



Report for **ARROW Energy Major Pipelines**

Water Availability Study



ABP No: 08-GHD-02-0002

REV 0



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1. Introduction

1.1 Project Overview

The Arrow Bowen Pipeline (ABP) is a proposed gas pipeline that will form part of Arrow Energy's pipeline network to deliver coal seam gas from its gas fields in the Bowen and Surat Basins to a proposed LNG facility located on Curtis Island near Gladstone.

The pipeline construction will comprise approximately 600 km of buried high-pressure steel gas transmission pipeline, up to 1,050 mm (42") in diameter, with the proposed main pipeline alignment shown on Figure 1-1.

1.2 Purpose and Scope of this Report

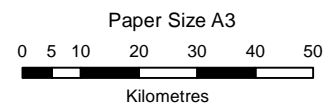
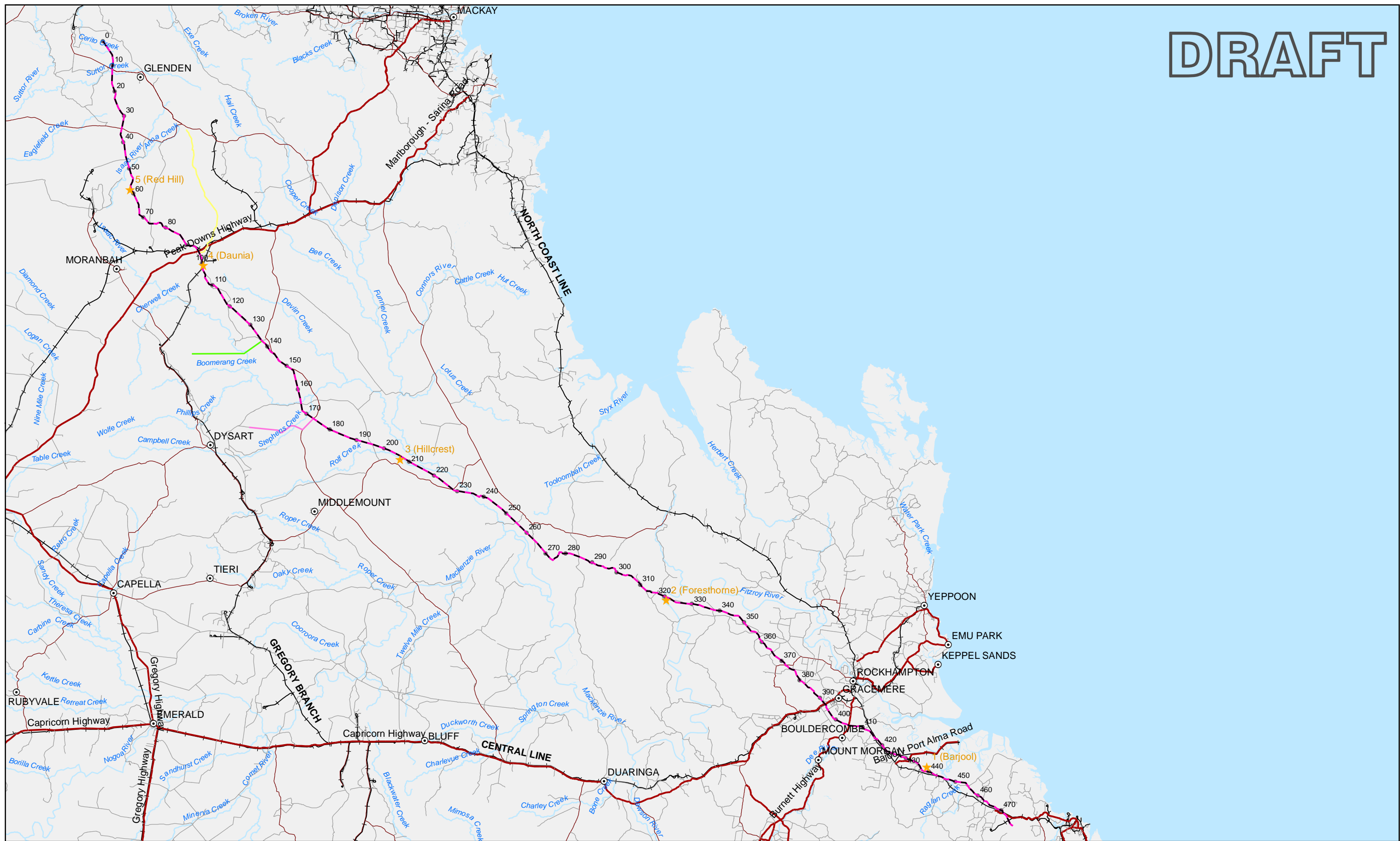
Arrow Energy engaged GHD to provide preliminary engineering services associated with the environmental impact assessment process for the ABP. The scope of work includes a Water Availability Study to assess the potential water supply requirements and sources during construction of the ABP. This report presents the outcomes of the Water Availability Study, and includes determination of:

- ▶ The location and nature of water demands related to construction and commissioning of the pipeline, including hydrostatic pressure testing;
- ▶ Volumetric and temporal distribution of likely potable and raw water demands relating to construction;
- ▶ Water supply sources available along the proposed pipeline route and to construction camp sites; and
- ▶ Identification of those entities responsible for relevant water sources, as well as any issues and approval mechanisms associated with obtaining access to water resources.

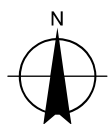


Figure 1-1 Proposed Arrow Bowen Pipeline Route

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Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



- ★ Proposed Camp
- ⊙ Populated Place
- ABP Mainline KP
- ABP Mainline Rev D
- ABP Lateral Elphinstone Rev D
- ABP Lateral Dysart Rev D
- ABP Lateral Saraji Rev D
- Principal Road
- Secondary Road
- Minor Road
- Rail
- Major Watercourse
- Watercourse Area



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Arrow Energy
ABP Water Availability Study

Locality Map

Job Number | 41-24306
Revision | A
Date | 08 Sep 2011

Figure 1-1



2. ABP Construction Delivery Information

The following details relating to the proposed construction program and associated water supply requirements were provided by Arrow Energy for use in this assessment.

2.1 Construction Programme

A preliminary programme for construction of the ABP has been provided and is included in Appendix A, with a summary provided in Table 1.

Table 1 ABP Construction Programme

Activity	Timing	Description
Preparation of Pipe Stockpile Areas	July-Dec 2015	Anticipate receipt of pipe onsite to commence September 2015.
ABP Construction Programme	April 2016 - July 2017	Construction activities include:
Section 1 Construction	April - Oct 2016	<ul style="list-style-type: none"> ▶ Clear and Grade ▶ Stringing ▶ Bending ▶ Welding ▶ Lower-in/backfill ▶ Rehabilitation
No work during wet season	Nov 2016 - March 2017	
Section 2 Construction	Aug 2016 – Jul 2017	
ABP Testing	June 2016 – Dec 2017	Testing and Commissioning activities include:
Section 1 Commissioning	June 2016 – July 2017	<ul style="list-style-type: none"> ▶ Hydrostatic testing/ Clean & Dry ▶ Cut-in mainline valves ▶ Pipeline commissioning
No work during wet season	Nov 2016 - March 2017	
Section 2 Commissioning	April 2017 – Dec 2017	

2.2 Construction Camp Locations

It is anticipated that the construction workforce will be accommodated in temporary camps located near the pipeline route on neighbouring rural properties. Five preliminary construction camp locations along the proposed pipeline route have been identified by Arrow Energy. Camps are to be located close to the construction Right of Way (ROW) to limit both travel times and the impacts of construction personnel on surrounding communities.

The construction camps will be fully self-contained and include:

- ▶ Accommodation;
- ▶ Ancillary facilities for personnel; and



- ▶ Construction support requirements including offices, line pipe laydown/stockpile sites, workshops and storage areas.

Summary details of the proposed camps are given below and it is expected that the workforce will be split between two adjacent camps. Each camp is expected to be in operation for about eight to ten weeks, representing two construction cycles, depending on the rate of progress.

Table 2 Proposed ABP Construction Camps

Camp	Adopted Details	Description
No. of camps	5	▶ To be located close to pipeline construction ROW
Total personnel to be accommodated in each camp	690	<ul style="list-style-type: none"> ▶ Assume critical case is construction crew located at one camp only ▶ Each camp is operational for 2 cycles
Camp locations	<ul style="list-style-type: none"> ▶ 5 (Red Hill) ▶ 4 (Daunia) ▶ 3 (Hillcrest) ▶ 2 (Foresthorne) ▶ 1 (Bajool) 	▶ Refer Figure 1-1 and Table 5



3. Water Supply Requirements

Water will be required during construction to supply camp facilities, personnel consumption and pipeline construction activities. Potable water will be sourced to supply camp facilities and personnel requirements, with non-potable water used to meet particular construction requirements including dust suppression, vegetation management and hydrostatic pressure testing of the pipeline.

Based on the identified allowances, potable water supply represents approximately 20% of the total water supply requirements. The remaining demand is due to construction activities and hydrostatic testing requirements, representing approximately 48% and 32% of the demand respectively.

3.1 Potable Water Demands

Arrow Energy has completed preliminary assessment of total potable water requirements for the construction camp supply requirements. The potable water supply allowances estimated for the construction camps are summarised in Table 3 below.

Table 3 Potable Water Demands – Construction Camp Supply

Activity	Allowance	Description/Assumptions
Unit Demand Water Usage	250 L/EP/day	Assumed per capita usage for all camp facilities.
Daily Water Use	200 kL/day	Total daily use for two camps. Based on up to 400 personnel being accommodated at each camp.
Total Water Use at each Camp	12.8 ML	Based on each camp being operational for two construction cycles, with a total construction phase of 320 days.
Total Camp Water Usage	64 ML	For total construction duration

For the purposes of this assessment, it is assumed that potable water only will be utilised to meet all construction camp water demands. While there may be some opportunity to substitute some of the camp water demand with non-potable water supplies, this will be dependent on the availability, location and quality of the raw water supply source. Provision of a potable and non-potable supply at the camp will also result in additional water management and dual infrastructure requirements to ensure the risks associated with supplying potable and non-potable water are appropriately mitigated and controlled.

Allowances for vehicle wash-down facilities associated with weed management will be located at the construction site and be supplied directly from water trucks prior to return to the camp sites. This water volume is included in the daily construction activity (non-potable) water allowances.



3.2 Potable Water Supply Options

There are three main options for the supply of water from potential sources to the construction camps, being:

- ▶ Purchase water from an existing potable water service provider and transport water by a new pipeline to the camp;
- ▶ Provide a package treatment plant to treat water from a non-potable water source for camp usage; and
- ▶ Purchase water from an existing potable water service provider and transport water by vehicle to the camp.

Establishing new trunk infrastructure for the purposes of camp supply is not likely to be cost-effective given the relatively short duration of construction camp operation and the relatively large cost of establishing the required infrastructure.

Additionally, with respect to the treatment option, there is still the issue of obtaining the non-potable supply. Given the relative locations of potable and non-potable water sources identified for the camps (refer to sections 4.1 and 5.2 respectively), the benefit of transporting non-potable water and then providing treatment at a dedicated water treatment plant compared with transporting potable water is unlikely to prove cost effective.

As such the transportation of already treated water is the identified approach to supplying the potable water demands of the construction camps. Notwithstanding the above, consideration should be given to opportunities for potable water substitution or on-site treatment once the availability and ease of access to raw water supply is confirmed.

3.3 Non-potable Water demands

Non-potable water is adequate for most construction phase activities not related to the camps and to conduct hydrostatic testing along the pipeline. Arrow Energy provided nominal allowances to be used in the assessment of non-potable water requirements and these have been summarised in Table 4.

Table 4 Non-Potable Water Demands – Pipeline Construction

Activity	Allowance	Description
Construction Water Demand	500 kL/day	Daily volume to provide dust suppression, vehicular washing and miscellaneous water use during construction.
Total Construction Water Usage	150 ML	Total construction allowances.
Hydrostatic Pressure Testing	100 ML	Based on approx. 100 km of pipeline being filled with water at any one time.
Total Non-Potable Water Usage	250 ML	For total construction duration



3.4 Non-potable Water Supply Options

Non-potable water supply will need to be obtained from an existing non-potable water service provider or existing landholder with available allocations. The primary options for conveying non-potable water from the identified source locations to the pipeline include:

- ▶ Transport water by vehicle to the construction site; or
- ▶ Provide new pipe infrastructure to deliver water to the site.

The establishment of new trunk infrastructure is not considered a cost-effective method given the regular movement of the construction site and the relatively large cost of establishing the required infrastructure.

As such, vehicular transportation of raw water is the identified approach to supplying the non-potable construction water demands. It is expected that most daily construction water use will be supplied directly from water trucks dedicated to carting and maintaining the non-potable water supply requirements. In the case of water for hydrostatic pressure testing, some form of short term storage may be required due to the volumes required.



4. Potable Water Availability

4.1 Identification of Potable Water Supply Sources

Potable water will be sourced from local reticulated water supplies where available. A review of existing potable water supplies in the vicinity of each proposed camp location is summarised below:

Table 5 ABP Construction Camp - Potable Water Supply Assessment

Camp	Chainage (km)	Local Government Authority	Nearest Town with Water Supply?	Distance to Potable Water Supply (km)
5 (Red Hill)	57	Isaac	Moranbah is south of the camp	28
4 (Daunia)	100	Isaac	Moranbah is west of the camp	35
3 (Hillcrest)	215	Isaac	Middlemount is south-west of the camp	48
2 (Foresthorne)	324	Rockhampton	Marlborough is located south of the camp however this only has a small non-potable water supply. Potable water supply from Rockhampton required.	75
1 (Bajool)	424	Rockhampton	Bouldercombe is west of the camp however the town only has a small population of 1,300 and no reticulated water supply. Rockhampton is approximately 28 km north-north-west of the camp, with potable water supply required from here.	28

4.2 Isaac Regional Council – Camps 3-5

Camps 3 (Hillcrest), 4 (Daunia) and 5 (Red Hill) are located in the Isaac Regional Council Local Government Area (LGA).

For Camps 4 and 5 (Daunia and Red Hil), potable water supply will be required to be trucked in from the township of Moranbah. Moranbah has a population of approximately 8,000 people who service a number of mines in the region. It is noted that the Urban Land Development Authority (ULDA) has identified a large development area south-west of the existing town to meet future expansion of the local mining operations.

For Camp 3 (Hillcrest), potable water supply will be required to be trucked to the proposed construction camp location from Middlemount. Middlemount is located approximately 242km south-west of Mackay and has a population of approximately 2,000, which services local mining operations at the German Creek and Foxleigh coal mines.

Isaac Regional Council currently provides occasional potable water supply for a range of demands throughout Central Queensland, with approximately 100 ML/annum supplied via a number of standpipe locations throughout Council's water supply network.

Preliminary discussions with Isaac Regional Council indicated there are existing standpipes in both Middlemount and Moranbah that would be capable of providing 200 kL/day to meet potable water



demand at the proposed camp locations. The current water price supplied from the standpipe locations is \$10.50/kL.¹

4.3 Rockhampton Regional Council

Camps 1 (Bajool) and 2 (Foresthorne) are located in the Rockhampton Regional Council LGA. Given the proposed camp locations along the pipeline route, potable water supply will need to be trucked into each camp from the Fitzroy River Water Scheme servicing Rockhampton. This supply is located approximately 30 km north and 75 km south-east of Camps 1 and 2 respectively.

Given the considerable distance between Camp 2 and the identified potable water supply source and the site's proximity to the Fitzroy River, the possibility of substituting part of the camp water supply with non-potable supply at this location is identified as a potential opportunity. It is noted that the duration of camp operation is relatively short, being 8-10 weeks. Given the additional effort to manage dual reticulation infrastructure with a mixed potable and non-potable supply and obtaining a raw water allocation at this location, this option was not considered to be a viable alternative compared with the transport of potable water supply to this location.

Preliminary discussions with Fitzroy River Water identified that short term potable water supply is available for purchase through the hire of access to a standpipe. Water can be drawn from fire hydrants at a number of locations throughout the network to meet the camp supply demands (200 kL/day). Provision for multiple standpipes may facilitate more efficient delivery to the camp locations. The costs in Table 6 were provided by Fitzroy River Water for potable water supply.

Table 6 Potable Water Supply Costs

Activity	Allowance	Description
Hire of Standpipe	\$1,500	Deposit for each standpipe
Monthly Standpipe Hire Charge	\$63.50	Monthly Hire Charge
Weekly Standpipe Hire Charge	\$25	Weekly charge or part thereof
Potable Water Supply	\$2/kL	Cost per kL of supplied water

4.4 Alternate camp locations – opportunity for reticulated water supply connection

The location of construction camps within existing townships has been avoided to minimise construction impacts to the surrounding areas. However from a potable water supply perspective, there are a number of towns that may have existing potable water supply capacity to accommodate the requirements of the construction camps. These include the townships of:

- Glenden;

¹ Phone conversation with Executive Director of Commercial Services, Isaac Regional Council, on 5 September 2011.



- ▶ Moranbah;
- ▶ Middlemount; and
- ▶ Rockhampton.

Glenden, Moranbah and Middlemount predominantly service local mining operations and have existing shortages in availability housing and short term accommodation facilities. It is assumed these towns do not have adequate housing stock to accommodate construction personnel within existing residences or accommodation services, i.e. caravan parks, hotel/motels.²

As such, provision of temporary accommodation facilities and associated service infrastructure is likely to still be required if the construction camps are to be located closer to existing townships, with the only advantage being reduced transportation distances from supply sources to the camp.

4.5 Camp Requirements

Potable water trucked into the construction camps will be discharged into storage tanks. The reticulated potable water supply network within each camp will be supplied from the storage tank via a booster pump arrangement providing adequate flow and pressure to the network. It is possible that reserve capacity in the storage tank and a hydrant booster pump may be required for emergency fire supply provision. This assessment will be completed as part of building services.

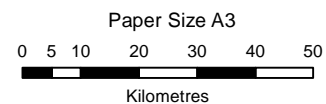
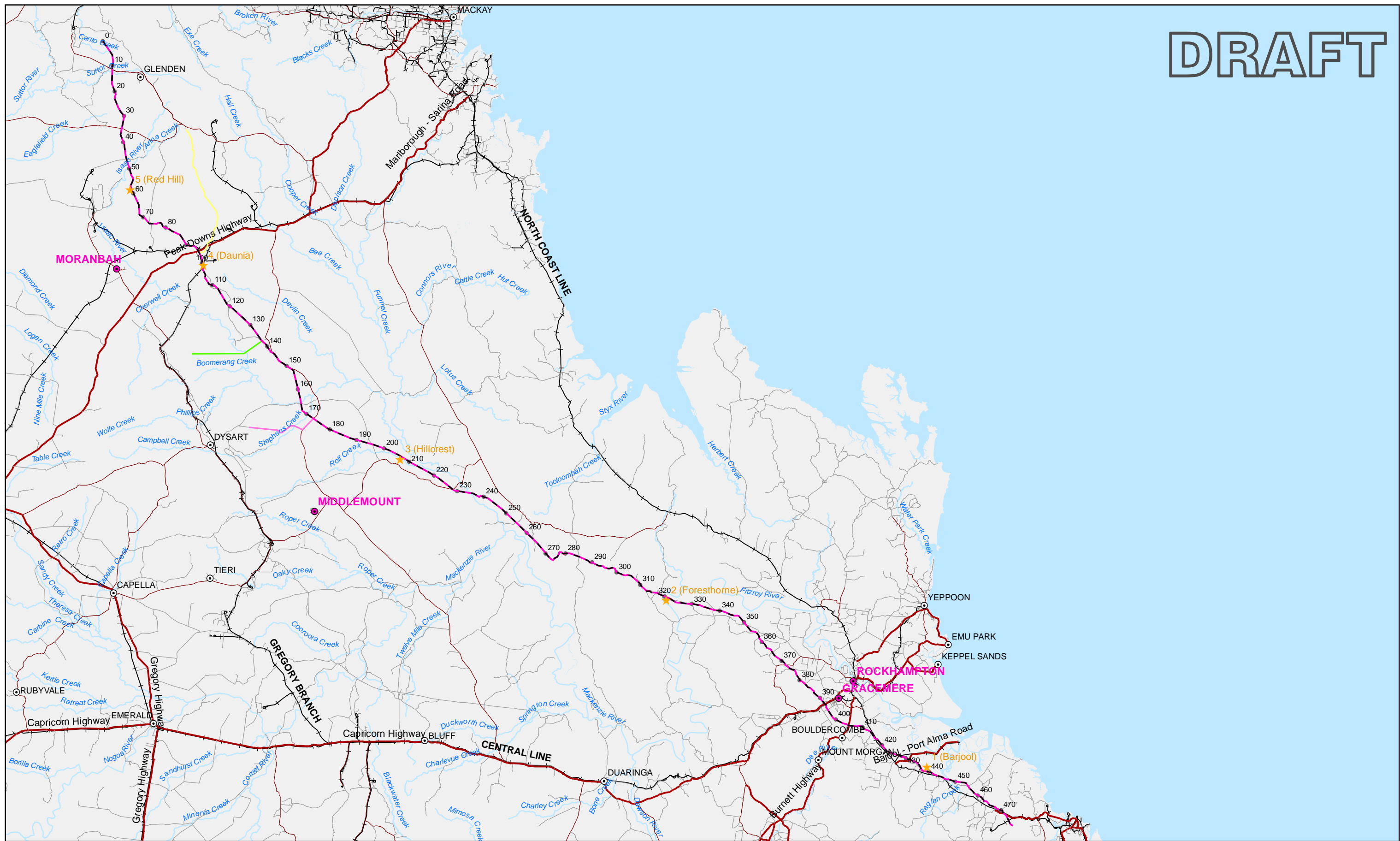
Depending on camp utilisation, demountable facilities and temporary water supply infrastructure will be able to be re-located and re-established at a number of camp locations as construction progresses. These camps are to be fully self-contained with an on-site wastewater treatment facility and disposal system identified as part of waste management requirements.

² This assumption is reinforced by Arrow Energy's firsthand experience in trying to secure even limited numbers of accommodation units in these locations during 2011.

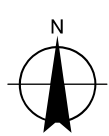


Figure 4-1 Potable Water Resources and Construction Camp Locations

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Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



- ★ Proposed Camp
- Populated Place
- Water Source
- ABP Mainline KP
- ABP Mainline Rev D
- ABP Lateral Elphinstone Rev D
- ABP Lateral Dysart Rev D
- ABP Lateral Saraji Rev D
- Principal Road
- Secondary Road
- Minor Road
- Rail
- Major Watercourse
- Watercourse Area



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Arrow Energy
ABP Water Availability Study

Potable Water Supply Source Locations

Job Number | 41-24306
Revision | A
Date | 08 Sep 2011

Figure 4-1



5. Non-potable Water Supply

As identified in Section 3.3, non-potable water supply for construction activities includes allowances for dust suppression, weed management, vehicle wash-down and hydrostatic pressure testing of the pipeline.

5.1 Non-potable Water Supply Requirements

The following sections outline the likely supply and delivery configuration requirements associated with the broad construction water demand categories.

5.1.1 Construction Activities

A total non-potable water allowance of 150 ML has been identified for construction activities along the pipeline. Construction activities will include dust suppression, welding, joint coating and vehicular wash-down as part of weed management, with potential ancillary use associated with pipe backfill.

Water supply for construction activities will be provided directly from water trucks, with trucks filled from non-potable raw water sources along the pipeline route including bores, dams, watercourses and piped raw water supplies.

No provision of storage along the pipeline has been identified for this water, and it will be sourced and used on an “as needs” basis.

5.1.2 Hydrostatic Pressure Testing

Hydrostatic pressure testing will be completed prior to commissioning the pipeline to verify the integrity of the pipeline and to confirm its ability to operate at the maximum allowable operating pressure. About 100 ML of non-potable water will be sourced from existing supplies to meet testing requirements.

The testing process includes a first flush ‘slug’ of water being used to clean the pipeline prior to pressurisation, which is subsequently discharged. This will generally be disposed of as wastewater into a lined temporary evaporation pond to concentrate any residues for disposal. Pressure testing will be undertaken in test sections with up to 100 km of pipeline being filled with water at any one time, with the opportunity to transfer water from section to section several times before it becomes unusable or limited by other factors.

5.2 Non-potable Water Resource Locations

Identifying adequate water resources spatially distributed along the proposed pipeline route will aid efficient construction of the pipeline as water transportation has the potential to become a considerable cost to project delivery. The following sections describe the local water resources identified along the ABP route and these are shown on Figure 5-1 to Figure 5-3.

5.2.1 SunWater Infrastructure and Water Resources

SunWater operates a number of water supply schemes providing water to mines, towns and rural consumers throughout Central Queensland. Preliminary discussions were held with SunWater to discuss



potential availability of short term allocations to meet the construction pipeline non-potable water requirements.³

Discussions with SunWater were based on the following non-potable supply demands for the ABP construction phase:

- ▶ Construction activities are planned to start in April 2016 and to complete in July 2017.
- ▶ Total water need is in the order of 250ML, comprising:
 - 150ML for construction; and
 - 100ML for hydrostatic testing.

The pipeline route was reviewed with respect to existing and planned SunWater or dedicated pipelines. Table 7 identifies sections of the pipeline relative to SunWater-owned and operated pipelines or regulated streams.

5.2.2 Additional Raw Water Sources

The pipeline location can be serviced to a large extent via SunWater-controlled infrastructure. However, other non-potable water sources may provide a better servicing outcome for the construction demands due to proximity, cost or phasing. A review of these water sources is included in Table 7.

The water demand amounts identified in Table 8 correspond to the potential water requirement based on the source's proximity to the construction site. These sources have been limited to a nominal maximum transportation distance of 50 km. Alternative sources may overlap and the best solution will need to be determined based on issues such as cost, available capacity, ability to garner an allocation agreement and access to the resource.

³ Meeting with Manager Sales and Marketing, SunWater on 6 September 2011.



Table 7 SunWater Pipelines and Potential Service Requirements

Raw Water Pipeline	Description	Proximity to ABP	Potential length and chainage to be serviced	Potential Non Potable Water Demand ⁴
Newlands Pipeline	Existing pipeline with a single client being serviced, also supplies the township of Glenden. Water source is the Bowen River Weir and Gattonvale Offstream Storage.	Crosses pipeline route at AB12 ⁴ .	60km; AB0 – AB60	19ML + 50ML
Burdekin Moranbah Pipeline (BMP)	Existing pipeline, runs parallel to the Eungella Pipeline for a section, supplies the Moranbah township and surrounding mine sites. Sourced from the Burdekin Falls Dam.	Crosses pipeline route at AB27. Runs parallel within 2 km of the route between AB24 and AB37. Within 15 km of route between AB37 and AB68.	75km; AB0 – AB75	24ML + 50ML
Eungella Water Pipeline	Existing pipeline, runs parallel to the BMP for a section, supplies the Moranbah township and surrounding mine sites. Sourced from the Eungella Dam.	Crosses pipeline route at AB27. Runs parallel within 2 km of the route between AB24 and AB37. Within 15 km of route between AB37 and AB68.	75km; AB0 – AB75	24ML + 50ML
Eungella Water Pipeline Eastern Spur Pipeline	Existing pipeline, delivery from Moranbah to Coppabella. Sourced from the Eungella Dam.	Within 15km of route between AB68 and AB90. Runs parallel to route between AB90 and ~AB95.	85km; AB45 – AB130	27ML + 50ML

⁴ Allowance of + 50ML at some locations are preferred locations for hydro'test water supply. These are nominated at locations in close proximity of the pipeline alignment. Actual hydro'test water volume requirements at each location will be dependent on the testing regime and source locations adopted.

⁴ AB12 represent a point on the ABP 12km from the start of the pipeline



Raw Water Pipeline	Description	Proximity to ABP	Potential length and chainage to be serviced	Potential Non Potable Water Demand ⁴
Eungella Pipeline Southern Spur Pipeline	Existing pipeline, delivery from Moranbah to mine sites north of Dysart. Sourced from the Eungella Dam.	Largely runs parallel 40 km west of the pipeline route between AB95 and AB160.	65 km; AB95 – AB160	20ML
Eungella Pipeline Southern Spur Pipeline Duplication	Proposed duplication of the Southern Spur from Moranbah to Saraji. Sourced from the Eungella Dam.	Largely runs parallel 40 km west of the pipeline route between AB95 and AB160.	65 km; AB95 – AB160	20ML
Connors River to Moranbah Pipeline	Proposed pipeline currently planned for construction in 2015 (and therefore may be operational when the ABP is being constructed). Sourced from the Connors River Dam.	Follows the Eungella Pipeline Southern Spur Pipeline route in the vicinity of the pipeline, running parallel to route between AB90 and ~AB95.	85 km; AB45 – AB130	27ML + 50ML
Saraji Pipeline	Existing pipeline transferring water from the Nogoia Mackenzie Water Supply Scheme to Norwich Park, Saraji, Peak Downs and German Creek mines, and towns including Dysart and Middlemount.	This pipeline and lateral connections are within 40 km of the pipeline between ~AB170 and ~AB250.	120 km; AB130 – AB250	38ML
Middlemount Pipeline	Proposed pipeline from Bingegang Weir to Middlemount, currently under investigation.	Middlemount is the closest point to the ABP route and is ~30 km south of the pipeline at around AB200.	30k m; AB185 – AB215	9ML
Stanwell Pipeline	Existing pipeline from the Lower Fitzroy Water Supply Scheme to the Stanwell Power Station.	Crosses pipeline route at AB387. Within 15 km of route between AB370 and AB400.	70 km; AB350 – AB420	22ML + 50ML



Table 8 Raw Water Sources and Potential Service Requirements

Raw Water Pipeline	Description	Proximity to ABP	Potential length and chainage to be serviced	Potential Non Potable Water Demand ⁵
Isaac River	The Isaac River and tributaries are part of the Fitzroy Basin. Groundwater or river extraction is licenced by DERM. Water resource to be obtained from existing allocation holders via the water market.	The Isaac River is crossed by the ABP route at AB50, AB165 and AB235, and generally flows parallel to the pipeline.	200 km; AB50 – AB250	63ML + 50ML
Nogoa Mackenzie Water Supply Scheme	The Nogoa Mackenzie Water Supply Scheme supplies predominantly agricultural and mining water requirements around Emerald and along the Mackenzie River. SunWater manages this water supply scheme as a regulated supply and is able to trade its allocations via the water market.	The Tartarus Weir is just 2 km from the pipeline at AB260, and within 30 km of the ABP route between AB250 and AB275.	45 km; AB240 – AB285	14ML + 50ML
Lower Fitzroy Water Supply Scheme	The Lower Fitzroy Water Supply Scheme extends from the Fitzroy Barrage to the Eden Bann Weir. The scheme primarily services the Stanwell Power Station as well as agricultural and riparian allocation holders along the Fitzroy River. SunWater manages this reach of the Fitzroy River as a regulated supply and is able to trade its allocations via the water market.	The ABP crosses the Fitzroy River at the Fitzroy Barrage which corresponds to the upper extent of SunWater's scheme. This is located at AB320, with the pipeline within 10 km of the scheme extents between AB310 and AB350.	100 km; AB280 – AB380	31ML + 50ML
Fitzroy River	The Fitzroy River and tributaries are part of the Fitzroy Basin. River and groundwater extraction is licenced by DERM, and water may be able to be obtained from existing allocation holders via the water market. Alternatively, customers could be approached directly. Downstream reaches of the Fitzroy River	The Fitzroy River flows predominantly parallel to the pipeline from AB370 to AB415, and is within 20 km of the ABP route.	85 km; AB350 – AB435	27ML

⁵ Allowance of + 50ML at some locations are preferred locations for hydrotest water supply. These are nominated at locations in close proximity of the pipeline alignment. Actual hydrotest water volume requirements at each location will be dependent on the testing regime and source locations adopted.



Raw Water Pipeline	Description	Proximity to ABP	Potential length and chainage to be serviced	Potential Non Potable Water Demand ⁵
	may potentially be brackish or saline.			
Raglan Creek	Raglan Creek is a creek approximately 20 km northwest of Mt Larcom and flows north to the Coral Sea. Waterway and groundwater extraction is licenced by DERM, and water may be able to be obtained from existing allocation holders via the water market. Downstream reaches of Raglan Creek will be saline.	The ABP crosses Raglan Creek at ~AB445.	50 km; AB420 – AB470	16ML + 50ML



5.3 Accessing Rights to Non-potable Water Resources

A range of potential non-potable water resources have been identified in Section 5.2. Agreement to utilise a combination of the identified sources will be required to enable reliable access to suitable quality water during the construction phase. The selection of resources will need to take into account factors including:

- ▶ Available capacity and reliability to accommodate the identified water demands;
- ▶ Willingness from the water allocation owner to lease the necessary water rights during the construction phase;
- ▶ Costs to obtain access and water pricing;
- ▶ Appropriate water quality for use at the construction site;
- ▶ Proximity to the construction sites; and
- ▶ Accessible take-off points at the source and adequate transportation route to the site.

Of the available resource types, the hierarchy of preferred available water sources in terms of surety of supply is generally as follows:

- ▶ High priority water allocations – These allocations are generally tied to existing infrastructure including pipelines and some regulated rivers. Available capacity and willingness to lease individual allocations will need to be determined.
- ▶ Medium priority water allocations – This could potentially be SunWater in the case of some regulated rivers. Fitzroy River Water is also potentially a source for medium priority water allocations.
- ▶ Temporary Transfers – Purchasing allocations at the required time from the water market as opposed to leasing the water in advance. This would be subject to price fluctuations and demand at the time of construction.
- ▶ Individual customer arrangements – Generally would comprise relatively informal agreements to allow access to water allocations from landholders.

SunWater is the asset owner and is responsible for operating the various resources outlined in Table 7. Generally rights to water resources are assigned to the parties for which the assets were originally established. Accordingly, agreement to use water resources will be primarily dependent on the following:

- ▶ Ability to access water resources from SunWater or associated subsidiary assets;
- ▶ Available supply capacity during the relevant construction period; and
- ▶ Acceptance from the relevant customers or stakeholders to allow reallocation of resources.

SunWater has advised that it will assist in facilitating negotiated access to water resources for SunWater-operated infrastructure. To ascertain the water supply take-off locations, resource availability and relevant contacts for negotiating access needs to be determined. To this end, SunWater has advised that a Water Options Study is required to set out this information, which would be undertaken internally by SunWater staff. It is recommended that this study be commissioned to provide greater detail on available sources and facilitate further development of the water resourcing strategy for the ABP construction phase.

It is noted that a separate agreement to obtain an allocation must be undertaken for each separate pipeline or regulated stream, irrespective of the customer. However an allocation can be sourced



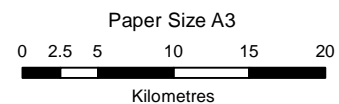
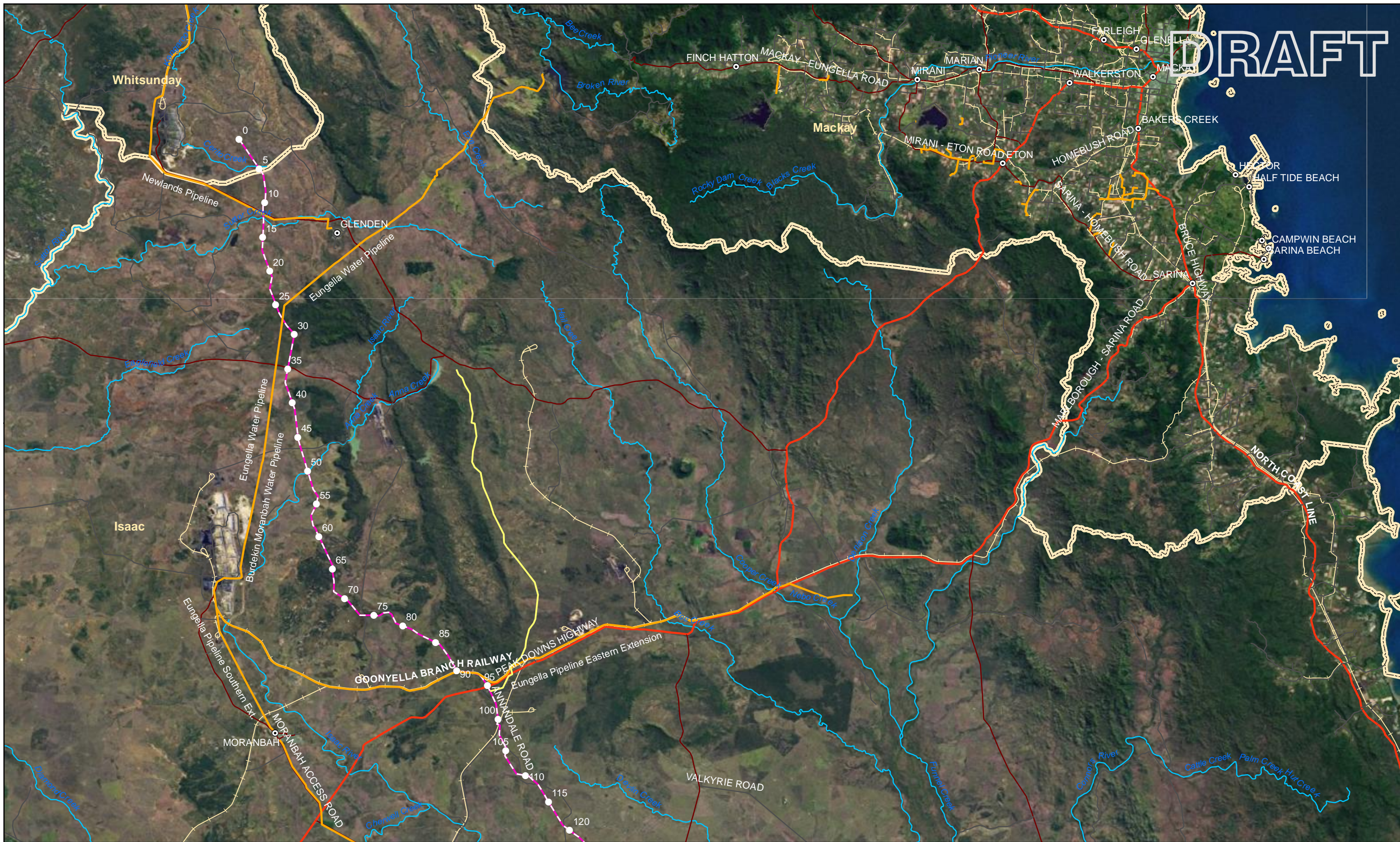
anywhere along the nominated source infrastructure, i.e. any access point on a pipeline or regulated stream. Alternate Raw Water Sources

Construction during prolonged drought periods may impact the availability of identified water sources. If water cannot be sourced from the existing schemes, options for bore water supply may require investigation along the pipeline route to meet construction demand.

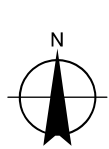


Figure 5-1 Non-potable Water Resources Availability - 1 of 3

DRAFT



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



- ▲ Sunwater Weir
- Populated place
- ABP Lateral Elphinstone Rev D
- ABP Mainline Rev D
- ABP Lateral Dysart Rev D
- ABP Lateral Saraji Rev D
- Sunwater Pipeline
- ABP Lateral Elphinstone Rev D
- ABP Mainline Rev D
- Principal Road
- Secondary Road
- Minor Road
- Rail
- Major Watercourse
- LGA



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Arrow Energy
ABP Water Supply Availability Study

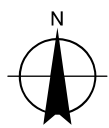
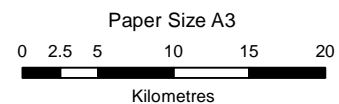
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Revision | A
Date | 09 Sep 2011

Non Potable Water Availability Figure 5-1



Figure 5-2 Non-potable Water Resources Availability - 2 of 3

DRAFT



- ▲ Sunwater Weir
- Populated place
- ABP Lateral Elphinstone Rev D
- ABP Mainline Rev D
- ABP Lateral Dysart Rev D
- ABP Lateral Saraji Rev D
- Sunwater Pipeline
- Principal Road
- Secondary Road
- Minor Road
- Rail
- LGA
- Major Watercourse

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



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Arrow Energy
ABP Water Supply Availability Study

Job Number 41-24306
Revision A
Date 09 Sep 2011

Non Potable Water Availability Figure 5-2

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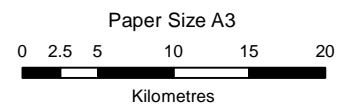
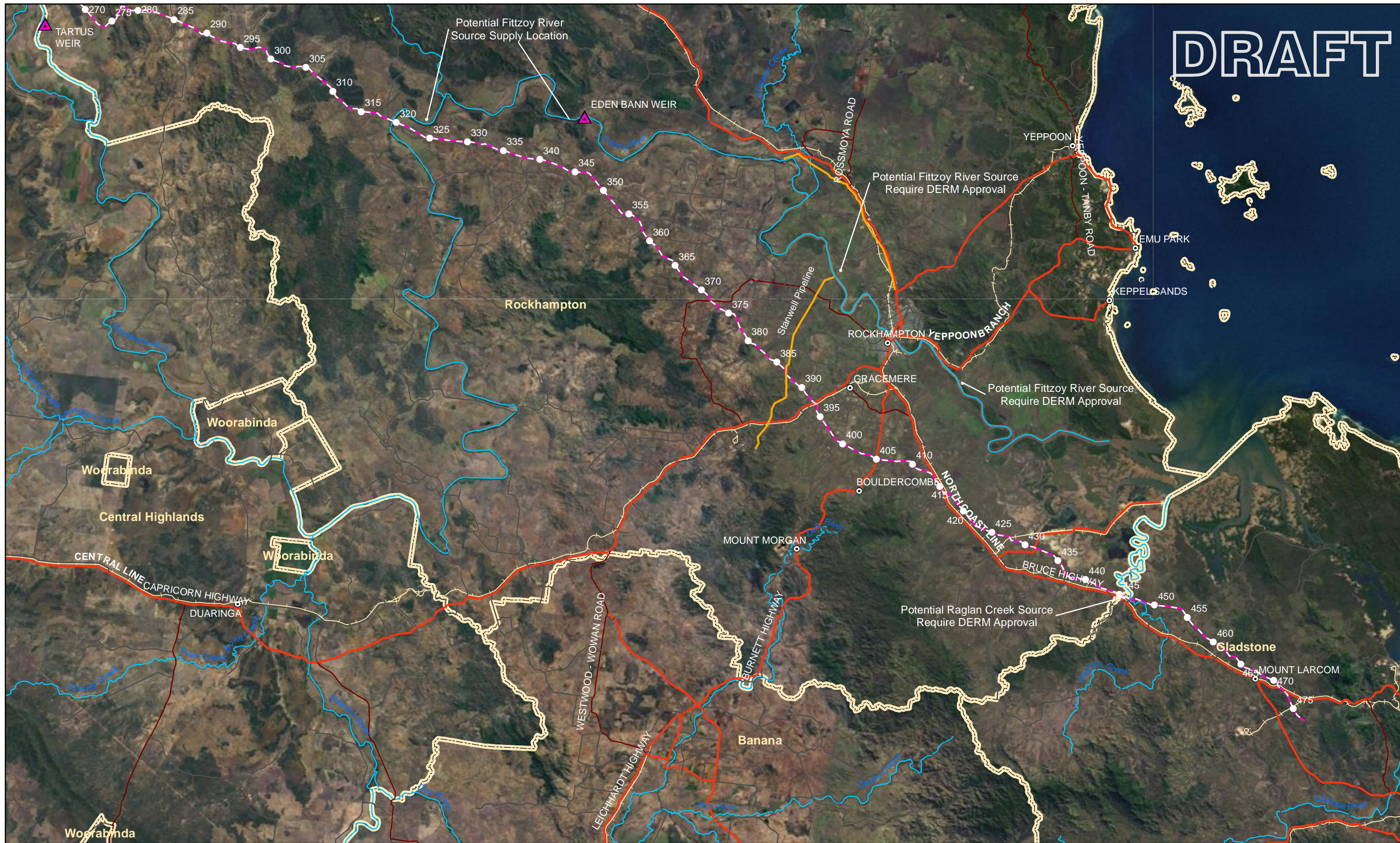
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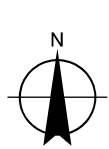


Figure 5-3 Non-potable Water Resources Availability - 3 of 3

DRAFT



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



- ▲ Sunwater Weir
- Populated place
- ABP Lateral Elphinstone Rev D
- ABP Lateral Dysart Rev D
- ABP Lateral Saraji Rev D
- Sunwater Pipeline
- ABP Mainline Rev D
- Principal Road
- Secondary Road
- Minor Road
- Rail
- Major Watercourse
- LGA



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Arrow Energy
ABP Water Supply Availability Study

Job Number 41-24306
Revision A
Date 09 Sep 2011

Non Potable Water Availability Figure 5-3



6. Conclusions and Recommendations

6.1 ABP Water Resourcing Summary

Arrow Energy requires both potable and non-potable water resources to be secured during the construction of around 600 km of up to DN1050 steel gas pipeline from the Bowen Basin to Gladstone. A summary of the needs for and outcomes from this water availability study is provided below:

- ▶ The construction phase for the pipeline is planned to commence in April 2016 and conclude in December 2017 with no work planned during the wet season (between November and March)
- ▶ Potable water will be required at each of the five nominated construction camps interspaced along the route, with an expected total water demand at the camps of 64 ML.
- ▶ Non-potable water will be required along the route for general construction purposes such as dust suppression, weed management and vehicle wash-down as well as to conduct hydrostatic pressure testing along the route. Total non-potable water demand for the construction of the pipeline is estimated at 250 ML.
- ▶ Potable water will generally be sourced from municipal supplies ranging in distance from 28 km to 75 km from each of the camp sites. Water will be trucked to storages located within the camps.
- ▶ Relevant Councils responsible for the relevant potable water supplies are identified in Table 5.
- ▶ Coverage of the construction site is generally good in terms of available water resources with numerous raw water pipelines and regulated river schemes identified in reasonable proximity to the route. Water trucks will be the primary means of delivering water to the construction site.

Raw water supply infrastructure owned and operated by SunWater is included in Table 7, with other potential raw water sources identified included in Table 8.

6.2 Recommendations

This study has identified water resources along the pipeline route to facilitate servicing for temporary accommodation camp and construction site water demands. Further assessment of the available supply options is required to refine the water servicing strategy. This should include the following actions:

- ▶ Undertake a risk analysis of the various water supply options to enable ranking of preference to guide the negotiation of water allocations. Particular risks to be evaluated will include accessibility, quality, ownership and level of water priority required (high or medium).
- ▶ Undertake a financial analysis of the various water supply options to determine the cost-effectiveness of the various options and guide the ranking of preferences.
- ▶ Engage SunWater to provide greater detail on the availability, capacity and opportunity for negotiated lease of water allocations within its operational infrastructure supplying raw water.
- ▶ Following definition of the preferred options for water resourcing, engage with the relevant water resource and allocation owners to commence obtaining the necessary water resources for construction of the ABP.



7. Disclaimer

This Report: has been prepared by GHD for Arrow Energy Pty Ltd and may only be used and relied on by Arrow Energy Pty Ltd for the purpose agreed between GHD and Arrow Energy Pty Ltd as set out in section 1 – Introduction of this Report.

GHD otherwise disclaims responsibility to any person other than Arrow Energy Pty Ltd arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

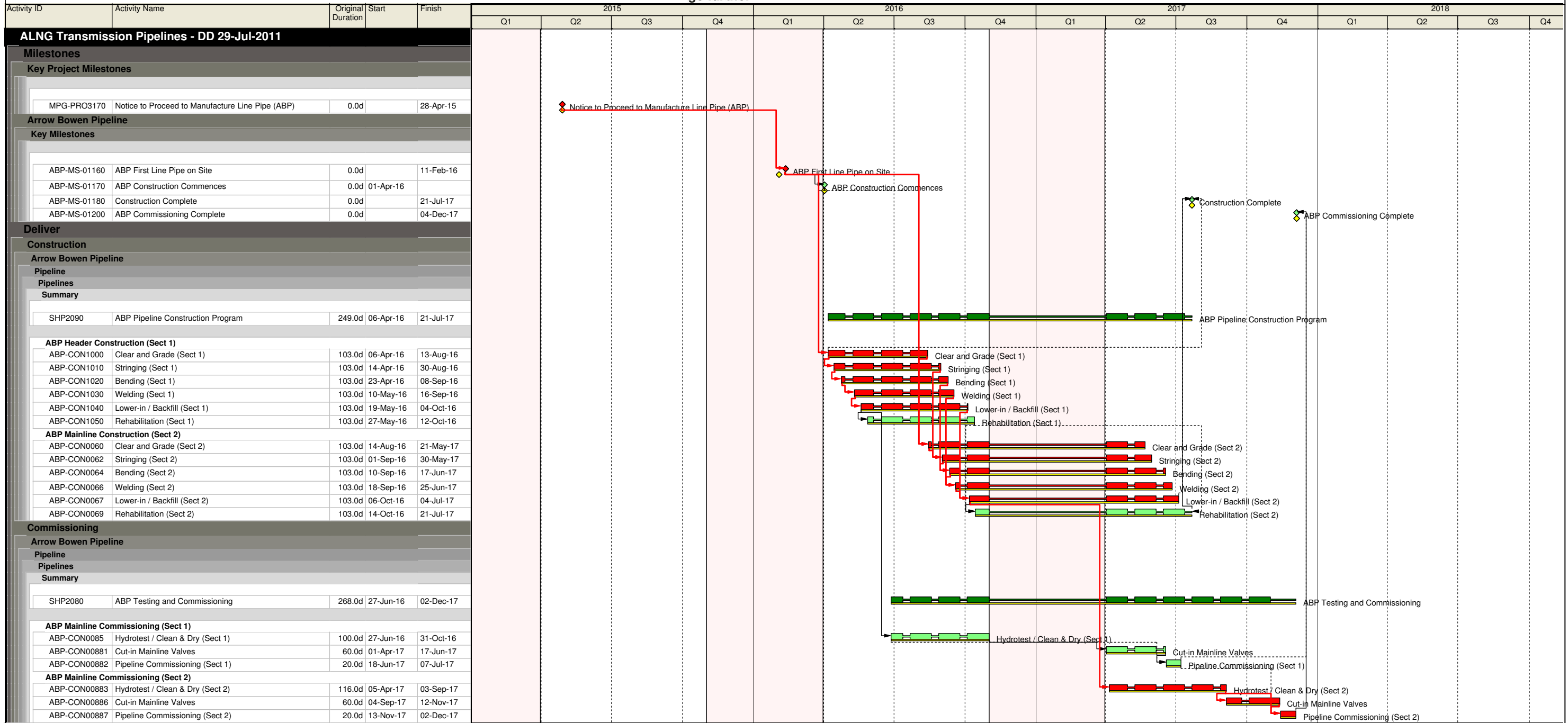
The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report (refer section 6). GHD disclaims liability arising from any of the assumptions being incorrect



Appendix A
ABP Preliminary Construction Programme

ARROW TXP PROJECT



■ Remaining Work
 ■ Critical Remaining Work
 ■ Primary Baseline
 ■ WBS Summary
◆ Milestone
 ◆ Critical Milestone
 ◆ Baseline Milestone
■ Actual Work

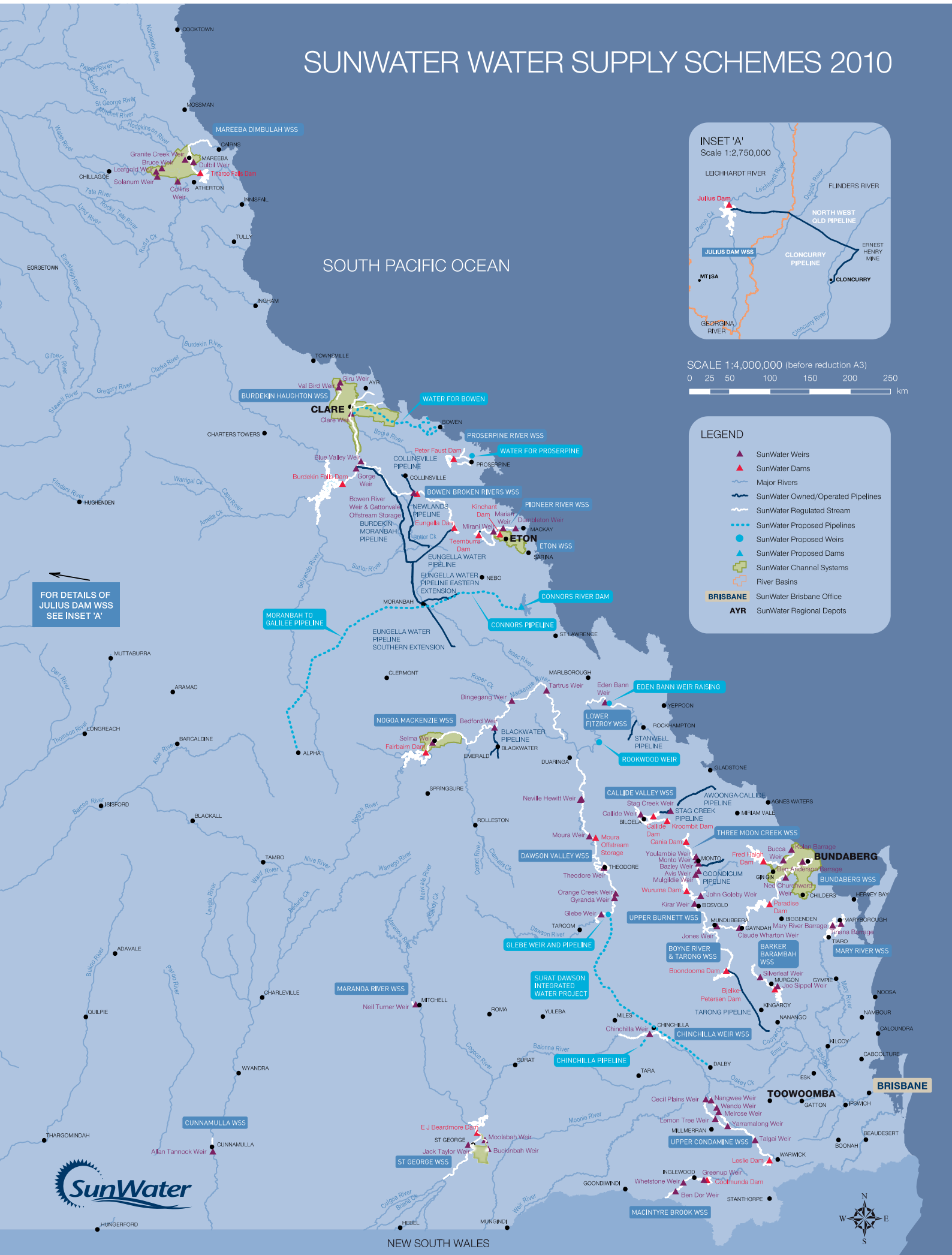
Date	Revision	Checked	Approved
29-Aug-11	TXP Project Baseline - Rev 0 (25-Mar-2011)		



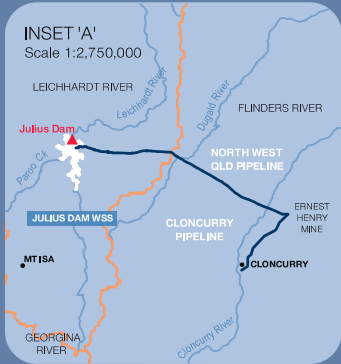
Appendix B
SunWater Water Supply Scheme

Source: www.sunwater.com.au

SUNWATER WATER SUPPLY SCHEMES 2010



FOR DETAILS OF JULIUS DAM WSS SEE INSET 'A'



SCALE 1:4,000,000 (before reduction A3)
0 25 50 100 150 200 250 km

LEGEND

- ▲ SunWater Weirs
- ▲ SunWater Dams
- Major Rivers
- SunWater Owned/Operated Pipelines
- - - SunWater Regulated Stream
- - - SunWater Proposed Pipelines
- SunWater Proposed Weirs
- ▲ SunWater Proposed Dams
- SunWater Channel Systems
- River Basins
- BRISBANE** SunWater Brisbane Office
- AYR** SunWater Regional Depots





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