processes by Arrow that have not been described and assessed in the EIS or SREIS, Arrow will be required to seek a new or amended environmental authority.
R26036	S153	Arrow's Coal Seam Water Management Strategy should be rejected, as their preferred management option (re-injection) is not the option that provides the most benefit to the local community. An	EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.7.4	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As identified in EIS Chapter 5, Project Description, Section 5.6.4, treatment and distribution for beneficial use is Arrow's preferred management option for coal seam gas water. As described in SREIS Chapter

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Issue No.	Submission No.	Issue	Reference	Responses
R26036	S153	economic analysis would show beneficial re-use as the best option for the local community.		<p>3, Project Description, Section 3.7.4, it is expected that the full range of coal seam gas water management options will be needed within the Surat Basin. The range of options is as follows:</p> <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use. • Injection into a suitable aquifer. • Discharge to watercourses and/or the ocean under defined conditions. <p>Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two proposed water treatment facility sites will dictate the management options that can be utilised at each site. Discharges to watercourses and/or the ocean are not preferred options but exercising either of these options would ensure that coal seam gas water produced during times of low demand could be managed.</p> <p>The management options for coal seam gas water and brine will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use become available.</p>
R26037	S079, S146	Coal seam gas water should be treated to a standard that can be used in the area of extraction to mitigate losses from the Condamine Alluvium to the Walloon Coal Measure. Reinjection and substitution are possible practices once both are proven safe and pose no long term impact. Also, coal seam gas water should be treated as a community asset, with the community allowed to have their say about it. Piping away coal seam gas water will exacerbate the limited resource problem.	EIS Chapter 5, Section 5.6.4 Attachment 5	<p>Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As identified in EIS Chapter 5, Project Description, Section 5.6.4, Arrow's preferred management option for coal seam gas water is beneficial use.</p> <p>Distribution of water to existing users (for substitution of their existing groundwater allocations from the Condamine Alluvium, 'virtual injection', and/or as additional supply) and/or to new users will require the development of water supply agreements between Arrow and each of the third party users. Agreements will specify timing, quality and volume of the supply of coal seam gas water. Arrow will ensure that coal seam gas water provided under individual agreements meets the requirements specified in relevant guidelines, which will be determined by the end use of the water and recognised standards for that use. Regular testing will be performed by Arrow (at monitoring points within Arrow's control) to ensure that the water complies with relevant water quality guidelines.</p> <p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the results from the trial will be used to prepare an application for an environmental authority (EA) or EA amendment.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26038	S153	Concern over the proposed treatment of coal seam gas water in integrated processing facilities by reverse osmosis and disposal of the brine into brine storage dams, as it is not sustainable and does not meet the community's expectations with regard to protecting land and water.	EIS Chapter 5, Section 5.6.4	A number of management options were considered for the disposal of brine, including selective salt recovery, and disposal to suitably licenced landfill facilities (EIS Chapter 5, Project Description, Section 5.6.4). The landfill option was assessed as representative of a worst-case scenario and found to be manageable. The landfill option presented in the EIS remains representative of a worst-case scenario. The SREIS re-iterates that further options are still under investigation and if pursued, will be assessed under a separate approvals process (i.e., a selective salt recovery plant, injection or ocean outfall pipeline).
R26039	S119, S123, S134, S156	<p>Arrow need to undertake further studies about the disposal of the waste water or if the studies undertaken give more detail than outlined in the EIS this information needs to be made available. Arrow's disposal of waste water needs to be more specific in its intentions and not just inspirational in context.</p> <p>a) Substitution of allocations – There needs to be legislation or a legal agreement in place to define formal indications from potential third party users than just expected that third party users will accept responsibility for impacts of the water.</p> <p>b) New uses – Anticipated new opportunities do not engender confidence. Arrow need to do more work or commission more work on the practicality and potential for new uses.</p> <p>c) Injection – Please provide results of injection feasibility study. Also proper analysis needs to be done of the feasibility of suitable aquifers for re-injection.</p> <p>d) Disposal to water courses – This is not really an option until Arrow can guarantee the quality of the water going into the water course. There needs to be more discussion and development of strategies for the management of brine to ensure that environmental and agricultural interests are protected in the event of flood and storm events. Who would Arrow receive approval from to discharge coal seam gas water into watercourses?</p> <p>e) Ocean outfall – Needs to be properly evaluated as an alternative method of disposal that does not have negative environmental or production outcomes. Further studies to ensure that detrimental impacts on coast line and marine</p>	EIS Attachment 5 SREIS Chapter 9, Chapter 10 and Chapter 11	<p>With regard to these comments:</p> <p>a) Distribution of water to existing users (for substitution of their existing groundwater allocations from the Condamine Alluvium, 'virtual injection', and/or as additional supply) and/or to new users will require the development of water supply agreements between Arrow and each of the third party users. Agreements will stipulate the timing, quality and volume of the supply of coal seam gas water. Arrow will ensure that coal seam gas water provided under individual agreements meets relevant water quality guidelines. These requirements will be determined by the end use of the water and recognised standards for that use. Regular testing will be performed by Arrow (at monitoring points within Arrow's control) to ensure that the water complies with relevant guidelines prior to use. Through meeting of quality, timing and volume specifications the risk of using the water is minimised and the responsibility for use of the water may be formally handed over to the user.</p> <p>b) Over the course of the project, it is anticipated that new uses of treated and untreated coal seam gas water will emerge and be investigated including agricultural, industrial, and domestic and urban uses. While the volume of coal seam gas water to be distributed for new uses over the life of the project cannot be determined at this time, it will form an option for Arrow to pursue in conjunction with distribution to known existing users. In the event that a new use is identified, Arrow will enter in to a water supply agreement with the third party as described above.</p> <p>c) As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected. Results from Arrow's coal seam gas water injection trials are not yet available as the approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable for coal seam gas water injection, the results from the trial will be used to generate an amendment to the EA.</p> <p>d) Since publication of the EIS, locations have been proposed for the two water treatment facilities at which brine will be stored and treated. Detailed</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26039	S119, S123, S134, S156	ecology do not occur. f) Beneficial uses of coal seam gas water – Needs to outline the quality of the coal seam gas water and the quality requirements for water used in agricultural pursuits.		<p>site-specific surveys have been undertaken at the water treatment facility locations to inform the SREIS. The site specific surveys have established baseline conditions and identified potential impacts of coal seam gas water discharge to watercourses at these locations. Recommendations have been made for appropriate release criteria upon which Arrow will base its discharge protocol. Information on the baseline conditions and proposed mitigation and management measures are presented within SREIS:</p> <ul style="list-style-type: none"> • Chapter 9, Surface Water. • Chapter 10, Aquatic Ecology. • Chapter 11, Terrestrial Ecology. <p>The frequency, volume and quality of water discharged to water courses will be within prescribed limits. The limits will be developed with consideration of the specific condition of the receiving watercourse and will be formalised as conditions of an approved EA, as granted by EHP.</p> <p>e) Disposal of brine or coal seam gas water to the sea via an ocean outfall pipeline is not the preferred management option. In the event that the preferred options are not available, the feasibility of an ocean outfall as an emergency or alternative disposal option for brine or coal seam gas water will be evaluated. If the ocean outfall option is considered feasible and taken forwards, a separate EIS will be undertaken, which would include full details on design, route options and outfall location, and an assessment of the associated impacts and appropriate avoidance, mitigation and management measures.</p> <p>f) Distribution of water to users (for beneficial uses) will require the development of water supply agreements between Arrow and third party users.</p>
R26040	S012, S013, S016, S027, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S158, S161, S164	<p>The target formation for brine injection must contain water that is of lesser quality than that of the injected material.</p> <p>The EHP (formerly DERM) guideline 'Preparing an EM Plan for Coal Seam Gas activities' states that the target formation for brine injection must be a single geological unit and not go outside the defined area.</p> <p>The required appropriate geological formation for the injection of brine has not been found at the time of the application (as stated in the EIS), it would therefore be irresponsible to take this option due to the known interconnectivity of the aquifers in question.</p>	<p>EIS Chapter 5, Section 5.6.4</p>	<p>As discussed in EIS Chapter 5, Section 5.6.4, should Arrow identify an appropriate formation during ongoing exploration activities, disposal of brine via injection will be considered. A criterion for injection is finding a target formation where the water quality is lower than that of the brine. The EIS acknowledges that to date, no such target formations have been identified. In the event that a suitable target formation for brine injection is identified, Arrow will be required to conduct an injection feasibility study, which will require the lodgement of an environmental authority (EA) or EA amendment application to conduct aquifer injection trials. The purpose of these trials will be to identify the volumes and rates of water that can be sustainably injected. Injection studies will be conducted under strictly controlled conditions to ensure that the test itself has no material impact. The feasibility study and trial results will in turn be used to generate a separate EA application for ongoing brine disposal.</p>
R26041	S106	The space provided in the Walloon Coal Measures	–	The Walloon Coal Measures is not a suitable target aquifer for injection

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Issue No.	Submission No.	Issue	Reference	Responses
R26041	S106	from other producers dewatering could provide for subsequent direct injection of coal seam water from newly developing coal seam gas fields, potentially without the need for treatment, associated costs and greenhouse gas generation.		<p>because gas production relies on the removal of water from the coal seams. Coal seam gas production associated with the Surat Gas Project will occur concurrently with gas production associated with the APLNG, GLNG and QCLNG projects over a period of approximately 30 years. During this time, the Walloon Coal Measures will be depressurised to allow coal seam gas to be released from the coal seams. To return coal seam gas water to the formation via injection will only result in the need to remove it again as part of the gas production process.</p> <p>The injection of coal seam gas water into geographically remote sections of an already depleted section of the Walloon Coal Measures, should these be available in time, may seem reasonable but because of lateral connectivity through the coal measures, reinjected water would eventually find its way back to extraction points.</p> <p>The Queensland Government's Coal Seam Gas Water Management Policy (2012) requires proponents to identify, as their first priority, a use for coal seam gas water that is beneficial to one or more of the following: the environment, existing or new water users, and existing or new water-dependent industries. The treatment and use of coal seam gas water for a wide variety of purposes aligns with this policy objective. Because of the potential for repeated removal of the same water, reinjection into the Walloon Coal Measures does not represent the best option for the environment.</p>
R26042	S124	Submitter requires Arrow to demonstrate if re-injection of waste coal seam gas water is viable and where it can be used.	EIS Attachment 5	<p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority (EA) amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection trials are not yet available as approvals are still pending. If an injection trial is approved and executed and it identifies an aquifer suitable for coal seam gas water injection, the results from the trial will be used to prepare and application for an EA or EA amendment.</p>
R26043	S025, S083, S145, S146, S158	<p>Further trials and research are needed before a decision is made regarding injection being an appropriate management measure for coal seam water.</p> <p>At this stage, Arrow does not know whether injection will be a successful water management strategy as trials have not been approved by the regulator.</p> <p>Trials by other Coal Seam Gas proponents have found reinjection to be problematic – both in terms of finding an aquifer to take large volumes of water</p>	EIS Attachment 5	<p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority (EA) amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected.</p> <p>Results from Arrow's coal seam gas water injection trials are not yet available as approvals are still pending. If an injection trial is approved and executed and it identifies aquifer(s) suitable for coal seam gas water injection, the results from the trial will be used to generate an amendment to the EA. Water injection will only be able to proceed if injection is proven to be physically feasible, and is approved by the administering authority. The Queensland</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26043	S025, S083, S145, S146, S158	<p>without clogging or causing aquifer damage and in terms of matching the water quality in the receiving aquifer.</p> <p>The injection process also comprises uncertainties in regard to geological integrity, as well as legislative authority. The former is still subject to as yet inconclusive trials by the company's own admission and is further rendered questionable since the experimentation is conducted by partisan interests.</p>		<p>Government's Coal Seam Gas Water Management Policy (2012) requires proponents to identify, as their first priority, a use for coal seam gas water that is beneficial to one or more of the following: the environment, existing or new water users, and existing or new water-dependent industries. The treatment and use of coal seam gas water for a wide variety of purposes aligns with this policy objective. Injection is only one option being considered.</p>
R26044	S012, S013, S016, S045, S046, S047, S084, S086, S100, S101, S102, S103, S107, S112, S134, S145, S151, S158, S161, S164	<p>EIS does not adequately describe or assess the impacts caused by injection.</p> <p>The following should be included in an assessment of injection of CSG water:</p> <ul style="list-style-type: none"> • The effects on the composition of the injected aquifers. • The effects of forcing the water under pressure into an aquifer including problems caused by pressure differentials. • The process, testing, monitoring and impacts of injection. • The effect of injection on other potential uses of water in the aquifer. • The standards and controls to be put in place when injecting coal seam water into aquifers. • The quantities of coal seam water to be injected into aquifers, locations where this is likely to occur, and alternative options for locations where reinjection is unable to be used. • The standard that the water is treated to. • Proof that reinjection will successfully mitigate the effects of drawdown and depressurisation. • Evidence to show that the water can be reinjected sustainably over the long-term, without causing environmental harm to groundwater assets • The appropriate legislative framework including government and environmental regulations that would apply. • The method of delivery. • The inherent risks to geological and natural landscape features. • A risk assessment providing details on potential hazards including their inherent risk, preventative measures and the residual risk. 	<p>EIS Attachment 5</p>	<p>As discussed in EIS Attachment 5, Environmental Management Plan, Arrow conducted an injection feasibility study in 2010 and has submitted environmental authority (EA) amendment applications to conduct aquifer injection trials. The purpose of these trials is to identify the volumes and rates of water that can be sustainably injected. Injection trials will be conducted under strictly controlled conditions to ensure that the trial itself has no material impact.</p> <p>Results from Arrow's coal seam gas water injection trials are not yet available as approvals are still pending. If an injection trial is approved and executed, and it identifies an aquifer suitable or coal seam gas water injection, the results from the trial will be used to generate an amendment to the EA. The matters listed within this set of submissions are the type of issues that will be addressed in detail in such an application.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26044	S012, S013, S016,	<ul style="list-style-type: none"> The processes for examination or monitoring of the injection of brine. 		
R26045	S079, S134	<p>Arrow to provide detail regarding:</p> <ul style="list-style-type: none"> How coal seam gas water will be treated or tested. What water quality criteria will be applied: <ul style="list-style-type: none"> What is the coal seam gas water quality? What quality does the reverse osmosis plant treat the water to? Who is responsible for the quality of coal seam gas water and its impacts? The process of amending treated water through the addition of trace elements. 	–	<p>Filtration and desalination by reverse osmosis (RO) is the primary process for water treatment. RO produces a low salinity (treated water) stream and a high salinity (brine) stream. Supporting the RO process are several pre-, post- and ancillary treatment processes, which are used to optimise the performance of the water treatment facility. The treated water is predominantly demineralised and requires additional balancing (addition of trace elements via chemical dosing into the treated water stream or blending with smaller amounts of untreated water) to meet water quality criteria appropriate to the beneficial end use or disposal route. Arrow will be responsible for ensuring that the water meets relevant water quality guidelines prior to use. Monitoring will be completed (at an appropriate point within Arrow's control) to provide assurance that water quality meets the relevant guidelines.</p>
R26046	S029	<p>Not enough research has been undertaken on the delivery of coal seam gas. Arrow should not be able to mine until the gas can be brought up while leaving the water and salt below.</p>	<p>EIS Chapter 1, Section 1.5.1, chapters 9 to 28 SREIS Chapters 5 to 15</p>	<p>Noted. The objective of the EIS is to ensure Arrow has fully examined and addressed all environmental, social and economic impacts of the proposed project, both direct and indirect (EIS Chapter 1, Introduction, Section 1.5.1). The outcomes of the assessments carried out by Arrow are included in EIS chapters 9 to 28. The SREIS summarises the further studies that have been undertaken. SREIS chapters 5 to 15 provide additional information and assessment of potential impacts of the project, as well as proposing additional mitigation measures when necessary to address potential impacts of the project, including those revised as a result of changes to project description.</p>
R26047	S014, S044, S081, S088, S143	<p>There is concern that any spillage or leakage of coal seam gas water or brine would be dispersed all over the Condamine floodplain and there would be no way to clean it up. What impact will salt/brine water have on cultivation if spilled? What mitigations are in place?</p> <p>Concern over brine management and the potential impacts on the Condamine flood plain. Potential impacts from temporary storage of brine in dams and flooding should be considered (impacts to farmland, creeks, rivers, aquatic systems, domestic water supply and groundwater).</p>	<p>EIS Chapter 12, Section 12.6.3.</p>	<p>The predominant management measure for potential spillage is prevention of the spill through rigorous design and process control. The storage of brine associated with water treatment facilities will occur on Arrow-owned (which is preferred) or leased properties. Brine dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Water gathering lines installed to deliver coal seam gas water from wells to the water treatment facilities may be located on private land and will be constructed in accordance with AS 4130:2009 to minimise the potential for failure. Landholders will be consulted during field planning to determine land use practices. Pipelines will be buried to a depth that minimises the risk of damage. Well site and remote equipment telemetry systems will be used in conjunction with information from the central gas processing facilities in order to meter gas and water flow, and alert operators to faults within the gathering network. During project activities, the potential for soil contamination resulting from</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26047	S014, S044, S081, S088, S143			project activities will be reduced by the application of management measures detailed in EIS Chapter 12, Geology, Landform and Soils, Section 12.6.3. Under the Environmental Protection Act 1994 (Qld), Arrow is legally required to remediate any contamination caused by project activities.
R26048	S075, S077	What happens to the toxic by product in the event of a flood? The toxic by product or even just salt products could have a devastating effect on the surrounding land.	EIS Chapter 25, Section 25.4.2	The storage of brine associated with water treatment facilities will occur on Arrow-owned (which is preferred) or leased properties. Brine dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). The requirements of State Planning Policy 1/03, Mitigating the adverse impacts of Flood, Bushfire and Landslide will be considered when designing, constructing and operating the project (Commitment C538). Arrow will site facilities above the 1-in-100-year average flood recurrence interval, where practicable, and design infrastructure taking into consideration overland flow and flooding regimes to reduce impacts on immediate and surrounding areas (Commitment C155), to protect against flooding and the project's vulnerability to changing climate patterns. Potential pollutants (concentrated brine, diesel, drilling muds, chemicals, wastes) will be stored and handled in accordance with appropriate Australian and international standards and codes for the storage and handling of hazardous materials. In addition, overflow and operational controls will be established for tanks and dams and internal and external hazard audit programs will be established. Risks associated with chemical and waste storage and associated mitigation and management measures are discussed in EIS Chapter 25, Preliminary Hazard and Risk, Section 25.4.2.
R26049	S079	With respect to pigging wastes (comprised of coal seam gas water and possibly sludge), what measures are in place to assure these do not infiltrate our soils and if they do then what are the environmental impacts?	SREIS Chapter 3, Section 3.6.2	As described in SREIS Chapter 3, Project Description, Section 3.6.2, pigging wastes will be collected in a chamber at the central gas processing facility and then disposed of to a regulated waste facility or treated at the central gas processing facility and disposed of along with the other waste streams generated at the facility. Arrow has committed to comply with Queensland Government waste tracking requirements (Commitment C495), and regulated wastes will be handled, stored and disposed of in accordance with relevant standards and the Environmental Protection (Waste Management) Regulation 2000 (Commitment C494).
R26050	S086	Arrow should incorporate into emergency response plan controlled discharge of coal seam gas water. Release of untreated coal seam gas water should not be allowed on Strategic Cropping Land as it will cause permanent alienation or diminished	EIS Chapter 5, Section 5.2.4 SREIS Chapter 3, Chapter 9, Chapter 10	As described in EIS Chapter 5, Project Description, Section 5.2.4, dams will be designed in accordance with relevant legislation, Queensland standards and EHP guidelines, with independent third party certification. Arrow will also monitor dam levels to provide early warning of potential overflow. Operations and water management plans will contain procedures for the discharge of

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Issue No.	Submission No.	Issue	Reference	Responses
R26050	S086	profitability.		<p>coal seam gas water under controlled and emergency conditions. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C497).</p> <p>SREIS Chapter 3, Project Description, describes the proposed discharge of coal seam gas water to watercourses both during normal operations and in emergency situations. Further detailed site-specific surveys have been undertaken at the two proposed discharge locations. SREIS Chapter 9, Surface Water, and Chapter 10, Aquatic Ecology, identified the potential impacts of discharging at these locations, and proposes mitigation measures to reduce these identified impacts.</p> <p>The frequency, volumes and quality of water discharged to water courses will be within prescribed limits, taking into consideration the specific condition of the receiving watercourse, as set out in the conditions of the environmental authority approval.</p>
R26051	S007, S023, S104, S108	<p>Concerned that storage of water in dams is unsuitable in flood prone areas. What safety measures are in place to stop the contents of the dam (evaporation pond), reaching farming land and river systems? What will happen to the water storage dams and the salt in them during a flood?</p> <p>Questions the number of existing dams that breached during recent extensive floods, and if saline water was released to the environment as a result.</p> <p>How is it possible to know if a dam is leaking (especially the brine dam), as a nearby bore will only detect a leak well after it has occurred.</p>	<p>EIS Chapter 5, Section 5.2.4</p> <p>SREIS Chapter 9, Attachment 5, Appendix 5</p>	<p>The storage of brine associated with water treatment facilities will occur on Arrow-owned (which is preferred) or leased properties. Brine dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). The requirements of State Planning Policy 1/03, Mitigating the adverse impacts of Flood, Bushfire and Landslide will be considered when designing, constructing and operating the project (Commitment C538).</p> <p>Arrow will monitor dam levels to provide early warning of potential overflow. Operations and water management plans will contain procedures for the discharge of coal seam gas water under controlled and emergency conditions. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C497).</p> <p>Since publication of the EIS, proposed locations have been identified for two water treatment facilities at which brine will be stored temporarily prior to disposal as described in SREIS Attachment 5, Coal Seam Gas Water and</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26051	S007, S023, S104, S108			Salt Management Strategy. Flood modelling of these locations has been undertaken for the SREIS showing the relationship of the facilities to the 1-in-100-year average flood recurrence interval. The results of the modelling are described in SREIS, Chapter 9, Surface Water and SREIS Appendix 5, Supplementary Surface Water Assessment Part A – Geomorphology and Hydrology.
R26052	S156	How can Arrow ensure that contaminated water and/or runoff does not find its way into the Condamine River or the north branch of the Condamine River?	<p>EIS Chapter 16, sections 16.3.7, 16.6.2 and 16.6.5</p> <p>SREIS Chapter 10, Section 10.4.4</p>	<p>Arrow recognises the need to identify and manage impacts on significant values of waterways in the project development areas. EIS Chapter 16, Aquatic Ecology, Section 16.3.7 identified these values, including the location of any relevant ESAs for aquatic ecology in the project development area.</p> <p>Arrow has committed to a range of measures to protect waterways, seeking as the highest priority to avoid the occurrence of impacts. The primary means by which avoidance is achieved is through the design of the project and associated facilities and infrastructure and the selection of sites.</p> <p>The storage of brine associated with water treatment facilities will occur on Arrow-owned (which is preferred) or leased properties. Brine dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f).</p> <p>Water gathering lines installed to deliver coal seam gas water from wells to the water treatment facilities may be located on private land and will be constructed in accordance with the APIA code of practice Upstream PE gathering networks CSG industry version 2 or the relevant Australian standards, as revised from time to time (Commitment C444).</p> <p>Arrow will manage potential impacts on waterways through the commitment to implement a buffer zone from the high bank of all watercourses to prevent development or clearance occurring within the buffer (other than construction of watercourse crossings for roads and pipelines, discharge infrastructure and associated stream monitoring equipment). Arrow will determine the buffer zone distance in accordance with the legislative requirements at the time of development or through preconstruction clearance surveys (Commitment C157).</p> <p>SREIS Chapter 10, Aquatic Ecology, Section 10.4.4 describes the detailed site-specific field surveys undertaken at the two proposed discharge locations for coal seam gas water, and proposes additional mitigation measures to reduce the potential impacts to the identified waterways, including the Condamine River.</p>
R26053	S141, S144	The EIS should include very specific conditions around the collection, transportation and treatment of the brine with the view to eliminating any risk of contaminating the soil and water resources.	<p>SREIS Attachment 5</p>	Noted. SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy provides further details regarding Arrow's brine and salt management options.

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Issue No.	Submission No.	Issue	Reference	Responses
R26054	S146	Given that associated coal seam water sterilises soils with clay content greater than 30%, it is imperative that any water discharged must be appropriate for the receiving environment.	EIS Chapter 3, Chapter 9 and Chapter 10	SREIS Chapter 3, Project Description, describes the proposed discharge of coal seam gas water to watercourses both during normal operations and in emergency situations. Further detailed site-specific surveys have been undertaken at the two proposed discharge locations. SREIS Chapter 9, Surface water, and Chapter 10, Aquatic Ecology, identified the potential impacts of discharging at these locations, and proposed mitigation measures to reduce these identified impacts. The frequency, volumes and quality of water discharged to watercourses will be within prescribed limits, taking in to consideration the specific condition of the receiving watercourse, as determined by the conditions of the environmental authority.
R26055	S024, S026, S034, S036, S069, S079, S081, S083, S162	How is accumulated water captured? Or is this water allowed to infiltrate soils? If so, what are the impacts on environmental values, such as soil, agriculture and/or groundwater?	EIS Chapter 5, Chapter 12, Chapter 13 and Chapter 14	Coal seam gas water is extracted as detailed in EIS Chapter 5, Project Description. The impacts of the project on soil, agriculture and groundwater are discussed in EIS Chapter 12, Geology, Landform and Soils, Chapter 13, Agriculture, and Chapter 14, Groundwater.
R26056	S046	The storage of brine and product water on farms has been limited in recent years however the EIS does not seem to be operating on the non-storage of brine/product water on farms – even temporarily.	SREIS Attachment 5	Salt will not be stored on intensively farmed land. Brine dams at water treatment facilities associated with CGPF2 and CGPF9 will not be located within intensively farmed land. Brine and salt will be removed from the water treatment facilities for processing (i.e., via selective salt recovery, offsite disposal at a third-party licensed landfill, injection to a suitable formation or discharge to the ocean), in line with Arrow's Coal Seam Gas Water and Salt Management Strategy (SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy).
R26057	S158	No guarantee has been given that storage of water from the process will retain its integrity. Accidents and natural disasters have the potential to inflict dramatic and irreversible harm to landscape features, biodiversity and human survival resource needs. Also, once water has evaporated (wastefully), the toxicity of what remains of the water content will present an unwarranted burden on the immediate and larger community to store and dispose of.	EIS Chapter 5, Section 5.2.4 SREIS Chapter 3, Section 3.7.5 Chapter 9	As described in EIS Chapter 5, Project Description, Section 5.2.4, dams associated with water treatment facilities will be located on Arrow-owned (which is preferred) or leased properties. Dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). The requirements of State Planning Policy 1/03, Mitigating the adverse impacts of Flood, Bushfire and Landslide will be considered when designing, constructing and operating the project (Commitment C538). Arrow will monitor dam levels to provide early warning of potential overflow. Operations / water management plans will contain procedures for the discharge of coal seam gas water under controlled and emergency conditions. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C497).

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Issue No.	Submission No.	Issue	Reference	Responses
R26057	S158			<p>Since publication of the EIS, proposed locations have been identified for two water treatment facilities at which brine will be stored temporarily prior to disposal, as described in SREIS Chapter 3, Project Description. Flood modelling of these locations has been undertaken for the SREIS showing the relationship of the facilities to the 1-in-100-year average recurrence interval flood event. The results of the modelling are described in SREIS, Chapter 9, Surface Water.</p> <p>Brine management options are presented in SREIS Chapter 3, Project Description, Section 3.7.5, and include selective salt recovery at a joint industry facility, selective salt recovery at an Arrow-only facility, injection into a suitable formation, discharge to the ocean and disposal to landfill. If disposal is chosen as a feasible brine management option, it will be undertaken in accordance with the regulated waste management procedures under the Environmental Protection Act 1994.</p> <p>Evaporation dams are not considered an option for the management of brine for the Surat Gas Project.</p>
R26058	S014, S044, S081	<p>What are the construction criteria for coal seam gas related ponds/dams? What flood capacity can these dams hold? Has modelling taken into account recent floods?</p>	<p>EIS Chapter 5, Section 5.2.4 Appendix H, Attachment A4 SREIS Chapter 3, Section 3.4.4 Chapter 9</p>	<p>As described in EIS Chapter 5, Project Description, Section 5.2.4, dams associated with water treatment facilities will be located on Arrow-owned (which is preferred) or leased properties. Dams will be designed in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). The requirements of State Planning Policy 1/03, Mitigating the adverse impacts of Flood, Bushfire and Landslide will be considered when designing, constructing and operating the project (Commitment C538).</p> <p>Arrow will monitor dam levels to provide early warning of potential overflow. Operations / water management plans will contain procedures for the discharge of coal seam gas water under controlled and emergency conditions. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).</p> <p>A review of historical flood information, including the flooding during the 2010 to 2011 wet season, was undertaken for major waterways within the project development area (EIS Appendix H, Surface Water Part A Fluvial Geomorphology, Attachment A4).</p> <p>As described in SREIS Chapter 3, Project Description, Section 3.4.4, the ranges of dam sizes at each facility is expected to be:</p> <ul style="list-style-type: none"> • Raw (untreated) water dam capacity: 450 ML to 1,050 ML. • Treated water dam capacity: 900 ML to 4,200 ML.

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Issue No.	Submission No.	Issue	Reference	Responses
R26058	S014, S044, S081			<ul style="list-style-type: none"> • Brine dam capacity: 90 ML to 2,880 ML. Flood modelling for the two known water treatment facilities has been undertaken to inform the SREIS, as is presented in SREIS Chapter 9, Surface Water.
R26059	S150	<p>All gas re-injection pilot trials or operational activities require a full accurate assessment of minor and major risks to environment and human health including sustainable economic development of the region. Arrow should be required to produce independently peer reviewed scientific data to support all future applications to trial re-injection of gas.</p> <p>DERM [EHP] should make publically available information outlining where gas re-injection activities are currently occurring or are proposed to occur, and all conditions associated with those gas re-injection activities or trials.</p> <p>Any trial or operation to reinject gas (due to over-production) poses an unacceptable threat to a public resource, namely the extracted gas.</p>	–	The reinjection of gas is not proposed as part of the Surat Gas Project.
R26060	S134, S158	<p>A clearer delineation of the word, 'appropriate' is required in relation to the promised monitoring. Arrow to provide details on monitoring discharge of coal seam gas water, including frequency, or actions to be taken if high or abnormal results are obtained.</p>	SREIS Chapter 3	<p>SREIS Chapter 3, Project Description, describes the proposed discharge of coal seam gas water to watercourses both during normal operations and in emergency situations. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498).</p> <p>These parameters are outlined in the Environmental Protection Act 1994 and the Water Supply (Safety and Reliability) Act 2008, which are set to pose minimal risks to human health and irrigation. An inspection and monitoring program will also be implemented to measure the volume and quality of coal seam gas water released to surface waters on a routine basis in accordance with legislative requirements and approved release limits (Commitment C529).</p> <p>Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26060	S134, S158			water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498). Monitoring requirements will be formalised through the environmental authority, with which Arrow will be required to comply.
R26061	S106	No reference is made to the abandonment of the acceptance of evaporation dams, nor is reference made to a desired practically achievable target of 97% to 99% of all feedwater being treated to potable standards, or some lesser standard as required by an end user, or injected into the Walloon Coal Measures at a site where earlier gas production has ceased, within a limited time of it being produced (say 1 to 24 months), otherwise the precious resource will be lost through evaporation.	SREIS Chapter 3, Section 3.7.4	Arrow will not use evaporation as a coal seam gas water management option and the proposed size of dams will mean that water will continually be distributed to the chosen management option. The management options for coal seam gas water will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use become available. Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). Beneficial uses of coal seam gas water include agricultural uses (irrigation and livestock watering), industrial uses (dust suppression, drilling and construction water supply, and power station cooling), and domestic or urban uses (augmentation of town water supplies). However, as described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal): <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate the management options that can be utilised at each site.
R26062	S055, S087	The EIS has highlighted the lack of scientific and technical baseline environmental data, a poor understanding of the management and environmental imperatives of existing land managers and no meaningful or practical solutions to the management of environmental issues that may arise following the extraction of huge quantities of water and salt.	EIS Chapter 5, Figure 5.17 SREIS Chapter 2 and Chapter 3, Section 3.7.4	Noted. The nature of the development is such that at the time of the EIS, Arrow was yet to determine the exact details of management options, and locations of infrastructure. The EIS presents a high level assessment of the coal seam gas water potential impacts within the project development area. As described in EIS Chapter 5, Project Description, Figure 5.17, a range of management options are available to Arrow, and as further detailed in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal): <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes.

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26062	S055, S087			<ul style="list-style-type: none"> • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. <p>The feasibility of these potential management strategies will be investigated and the chosen management options detailed in the Coal Seam Gas Water Management Plan that will be presented through the environmental authority (EA) or EA amendment application process described in SREIS Chapter 2, Project Approvals. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies. The management options for coal seam gas water and/or brine/salt will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use become available.</p>
R26063	S112	<p>The EIS says that "Arrow's preferred approach is to beneficially use coal seam gas water by substituting existing water allocations in the area, but goes on to add that it is expected that the third-party users will accept responsibility (legally and practically) for the impacts of their use of the water". Farmers could be expected to be very cautious about signing up to that sort of a deal, to irrigate their crops, given they would be liable for any problems caused by toxins which may be in the water.</p>	–	<p>Filtration and reverse osmosis are proposed for the treatment of coal seam gas water produced through Arrow's operations. This proven technology is broadly recognised for the removal of a wide range of ions and toxins. Water treated through reverse osmosis may be described as demineralised upon completion of the reverse osmosis process. Balancing of the water after the treatment ensures that it is non-toxic and chemically and physically suitable for multiple uses, such as water sourced directly from other water resources. Arrow will deliver agreed volumes of coal seam gas water at an agreed quality under water supply agreement with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow to ensure that the water complies with the relevant approval. The water supplied by Arrow will be fit for purpose and meet the prescribed water quality for supply. The use of this water for irrigation, industrial or other uses will be conducted under the regulatory framework that applies to that industry. Hence this water will be applied in accordance with current land use practices (e.g., irrigation or stock watering) undertaken by the third party.</p>
R26064	S123, S134, S146	<p>Arrow to address the rights and responsibilities of landholders regarding the substitution arrangements. When communicating this approach to producers, it must be made very clear that this water is of same quality as their allocation would be, and that it is a temporary substitution only and in no way affects their rights to their permanent water allocation.</p> <p>Is it planned that this substitution is compulsory or do producers have a choice, maybe they should have an incentive, i.e., more water than their permanent allocation as a sweetener to change</p>	<p>EIS Chapter 5, Section 5.6.4</p>	<p>Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). EIS Chapter 5, Project Description, Section 5.6.4, indicates that Arrow's preferred approach is to ensure that coal seam gas water is available for beneficial use by substituting existing groundwater allocations from the Condamine Alluvium, i.e., the volumes of groundwater currently extracted by third parties in accordance with existing allocations will be replaced with coal seam gas water provided by Arrow. The strategy proposes substitution of groundwater allocations for the duration of the project, until the production of coal seam gas water ceases.</p> <p>Entering into a water supply agreement with Arrow is voluntary. As there is not a regulatory framework in place to manage substitution, Arrow will manage these arrangements through commercial water supply agreements.</p>

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26064	S123, S134, S146	over.		Under a water supply agreement Arrow will deliver agreed volumes of coal seam gas water at an agreed quality and over an agreed period of time. Under water supply agreements with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets water quality prescribed in the relevant approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow to ensure that the water complies with the relevant approval. At the end of the agreement the third party will revert to utilising their groundwater allocation.
R26065	S134	Arrow to provide details regarding the timeframe expected for facilitating changes (by Queensland Government) to substitution of allocations.	–	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). The Queensland Government's Coal Seam Gas Water Management Policy (2012) promotes substitution. Currently there is no regulatory framework to facilitate substitution. Arrow will manage these arrangements through commercial agreements. Under a water supply agreement Arrow will deliver agreed volumes of coal seam gas water at an agreed quality and over an agreed period of time. Arrow is not seeking changes to legislation to facilitate substitution.
R26066	S139	Approval of the substitution strategy proposed by Arrow must ensure that the water available for substitution replaces existing entitlements only, and not new uses.	SREIS Attachment 5	Arrow's preferred approach is to beneficially use coal seam gas water by substituting existing groundwater allocations from the Condamine Alluvium, i.e., the volumes of groundwater currently extracted by third parties in accordance with existing allocations will be replaced with coal seam gas water provided by Arrow. This will normally entail substitution of water allocations for the duration of the given project, until the production of coal seam gas water ceases. See SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy. The volume of water made available to new users will depend on the uptake of the substitution strategy.
R26067	S139, S158	Approval of the substitution strategy proposed by Arrow must ensure that substituted water is delivered to the irrigators at no cost to them, especially since irrigators will still have to maintain existing bores and associated infrastructure. Does the substitution strategy mean that Arrow will provide water to the user, thus precluding the user's need to extract the water (presumably from underground or waterways), and if so, what is the energy and access burden of such provision?	EIS Chapter 5, Section 5.6.4	The Queensland Government's Coal Seam Gas Water Management Policy (2012) promotes substitution or 'virtual injection'. Currently there is no regulatory framework to facilitate substitution. Arrow will manage these arrangements through commercial water supply agreements. Under a water supply agreement Arrow will deliver agreed volumes of coal seam gas water at an agreed quality and over an agreed period of time and the end user will utilise Arrow's water in lieu of their groundwater allocation from the Condamine Alluvium. EIS Chapter 5, Project Description, Section 5.6.4 confirms that Arrow's preferred approach is to ensure that coal seam gas water is available for beneficial use by substituting existing groundwater allocations from the Condamine Alluvium, i.e., the volumes of groundwater currently extracted by third parties in accordance with existing allocations will be replaced with coal seam gas water provided by Arrow. The strategy proposes substitution of groundwater allocations for the duration of the project, until the production of

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26067	S139, S158			coal seam gas water ceases. Specific arrangements regarding access and supply will be negotiated as part of each supply agreement.
R26068	S139	Approval of the substitution strategy proposed by Arrow must ensure that existing options for carry-over are maintained.	–	Noted. Currently there is no regulatory framework to facilitate substitution. Arrow will manage substitution arrangements through commercial water supply agreements. Under a water supply agreement Arrow will deliver agreed volumes of coal seam gas water at an agreed quality and over an agreed period of time. Specific arrangements regarding details of the groundwater entitlements to be substituted such as carry-over will be negotiated as part of each water supply agreement.
R26069	S146	Concerned that unless it is properly regulated, the substitution of allocations method may cause inequitable water redistribution, with those impacted from coal seam gas extraction not benefiting from the practise of substitution of allocation/reinjection.	SREIS Chapter 8	As described in SREIS Chapter 8, Groundwater, those impacted by coal seam gas water extraction by way of impaired groundwater bore capacity will receive 'make-good' measures as defined by the Office of Groundwater Impact Assessment (OGIA) under the Surat Cumulative Management Area Underground Water Impact Report (UWIR). Currently the UWIR published by the OGIA does not predict any bore owners in the Condamine Alluvium to experience impaired capacity as a result of coal seam gas activities. Arrow is seeking to proactively mitigate the potential impacts to the Condamine Alluvium through substitution or 'virtual injection' and for deeper aquifers will negotiate 'make good' measures with bore owners who may experience impaired capacity.
R26070	S081, S139	No detail has been provided as to the extent of infrastructure required for the substitution of allocation proposal. Any lost opportunity for storage space occupied by infrastructure associated with the substitution strategy must be compensated for by either providing more water or financial compensation. Approval of the substitution strategy proposed by Arrow must ensure that the coal seam gas industry is responsible for any additional on or off farm infrastructure required to use the substituted allocation.	–	Distribution of water to existing users (for substitution of their existing groundwater allocations from the Condamine Alluvium, 'virtual injection', and/or as additional supply) and/or to new users will require the development of water supply agreements between Arrow and each of the third party users. Under a water supply agreement Arrow will deliver agreed volumes of coal seam gas water at an agreed quality, over an agreed period of time at an agreed delivery point. Infrastructure necessary to deliver the water to that delivery point will be Arrow's responsibility. Arrow will negotiate land access for beneficial use infrastructure with individual affected landholders. Coal seam gas water volumes provided under substitution arrangements will account for any losses and/or evaporation resulting from the substitution.
R26071	S134	Arrow to detail how treated coal seam gas water used to substitute groundwater allocations will be distributed to landholders. Will this require another set of pipe infrastructure through Good Quality Agricultural Land?	–	A beneficial use network will be installed. Under water supply agreements, Arrow will deliver agreed volumes of coal seam gas water at an agreed quality, over an agreed period of time at agreed delivery points. Infrastructure necessary to deliver the water to delivery points will be Arrow's responsibility. Arrow will negotiate land access for beneficial use infrastructure with individual affected landholders. Where possible, Arrow will seek to co-locate water infrastructure within already disturbed areas, as agreed with landholders.

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Issue No.	Submission No.	Issue	Reference	Responses
R26072	S081	<p>Provide further details about the interconnection between the water treatment facilities (described in Arrow's water management strategy), such as:</p> <ul style="list-style-type: none"> • What form does this interconnection take, is it a pipeline network? • Over what distances would the interconnection occur? • To what depth would the pipes be buried? • What is the diameter of the pipes in question? • What is the width of the Right of Way required for these pipes? • How frequently will these pipes be monitored? • How long will the project take to construct? • Is the water in the pipes under pressure? • Will risers, lifts etc. be required? • Does the pipeline contain treated or untreated water? • What is the sensitivity, magnitude, extent of impacts and mitigation strategies regarding the environmental values? 	<p>SREIS Chapter 3, Section 3.7.4</p>	<p>Two water treatment facilities will be developed. The proposed locations of these facilities has been described, and further site specific field surveys have been undertaken at the locations, to describe the environmental conditions of the facility locations.</p> <p>To maximise the flexibility of water treatment management options, the two facilities may be connected by a network of pipelines (capable of transferring untreated and treated water between the facilities). Additional detail is presented in SREIS Chapter 3, Project Description, Section 3.7.4. The impact assessment completed for the gathering network will be interpreted as also being applicable for the interconnection and beneficial use network. Further details on Arrow's distribution pipelines, including specific construction details, inspection and monitoring and management options are still under investigation, and such statutory information requirements will be provided in accordance with the EHP Guideline 'Application requirements for petroleum activities' to accompany environmental authority (EA) or EA amendment application(s).</p>
R26073	S079	<p>If we are able to use the substitution allocation, are we going to be able to construct storage facilities to hold and store this water to be used at appropriate times?</p>	<p>–</p>	<p>Under water supply agreements Arrow will deliver agreed volumes of coal seam gas water at an agreed quality, over an agreed period of time and at agreed delivery points. Infrastructure necessary to deliver the water to delivery points will be Arrow's responsibility. Arrow will negotiate land access for beneficial use infrastructure with individual affected landholders. The management and storage of this water will be the responsibility of the third party beyond the off-take point.</p>
R26074	S081	<p>The substitution of existing allocations with produced coal seam gas water has been mentioned in several instances, however only in principal.</p>	<p>SREIS Attachment 5</p>	<p>Details of the substitution of existing groundwater allocations ('virtual injection') from the Condamine Alluvium are presented in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy. This attachment also includes an update to Arrow's water and salt management strategy.</p>
R26075	S134, S145	<p>Arrow to provide adequate detail regarding investigations demonstrating that water substitution with licence holders is a viable option for management of coal seam water. More detail is required to substantiate this proposed beneficial use option (substitution of allocations).</p>	<p>SREIS Chapter 3, Section 3.7.4 Attachment 5</p>	<p>Details of the substitution of existing groundwater allocations are presented in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy. This attachment also includes an update to Arrow's water and salt management strategy. As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal):</p> <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions.

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Issue No.	Submission No.	Issue	Reference	Responses
R26075	S134, S145			The application of these options will be dependent on the uptake of substitution of groundwater allocations from the Condamine Alluvium.
R26076	S134	Arrow to provide details on options to be implemented before the substitution of allocations is introduced. (Very little details provided on what new users are.)	SREIS Chapter 2 and Chapter 3, Section 3.7.4	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised, they are: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate the management options that can be utilised at each site. Disposal to watercourses will be considered in the event that beneficial uses of coal seam gas water are temporarily unavailable, beneficial use approvals are not granted, significant or prolonged wet weather events occur or the demand for water decreases and alternative disposal options are required to maintain dam integrity and safety. The feasibility of these potential management strategies will be investigated and the chosen management options detailed in the Coal Seam Gas Water Management Plan for the environmental authority (EA) or EA amendment application process described in SREIS Chapter 2, Project Approvals. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies. The management options for coal seam gas water and/or brine/salt will be continually reviewed as planning for field development evolves and opportunities for additional beneficial use present themselves.
R26077	S014, S044, S139	Questions the benefit in substituting surface water allocations with treated coal seam gas water because it is understood that existing surface water allocations will not be impacted by coal seam gas activities. Therefore the substitution strategy should be limited to groundwater allocations only. Surface water allocations will in no way mitigate for impacts on groundwater but acknowledges that substitution for groundwater users may be feasible to mitigate depressurisation. The project must be conditioned so that the proponent is required to outline how the substitution strategy would be implemented, and	SREIS Chapter 8	The substitution strategy is limited to groundwater allocations from the Condamine Alluvium only. SREIS Chapter 8, Groundwater, provides details on the potential effects of the substitution strategy on groundwater drawdown.

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Issue No.	Submission No.	Issue	Reference	Responses
R26077	S014, S044, S139	that they are limited to the substitution of groundwater allocations only (not surface water allocations). There must be enforceable conditions which prohibit harm to the environmental values of groundwater.		
R26078	S134, S139	Arrow to provide details of water balance modelling to demonstrate the viability of substitution. Approval of the substitution strategy proposed by Arrow must ensure that the Condamine Alluvium resource sees a net gain at the end of the process and overall water balance in the Condamine Alluvium is maintained and is within potential modelling errors, accounting for potential leakage into the Walloon Coal Measures.	EIS Chapter 14 SREIS Chapter 8	Additional information on the water balance completed for the EIS is presented in EIS Chapter 14, Groundwater. Groundwater models completed for the EIS are dynamic models that can be updated in real time as additional data is gained. The EHP-approved Office of Groundwater Impact Assessment model has been utilised for the SREIS, with the latest field data from Arrow incorporated. The predicted effectiveness of substitution of existing groundwater allocations from the Condamine Alluvium on mitigating drawdown impacts is described in SREIS Chapter 8, Groundwater.
R26079	S161	Arrow's prediction that by substituting existing water allocations they will facilitate natural recharge of aquifers and offset depressurisation impacts is misleading, and masks the potential severity of the impact on water resources in the long term. The degree to which substituting existing water allocations with treated coal seam water will replenish aquifers is unknown.	EIS Chapter 14 SREIS Chapter 8	Additional information on the water balance completed for the EIS is presented in EIS Chapter 14, Groundwater. Groundwater models completed for the EIS are dynamic models that can be updated in real time as additional data is gained. SREIS Chapter 8, Groundwater provides an overview of the effectiveness of proposed mitigation measures, as predicted in the revised groundwater model.
R26080	S072, S090, S134	Arrow does not know whether any existing water allocation holders would be willing to sign up for substitution, and should provide detail of disposal options for locations where landholders do not accept substitution by treated coal seam gas water and hand back their water licences. If landholders do not hand back their water allocations then there is no offset of water being extracted by Arrow's substitution of water allocation strategy. How will the lack of offset and lack of disposal of water be handled? Arrow has no workable processes to substitute allocations for the large volumes of water proposed	SREIS Chapter 3, Section 3.7.4	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised, they are: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use. • Injection into a suitable aquifer. • Discharge to watercourses and/or the ocean under defined conditions. Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate the management options that can be utilised at each site.
R26081	S106	Concerned that no mention of the provided percentage of required substitution is outlined.	SREIS Chapter 3, Section 3.7.4 Chapter 8	Arrow has committed to maximise beneficial use of coal seam gas water (Commitment C174). As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised, they are: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via

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Issue No.	Submission No.	Issue	Reference	Responses
R26081	S106			<p>watercourses forming part of manage schemes.</p> <ul style="list-style-type: none"> • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. <p>Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate the management options that can be utilised at each site. Additional detail regarding the effectiveness of proposed mitigation measures is presented in SREIS Chapter 8, Groundwater.</p>
R26082	S146	Arrow Energy must define what is meant by substituting existing water "in the area". Does this refer to "in the area where the gas is extracted"?	SREIS Chapter 3	Arrow will seek to substitute existing groundwater allocations from the Condamine Alluvium by providing coal seam gas water to those users via a mechanism known as 'virtual injection'. Substitution is planned to occur in the area of greatest drawdown in the Condamine Alluvium to offset the predicted likely flux from the alluvium as a consequence of depressurizing the Walloon Coal Measures. Further explanation is provided in SREIS Chapter 3, Project Description.
R26083	S139, S146	Approval of the substitution strategy proposed by Arrow must ensure that there is no increased risk applicable to delivery timing and access. How will water substituted for allocations be accounted for?	–	<p>Distribution of water to existing users (for substitution of their existing groundwater allocations from the Condamine Alluvium, 'virtual injection', and/or as additional supply) and/or to new users will require the development of water supply agreements between Arrow and each of the third party users. As well as the timing, these agreements will stipulate the volume and quality of the water to be supplied.</p> <p>If water is supplied to areas off tenure, approvals may be required under the Sustainable Planning Act 2009 and/or the Waste Reduction and Recycling Act 2011.</p>
R26084	S139	Approval of the substitution strategy proposed by Arrow must ensure that there is no increased salt load in the region as a result of allocation substitutions with coal seam gas water.	–	Arrow will deliver agreed volumes of coal seam gas water at an agreed quality under a water supply agreement with third parties, Arrow will ensure that coal seam gas water provided under individual agreements meets the water quality requirements prescribed in the relevant government approval. These water quality requirements will be determined by the end use of the water and recognised standards for that use, and regular testing will be performed by Arrow to ensure that the water complies with the relevant approval. Using this approach, the salt load on land receiving coal seam gas water under substitution supply agreements should not increase. In many cases, the water supplied will be of better quality than that currently being used.
R26085	S079, S090, S091, S134, S139, S143, S145	Water quality data should be provided for treated coal seam gas water to ensure it is suitable for substitution of existing allocations. Does Arrow's substitution water have to meet the current water	–	Distribution of water to existing users (for substitution of their existing groundwater allocations from the Condamine Alluvium, 'virtual injection', and/or as additional supply) and/or to new users will require the development of water supply agreements between Arrow and each of the third party users.

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Issue No.	Submission No.	Issue	Reference	Responses
R26085	S079, S090, S091, S134, S139, S143, S145	quality [of the groundwater]? The quality of treated coal seam gas water used for substitution of allocations should be of equal or better quality than current allocations.		As well as the water quality, these agreements will stipulate the timing of the supply of coal seam gas water and the volume of the water to be supplied.
R26086	S106, S134	Coal seam gas water cannot substitute for existing water allocations on an ongoing basis after the cessation of coal seam gas production. Arrow should identify how land holders will maintain their water access after Arrow is no longer operating, if they accept substitution of their water licences for treated coal seam gas water provided by Arrow.	EIS Attachment 5, Section 4.8.1	As discussed in EIS Attachment 5, Environmental Management Plan, Section 4.8.1, Arrow's coal seam gas management strategy proposes substitution of groundwater allocations from the Condamine Alluvium for the duration of the project until the production of coal seam gas water ceases. At the end of the water supply agreement, the third party will revert to utilising their groundwater allocation.
R26087	S123	What is the life of substitution of water allocation and how will this be adapted for any future make good provisions. What is the policy for the company if quality is affected rather than amount if there are any flows from an aquifer of low quality to higher quality?	EIS Chapter 14, Section 14.4	Make good provisions and substitution of allocations will be managed under two separate frameworks. A make good agreement is a requirement of the Water Act 2000 (Qld), and must be in place for bores that are predicted, in the Office of Groundwater Impact Assessment's (OGIA's) Underground Water Impact Report (UWIR), to experience an impaired capacity. Substitution or 'virtual injection' is a proactive measure to supply water to existing groundwater users in the Condamine Alluvium despite the fact that no impaired capacity is predicted by OGIA for this area. Substitution will be managed through water supply agreements. Just as Arrow is required to make good on impaired groundwater supply due to coal seam gas water activities, they are also obligated under the Water Act to make good if the water quality is impaired as a result of coal seam gas activities. For example, in the event that aquifer depressurisation causes groundwater to migrate between aquifers, resulting in changes to groundwater quality, and subsequently impacts on the ability of the groundwater from that bore to be used for a specific purpose. The mechanisms for aquifer interflow are discussed in EIS Chapter 14, Groundwater, Section 14.4.
R26088	S002, S003, S009, S018, S019, S020, S030, S032, S037, S039, S053, S055, S059, S064, S065, S070, S071, S076,	Issues related to substitution and injection of coal seam gas water must be resolved in full consultation with landholders and current groundwater entitlement holders.	–	Noted. Arrow acknowledges the need for the development of water supply agreements between Arrow and each of the third party users. Arrow has undertaken consultation with stakeholders in relation to substitution and recognises that various elements of the water supply agreement may need to be tailored depending on the nature of the business of the end user. Arrow will continue to engage with potential end users to ensure that beneficial use and substitution can be efficiently achieved.
R26089	S153	The SREIS needs to reassess the Coal Seam Gas Water Management Strategy, making reference to current technology in order to reduce the amount of brine produced that requires disposal of or re-use.	EIS Chapter 5, Section 5.2.4 SREIS Chapter 3, Section 3.4.4	As described in EIS Chapter 5, Project Description, Section 5.2.4, Arrow has undertaken a comprehensive assessment to evaluate the various technologies available for the treatment of coal seam gas water and brine. At the time of writing the EIS, reverse osmosis had been selected as the treatment technology of choice; however, Arrow will continue to investigate

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Issue No.	Submission No.	Issue	Reference	Responses
R26089	S153			<p>new and emerging technologies to evaluate their applicability to operations based on economics, energy consumption, brine recovery and environmental footprint of the technology.</p> <p>SREIS Chapter 3, Project Description, Section 3.4.4 describes Arrow's continued preference to utilise desalination via reverse osmosis, as the primary process for water treatment. This preference is based on Arrow's internal engineering assessment of the available technologies that meet Arrow's needs. New and emerging technologies that become available as the project develops will continue to be investigated and may be adopted if proven feasible. Alternative options would be assessed under a separate approvals process if pursued.</p>
R26090	S001, S015, S075, S077, S089, S158, S161	<p>Methods for the precipitation process have not been identified and the processes for brine transformation have not been identified. Selective salt precipitation is highlighted as a management option, but this method does not deal with other chemical by-products. There needs to be greater emphasis on how to deal with the toxic by-products.</p>	-	<p>A number of management options are being considered for the disposal of brine, including selective salt recovery. Arrow is consulting with commercial enterprises to investigate viable opportunities for the beneficial use of brine/salt. As part of this process, Arrow is commissioning selective salt recovery trials to better understand the chemical composition of the brine, identify methods to enhance precipitation of the brine and identify viable chemical processes to transform the brine into commercial products. Any chemical by products that would be produced as a result of such a process would either be addressed under the commercial operator's own environmental authority or would be assessed by Arrow under a separate approval process.</p>
R26091	S001, S022, S025, S066, S083, S134, S137, S158, S161	<p>The EIS identified the use of a reverse osmosis plants to treat water, but there is no clear or practical solution for dealing with the by-products, so it is assumed we will be dealing with liquid brine or salt as a solid after evaporation. Arrow to detail how it will manage the removal, storage and disposal of by-products (including heavy metals and trace elements) of reverse osmosis/water treatment of CSG water as the EIS does not adequately address how to deal with the toxic and chemical by-products related to brine management. The EIS does not deal with salt solids except to a registered landfill at Swanbank. Brine injection into an aquifer is mentioned but no suitable formations have yet been identified. There is a lack of knowledge about the chemistry and amounts of brine to be produced. Citing suitably licensed Landfills in the area belies the scale and nature of the hazardous waste to be generated from this project.</p>	<p>EIS Chapter 26 SREIS Chapter 3, Section 3.7.5</p>	<p>SREIS Chapter 3, Project Description, Section 3.7.5 identifies brine management options as follows:</p> <ul style="list-style-type: none"> • Selective salt recovery at a joint industry facility. • Selective salt recovery at an Arrow-only facility. • Injection into a suitable formation. • Discharge to the ocean. • Disposal to landfill. <p>Other wastes are generated through the reverse osmosis process; these are addressed in EIS Chapter 26, Waste Management. Any chemical by-products that would be produced as a result of a selective salt recovery process would either be addressed under the commercial enterprise operator's own environmental authority or would be assessed by Arrow under a separate approval process. Disposal to suitably licensed waste disposal facilities, while not the preferred option, may be considered should other disposal options not be available.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26092	S036, S092, S124	Is there potential for brine to be disposed of to watercourses? General objection to brine discharge raised for the project, with particular concern to the potential environmental harm to Intensively Farmed Land and black soils.	EIS Chapter 5, Section 5.6.4	Brine will not be discharged to watercourses. EIS Chapter 5, Project Description, Section 5.6.4 describes the process of brine management following reverse osmosis, identifying multiple options, including selective salt precipitation, injection, ocean outfall, or the least preferred option of disposing to a suitably licenced landfill.
R26093	S108	The Geology, Landform and Soils technical report states “Ideally saline material should be stored in landfill –style cells lined with low-permeability clay or other suitable liner”. The submitter has interpreted this to mean that saline material should potentially remain on site.	EIS Chapter 5, Section 5.6.4	EIS Chapter 5, Project Description, Section 5.6.4 describes the process of brine management following reverse osmosis, identifying multiple options, including selective salt precipitation, injection, ocean outfall, or the least preferred option of disposing to a suitably licenced landfill. Brine will be temporarily stored on Arrow owned or leased sites prior to the progression of any of the above management options. The brine dams would meet the intent of ideal storage requirements outlined in the Geology, Landform and Soils technical report. Arrow does not propose permanent disposal of brine ‘on site’. Arrow has committed to excavate any saline material during rehabilitation of coal seam water dams or brine dams and select an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill) (Commitment C073).
R26094	S012, S013, S016, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S164	Concern over legality of both sending brine to an existing waste disposal facility, and constructing evaporation ponds in the gas field area. Is Arrow being allowed to transfer responsibility for the waste product to another company? According to the Environmental Guideline, transferring responsibility for brine management to another entity is not an option. Submitter states that legally, Arrow’s only options are to inject the brine or evaporate to salt, and that they must be responsible for the management of the issues involved. The DERM fact sheet regarding salt and brine management in coal seam gas production states that salt (not including brine) may be directed into a purpose built licensed regulated waste disposal facility on freehold land owned by the coal seam gas operator. The EIS does not specify how salt is to be stored or disposed of, but assumes that all brine concentrate will be trucked to a waste facility at Swanbank. Swanbank is not owned by Arrow.	SREIS Attachment 5	Arrow will not construct or utilise evaporation dams as a method of brine disposal. Although beneficial use is the preferred option for brine management, for the purposes of the EIS impact assessment, it was assumed that brine will be stored in dams and disposed to a suitably licenced landfill, representing a worst-case scenario (in terms of greenhouse gas emissions and traffic generation) for assessment. This worst-case option, disposal to landfill, was found to be manageable. The revised SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, has been informed by the Queensland Government’s Coal Seam Gas Water Management Policy (2012), which acknowledges disposing to a regulated waste facility as an option for the management of brine.
R26095	S069, S141, S144	If the project is to be approved, it must include specific conditions around the management of salt,	–	Noted. Arrow will comply with the conditions of the environmental authority with respect to salt management.

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Issue No.	Submission No.	Issue	Reference	Responses
R26095	S069, S141, S144	including the collection, transportation and treatment of brine, with the view to eliminating any risk of contaminating the soil and water resources.		
R26096	S112, S134, S149, S153	It is very likely brine would be stored in temporary storage dams across the Darling Downs. This would be a ticking environmental time-bomb posing a great risk to farmland, creeks, rivers and groundwater aquifers. The risk of a major flood event flushing this toxic load down the Murray-Darling river system would appear to be very high. Arrow to identify how land use under or adjacent to the brine storage dams is affected and what remediation works or controls to be put in place for brine storage dams. The proposal to store brine in large dams should be rejected and a more-sustainable proposal detailed and offered in the SREIS. Where will the salt be stored while treatment or disposal is undertaken so that there is no chance of it harming the adjacent highly productive land? Arrow to provide detail regarding the long term impacts resulting from brine, heavy metals and trace elements in remaining dams to landholders, council, road reserves or governments owned land.	EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.5	EIS Chapter 5, Project Description, Section 5.6.4 describes the process of brine management following reverse osmosis, identifying multiple options, including selective salt precipitation, injection, ocean outfall, or the least preferred option of disposing to a suitably licenced landfill. As set out in SREIS Chapter 3, Project Description, Section 3.5, the number of water treatment facilities has been reduced from six to two. These facilities are proposed to be co-located with CGPF2 and CGPF9. Each water treatment facility will include two brine dams. Arrow has committed to develop the construction, design and monitoring requirements for new dams (either raw water, treated water or brine dams) and determine the hazard category of the dam in accordance with the requirements of the most recent version of Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EHP, 2012f). Arrow will construct the dams under the supervision of a suitably qualified and experienced person in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141). Design requirements are aimed to prevent overflow during heavy rainfall events and potential seepage to groundwater systems. Arrow has committed to excavate any saline material during rehabilitation of coal seam water dams or brine dams and select an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill) (Commitment C073).
R26097	S108	Addition of salt to the environment is a Commonwealth issue under the Murray Darling Basin Authority Management Plan. Operations within Queensland have an obligation to minimise/restrict salt addition to the catchments. This requires full assessment prior to the approval of the project.	–	Noted.
R26098	S123	Requests a study of how aggregated salt from all Surat projects is disposed of, including a management plan for operational accidents (i.e., transport accidents) and natural disasters. Suggest ocean piping would be best means of disposal if injection was not possible.	–	Arrow recognises the potential for loss of containment of potentially hazardous materials (such as brine) during unloading or transfer for example. Emergency and spill response procedures will be developed and implemented to reduce impacts that could occur as a result of releases of hazardous materials or loss of containment of storage equipment (Commitment C036).
R26099	S066, S079, S139	There is a great danger of increasing surface saline levels which would have many disastrous effects	EIS Chapter 13, sections 13.4.6	Noted. EIS Chapter 13, Agriculture, Section 13.4.6, outlines potential impacts and Section 13.6, highlights how these impacts will be managed. EIS Chapter

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Issue No.	Submission No.	Issue	Reference	Responses
R26099	S066, S079, S139	<p>on agricultural and grazing land. Coal seam water which has a high salt content must not come into contact with soils, as it could permanently contaminate and render the soils sterile. What impact will salt/brine water have on cultivation if spilled? What mitigations are in place?</p>	<p>and 13.6 Chapter 12, Section 12.6.3</p>	<p>12, Geology, Landform and Soils, Section 12.6.3 outlines avoidance, mitigation and management measures that will be implemented for all project activities that have the potential to cause land contamination. Arrow will be required to remediate any contamination caused by project activities. Remediation goals including the identification of proposed land uses will be determined as part of a remediation action plan. Coal seam gas water and brine will be temporarily stored in dams adjacent to water treatment facilities. Arrow has committed to construct dams (including raw water, treated water or brine dams) under the supervision of a suitably qualified and experienced person in accordance with the relevant DERM schedule of conditions relating to dam design, construction, inspection and mandatory reporting requirements (Commitment C141). Arrow will implement a decommissioning and rehabilitation plan in accordance with the dam design plan (Commitment C074). Arrow has committed to excavate any saline material during rehabilitation of coal seam water dams or brine dams and select an appropriate option for management for the material (e.g., treat for reuse, or dispose of in a registered landfill) (Commitment C073).</p>
R26100	S075, S077, S089, S161	<p>The brine management option of disposal to landfill is environmentally irresponsible, as the project development area encompasses flood plains, leading to potential land and water contamination by toxic by-products in the event of a flood. It would be manifestly irresponsible for this project to be allowed to proceed with no satisfactory plan for such a cumulatively large by-product disposal. The final options of brine landfill or pouring the brine into the ocean are environmentally irresponsible.</p>	<p>EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.7.5</p>	<p>EIS Chapter 5, Project Description, Section 5.6.4 describes the management options considered for the disposal of brine. The landfill option was assessed as representative of a worst-case scenario and found to be manageable. It should be noted that suitably licenced landfill facilities would be approved and managed under their own environmental authority conditions to ensure containment of disposed materials under various environmental conditions (including flooding). As described in SREIS Chapter 3, Project Description, Section 3.7.5, the landfill option presented in the EIS remains representative of a worst-case scenario. Further brine management options are still under investigation, and new and emerging technologies will be assessed as the project progresses. Should any of these options (i.e., a selective salt recovery plant, injection or ocean outfall pipeline) be pursued, they will be assessed under a separate approvals process.</p>
R26101	S089	<p>The EIS states that there are no suitable aquifers for brine reinjection. It would be irresponsible to take this option due to the known interconnectivity and possible other interconnectivity of the aquifers in question, particularly after damage sustained in the mining process.</p>	<p>EIS Chapter 5, Section 5.6.4</p>	<p>EIS Chapter 5, Project Description, Section 5.6.4 identifies a range of alternatives for brine management, including selective salt recovery, injection, ocean outfall, and the least preferred option of disposing to a suitably licenced landfill. The Queensland Government's Coal Seam Gas Water Management Policy (2012), identifies disposal by injecting the brine underground as an acceptable brine management option. If brine injection is pursued by Arrow, it will only be once a suitable geological formation has been identified, for which a comprehensive risk assessment has demonstrated that injection will not contaminate the overlying aquifers. Should the option be progressed, it will be assessed under a separate approvals process.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26102	S012, S013, S016, S024, S025, S026, S036, S045, S046, S047, S062, S079, S081, S083, S084, S090, S095, S100, S101, S102, S103, S107, S110, S151, S162, S164	<p>Has the environmental impact of disposing brine at Swanbank been considered in this EIS?</p> <p>To state that brine will be transported to “an existing licensed facility” (Swanbank) is not detailed enough, and Arrow must include more information to make their case.</p> <p>Do any of the relevant specialists environmental impact assessment reports in the Appendices give regard to the feasibility and safety of disposing of these massive amounts of brine at Swanbank?</p> <p>Detailed information on the suitably licensed landfill option has not been provided i.e., how is the salt extracted from the brine dam, what are the specifications of the transport vehicle to the landfill facility etc.</p> <p>Flow on impacts from transporting brine to Swanbank should be considered in the EIS. What are the impacts on rail and road systems, what are the long term impacts from storing brine at Swanbank?</p> <p>The EIS states that all brine concentrate will be trucked to Swanbank. What is the name of the company/facility at Swanbank and where is it located.</p>	<p>SREIS Chapter 3, Section 3.7.5, Chapter 6 and Chapter 12</p>	<p>EIS Chapter 5, Section 5.6.4, presents the brine management options being considered by Arrow. Although beneficial use is the preferred option for brine management, for the purposes of the EIS impact assessment it was assumed that brine will be stored in dams and disposed to a suitably licenced landfill facility, representing a worst-case scenario (in terms of greenhouse gas emissions and traffic generation) for assessment. This landfill option was assessed and found to be manageable. The landfill facility will be listed on the Environmental Management Register in its own right and would be required to operate under the conditions of its own environmental authority. The third party operator would therefore be responsible for the environmental management requirements that are applicable to regulated waste management facilities.</p> <p>As described in SREIS Chapter 3, Project Description, Section 3.7.5, the landfill option presented in the EIS remains representative of a worst-case scenario and assumes disposal to a nominal licensed facility within the region. Potential greenhouse gas and traffic impacts are described in detail in SREIS Chapter 6, Greenhouse Gas Emissions and SREIS Chapter 12, Roads and Transport.</p> <p>Further brine management options are still under investigation, and new and emerging technologies will be assessed as the project progresses. Should any of these options (e.g., a selective salt recovery plant, injection or ocean outfall pipeline) be pursued, they will be assessed under a separate approvals process.</p>
R26103	S112, S134	<p>The EIS does not have an estimate for the salt concentration of the brine. An email provided by Arrow stated 2 to 3% and therefore the total amount of brine estimated to be produced over the life of the project is between 117 million and 175 million tonnes. That equates to 2.9 to 4.4 million B double truckloads of 40 t each, to be trucked through Toowoomba and down the Warrego Highway to Swanbank. What a ridiculous suggestion.</p> <p>The total quantity of salt estimated to be produced over the life of the project is 3.5 million tonnes, that's a lot of salt. The alarming thing is that Arrow has no idea what to do with the salt produced.</p> <p>Arrow to specify how much brine concentrate will be generated by reverse osmosis per year.</p>	<p>EIS Chapter 5, Section 5.6.4 SREIS Chapter 3, Section 3.7.5 Chapter 6 Chapter 12</p>	<p>As set out in EIS Chapter 5, Project Description, Section 5.6.4, a number of management options were considered for the disposal of brine. Disposal to suitably licenced landfill facility was identified as being representative of a worst-case scenario (in terms of greenhouse gas emissions and traffic generation) for assessment. This landfill option was assessed and found to be manageable.</p> <p>As described in SREIS Chapter 3, Project Description, Section 3.7.5, the landfill option presented in the EIS remains representative of a worst-case scenario and assumes disposal to a nominal licensed facility within the region. SREIS Chapter 3, Project Description, Section 3.7.5, provides a revised calculation of the approximate amount of brine to be generated by the project. The revised calculation of average brine volume production (over time) has been used to inform the greenhouse gas and traffic and transport assessments, presented in SREIS Chapter 6, Greenhouse Gas Emissions and SREIS Chapter 12, Roads and Transport.</p>
R26104	S004, S006, S012,	The strategy for brine storage and disposal to	SREIS	Arrow's preference, as set out in SREIS Attachment 5, Coal Seam Gas Water

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Issue No.	Submission No.	Issue	Reference	Responses
R26104	S004, S006, S012, S013, S016, S045, S047, S084, S095, S100, S101, S102, S103, S107, S151, S158, S164	<p>landfill is too vague and relies on too many assumptions. What method is being used to store the brine at Swanbank? EIS does not specify whether the brine is going into dams for evaporation or how the resulting salt is to be stored or disposed of at Swanbank. If ponds are to be used to store the brine at Swanbank, are those ponds subject to overland flow? Is water from these ponds likely to end up in the Bremer River via Bundamba Creek (or Six Mile Creek depending on the location)? If so, how much water/brine is expected to leak from this landfill into local aquifers or Bundamba Creek and then the Bremer River? What is the likely environmental impact? No plan has been suggested, nor any acknowledgement made, for the longevity of the brine and the subsequent storage and security demands, which will become the burden of the community.</p>	Attachment 5	<p>and Salt Management Strategy is to transport brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, the brine can be transformed into commercial products including salts and soda ash. Disposal of brine to landfill is not Arrow's preferred option but it was assessed in the EIS as being representative of a worst case scenario. Should disposal to landfill be progressed, brine will be transported to a third party operated regulated waste facility licensed to accept this material. Such a facility will be listed on the Environmental Management Register in its own right and would be required to operate under the conditions of its own environmental authority. The third party operator would therefore be responsible for the environmental management requirements that are applicable to regulated waste management facilities. Typically, environmental authority conditions for these types of facilities will address appropriate containment of the waste under a range of environmental conditions and the protection of nearby waterways.</p>
R26105	S012, S013, S016, S025, S045, S047, S083, S084, S100, S101, S102, S103, S107, S151, S164	<p>It is clear from the information provided in the EIS that Arrow has at this time no beneficial uses for the brine and that the only brine management option currently available is burial at suitably licenced waste disposal facilities. The EIS has a contradiction, as it says that beneficial use is the preferred option for brine management, but for the purposes of the impact assessment it is assumed that brine will be stored in dams and disposed to a suitably licensed landfill.</p>	EIS Chapter 5, Section 5.6.4 SREIS Attachment 5	<p>As set out in EIS Chapter 5, Project Description, Section 5.6.4, a number of management options were considered for the disposal of brine. Arrow's preference, as set out in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, is to transport brine to a selective salt recovery plant via pipeline for treatment. Using enhanced precipitation and chemical processes, the brine can be transformed into commercial products including salts and soda ash. SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, describes Arrow's investigation of a collaborative approach (with the other coal seam gas proponents in the region) for the development of a selective salt recovery plant for the management of brine. It also describes the further research that has been undertaken to refine the strategy for Arrow to progress this option on its own, which would be assessed under a separate approvals process. Further brine management options are still under investigation, and new and emerging technologies will be assessed as the project progresses. Should any of these options (e.g., injection or ocean outfall pipeline) be pursued, they will be assessed under a separate approvals process.</p>
R26106	S069, S156	What impact will the disposal of coal seam gas water to watercourses have on human health?	SREIS Chapter 9 and Chapter 10	<p>The frequency, volumes and quality of water discharged to watercourses will be within limits prescribed in the conditions of the environmental authority (EA). EA conditions will also address specific condition of the receiving watercourses. EIS Appendix I, Surface Water Part B: Water Quality Impact Assessment, Section 3.3 details the environmental protection objectives for waters in the</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26106	S069, S156			<p>receiving environment of Arrow's operations. These include the objective to ensure the quality and quantity of water emissions does not adversely affect the health, welfare and amenity of people and land uses. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498). These parameters are outlined in the Environmental Protection Act 1994 and the Water Supply (Safety and Reliability) Act 2008, which are set to pose minimal risks to human health and irrigation. An inspection and monitoring program will be implemented to measure the volume and quality of coal seam gas water released to surface waters on a routine basis in accordance with legislative requirements and approved release limits (Commitment C529). Further detailed site-specific surveys have been undertaken at the locations of two potential discharge locations. SREIS Chapter 9, Surface Water, and Chapter 10, Aquatic Ecology, identified the potential impacts following discharge at these locations, and proposed mitigation measures to reduce potential impacts.</p>
R26107	S004, S006, S012, S013, S016, S041, S045, S046, S047, S081, S084, S100, S101, S102, S103, S107, S110, S112, S123, S134, S143, S145, S151, S158, S161, S164	<p>The EIS states that in the event that preferred coal seam gas water management options do not eventuate, the feasibility of an ocean outfall will be evaluated. This level of non-detail, non-data is not acceptable as management of concentrated brine, as the EIS does not adequately describe and assess impacts caused by disposal of treated coal seam water via an ocean outfall pipeline. The disposal to ocean outfall option is fraught with uncertainty and flawed reasoning.</p> <ul style="list-style-type: none"> • Where is the pipeline to go? • What is the proposed route? • What is the environmental and social impact from the pipeline (including flora and fauna)? • What are the proposed off-sets from any damage caused? • What is the evidence that the outfall of the pipeline will not cause a localized increase in salinity within the area of the 'plume'? • Can Arrow provide the expert scientific analysis that shows that environmental values will not be 	<p>SREIS Attachment 5</p>	<p>The feasibility of options as presented in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy will be investigated and the chosen management options detailed in the coal seam gas water management plan for the environmental authority (EA) or EA amendment application. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies in accordance with the EHP Guideline "Application requirements for petroleum activities". Disposal of brine or coal seam gas water to the sea via an ocean outfall pipeline is not the preferred management option. In the event that preferred options are not available, the feasibility of an ocean outfall as an emergency or alternative disposal option for brine or coal seam gas water will be evaluated. If the ocean outfall option is considered feasible and taken forward, a separate EIS will be undertaken, which would include a full impact assessment, details on design, route options and outfall location, discharge and dispersal at the disposal outfall location and appropriate avoidance, mitigation and management measures. The word "outfall" is used to describe a controlled discharge point into the ocean.</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26107	S004, S006, S012, S013, S016, S041, S045, S046, S047, S081, S084, S100, S101, S102, S103, S107, S110, S112, S123, S134, S143, S145, S151, S158, S161, S164	<p>adversely affected by piped ocean outfall of brine solution?</p> <p>Arrow to provide further details regarding disposal of treated coal seam water at sea, including how it will be managed and what standards and controls are in place to prevent impacts to the receiving environment including any monitoring planned.</p> <p>The Ocean Outfall option is deplorable and should not be permitted under any circumstances. Effects of brine disposal on reefs and aquatic communities have been well noted worldwide, particularly in relation to unsatisfactory desalination plant practices.</p> <p>The brine management option of pouring the brine into the ocean is environmentally irresponsible. "Ocean Outfall" should be "Ocean Dumping".</p>		
R26108	S108	<p>Disposal of coal seam gas water to an ocean outfall should not be permitted as it is a waste of water from the Great Artesian Basin and would be contrary to the Murray Darling Basin Plan intentions.</p>	-	<p>Disposal of coal seam gas water to the sea via an ocean outfall pipeline is recognised as a feasible option; however it is not the preferred option. In the event that preferred coal seam gas water management options do not eventuate, the feasibility of an ocean outfall, as an emergency or alternative disposal option for coal seam gas water, will be evaluated. This evaluation will be conducted at the time of detailed design of the field and facilities.</p> <p>If the ocean outfall option is taken forward, a separate environmental impact statement will be prepared, which would include details on design, route options and outfall location, discharge and dispersal at the disposal outfall location and appropriate avoidance, mitigation and management measures to address potential impacts.</p>
R26109	S014, S027, S044	<p>Page 55 of Chapter 5, 'Disposal of coal seam gas water to the sea via ocean outfall pipeline is recognised as a feasible option, however it is not the preferred option. In the event that preferred coal seam gas water management options do not eventuate, the feasibility of an ocean outfall, as an emergency or alternative disposal option for coal seam gas water, will be evaluated.'</p> <p>At Arrow's community information session in Cecil Plains on May 1, 2012, Arrow stated 'we're not going to pump it to the ocean'. When questioned the response was this only related to the brine steam and it was not Arrow's preference or an option they would consider pursuing. If this is the</p>	<p>SREIS Attachment 5</p>	<p>The feasibility of options as presented in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy will be investigated and the chosen management options detailed in the coal seam gas water management plan for the environmental authority (EA) or EA amendment application process. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies in accordance with the EHP Guideline 'Application requirements for petroleum activities'.</p> <p>Disposal of brine or coal seam gas water to the sea via an ocean outfall pipeline is not the preferred management option. In the event that preferred options are not available, the feasibility of an ocean outfall as an emergency or alternative disposal option for brine or coal seam gas water will be evaluated. If the ocean outfall option is taken forward, a separate environmental impact statement will be prepared, which would include details</p>

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Issue No.	Submission No.	Issue	Reference	Responses
R26109	S014, S027, S044	case, the above quoted paragraph should be removed from the EIS and not considered as an option to dispose of coal seam water. The suggestions of an ocean outfall eventuating are highly unlikely.		on design, route options and outfall location, discharge and dispersal at the disposal outfall location and appropriate avoidance, mitigation and management measures to address potential impacts.
R26110	S134	Arrow to provide details regarding volumes and percentages of treated and untreated coal seam gas water to be used for each of the range of proposed disposal options.	SREIS Chapter 2 Chapter 3, Section 3.7.4	As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is possible that the full range of coal seam gas water management options will need to be utilised (distribution, injection and disposal) including: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Disposal to watercourses and the ocean are not preferred options but variability in rainfall between seasons and from year to year and demand for coal seam gas water over time will determine the volumes of coal seam gas water that can be managed through application of the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate how the management options may be utilised at each site. It should be noted that disposal to watercourses and the ocean are only preferable when there is low alternative demand for coal seam water. SREIS Chapter 3, Project Description, Section 3.7.4, presents conceptual water management at the proposed water treatment facilities at CGPF2 and CGPF9. The specific details of options for water and brine management will be developed further through detailed engineering design. Chosen management options will be detailed in the coal seam gas water management plan required for the environmental authority (EA) or EA amendment application described in SREIS Chapter 2, Project Approvals. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies in accordance with the EHP Guideline 'Application requirements for petroleum activities'.
R26111	S001, S026, S036, S081, S146	The Coal Seam Gas Water Management Strategy suggests coal seam gas water disposal to ocean outfall or into local watercourses and brine disposal to ocean outfall. Neither of these options are feasible. Which coastal city would have the pipeline and how could they allow dumping brine into the sea? Dumping coal seam gas water of unknown quality into local streams would be contentious and open to human error. Arrow Energy should be heavily discouraged	EIS Chapter 15, Section 15.6.1 SREIS Attachment 5	The specific details of options for water and brine management presented in SREIS Attachment 5, Coal Seam Gas Water and Salt Management Strategy, will be developed further through detailed engineering design. Chosen management options will be detailed in the coal seam gas water management plan required for the environmental authority (EA) or EA amendment application. The management plan will include detailed coal seam gas water and brine impact assessments and management strategies in accordance with the EHP Guideline 'Application requirements for petroleum activities'. The frequency, volumes and quality of water discharged to watercourses will be within limits prescribed in the conditions of the environmental authority.

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Issue No.	Submission No.	Issue	Reference	Responses
R26111	S001, S026, S036, S081, S146	(through conditioning or risk management obligations) from using disposal to watercourses and ocean outfall as methods of water disposal. The project must not be given approval to proceed until coal seam gas disposal strategies have been determined.		The commitments detailed in EIS Chapter 15, Surface Water, Section 15.6.1 demonstrate how impacts to watercourses will be avoided, mitigated or managed. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498). These parameters are outlined in the Environmental Protection Act 1994 and the Water Supply (Safety and Reliability) Act 2008, which are set to pose minimal risks to human health and irrigation. An inspection and monitoring program will also be implemented to measure the volume and quality of coal seam gas water released to surface waters on a routine basis in accordance with legislative requirements and approved release limits (Commitment C529). Disposal of brine or coal seam gas water to the sea via an ocean outfall pipeline is not the preferred management option. In the event that preferred options are not available, the feasibility of an ocean outfall as an emergency or alternative disposal option for brine or coal seam gas water will be evaluated. If the ocean outfall option is taken forward, a separate environmental impact statement will be prepared, which would include details on design, route options and outfall location, discharge and dispersal at the disposal outfall location and appropriate avoidance, mitigation and management measures to address potential impacts.
R26112	S012, S013, S016, S024, S025, S026, S036, S041, S045, S047, S054, S069, S075, S077, S081, S083, S084, S095, S100, S101, S102, S103, S107, S123, S134, S145, S146, S151, S156, S158, S162, S164	Since injection isn't even at the trial stage yet, and substitution of allocation is not a very appealing option to end users, it appears quite likely that disposal to watercourses is a very likely water management option. This presents serious environmental issues on a number of levels including impacts to watercourses, water quality and surface water users to name a few. Arrow to provide further details regarding disposal of treated coal seam water to watercourses, including how it will be managed and what standards and controls are in place to prevent impacts to the receiving environment. Provide details of the waterways which may receive coal seam gas water, the possible volumes and potential direct and indirect impacts on aquatic fish habitats, waterways and aquatic species within the	SREIS Chapter 3, sections 3.5, 3.7.4, Chapter 9, Chapter 10 and Chapter 11	As described in SREIS Chapter 3, Project Description, Section 3.7.4, within the Surat Basin, it is expected that the full range of coal seam gas water management options will need to be utilised, they are: <ul style="list-style-type: none"> • Distribution to existing and new users for beneficial use, including via watercourses forming part of manage schemes. • Injection into a suitable aquifer. • Disposal to watercourses and/or the ocean under defined conditions. Variability in the demand for coal seam gas water over time, and in rainfall between seasons and from year to year will determine the volumes of coal seam gas water that can be managed by the identified options. Water demand, land use, weather, watercourse type and morphology, and aquatic ecosystems at the two identified water treatment facility sites will dictate the management options that can be utilised at each site. Disposal to watercourses will be considered in the event that beneficial uses of coal seam gas water are temporarily unavailable, beneficial use approvals are not granted, significant or prolonged wet weather events occur or the demand for water decreases and alternative disposal options are required to

Table 19.26 Coal Seam Gas Water and Salt Management Strategy

Issue No.	Submission No.	Issue	Reference	Responses
R26112	S012, S013, S016, S024, S025, S026, S036, S041, S045, S047, S054, S069, S075, S077, S081, S083, S084, S095, S100, S101, S102, S103, S107, S123, S134, S145, S146, S151, S156, S158, S162, S164	project area.		<p>maintain dam integrity and safety. The commitments detailed in EIS Chapter 15, Surface Water, Section 15.6.1 demonstrate how impacts to watercourses will be avoided, mitigated or managed. Arrow has committed to develop a strategy for the discharge of coal seam gas water to watercourses in accordance with relevant legislation. The strategy will incorporate a water quality monitoring program with locations upstream and downstream of the discharge point to inform site specific water quality objectives. A detailed environmental flows assessment informed by water quality monitoring data and an aquatic ecology monitoring program will inform the discharge strategy. Periodic inspections of the physical form and hydrology of the watercourse are to be incorporated in the strategy to monitor geomorphic performance (Commitment C498). These parameters are outlined in the Environmental Protection Act 1994 and the Water Supply (Safety and Reliability) Act 2008, which are set to pose minimal risks to human health and irrigation. An inspection and monitoring program will also be implemented to measure the volume and quality of coal seam gas water released to surface waters on a routine basis in accordance with legislative requirements and approved release limits (Commitment C529).</p> <p>The frequency, volumes and quality of water discharged to watercourses will be within limits prescribed in the conditions of the environmental authority (EA). The EA conditions will also address the specific condition of the receiving watercourses.</p> <p>Arrow has identified two proposed discharge locations, as described in SREIS Chapter 3, Project Description, Section 3.5. Extensive site-specific field surveys were undertaken to assess baseline conditions at the proposed discharge locations as described in SREIS:</p> <ul style="list-style-type: none"> • Chapter 9, Surface Water. • Chapter 10, Aquatic Ecology. • Chapter 11, Terrestrial Ecology.
R26113	S150, S156	<p>EIS states 'At this stage it is anticipated that discharge to watercourses will only be conducted under emergency situations.' What would be considered an emergency situation? It is unacceptable for coal seam gas water to be washed away in floods, or released to the wider environment for emergency disposal.</p>	<p>SREIS Chapter 3, Section 3.7.4</p>	<p>As described in SREIS Chapter 3, Project Description, Section 3.7.4, discharge to watercourses may occur either during normal operations or in emergency situations. In all cases, the frequency, volumes and quality of water discharged to watercourses will be within limits prescribed in the conditions of the environmental authority (EA). The EA conditions will also address the specific condition of the receiving watercourses.</p>

Supplementary Report to the Surat Gas Project EIS
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