



## APPENDIX E

# ARROW BOWEN PIPELINE – ENVIRONMENTAL MANAGEMENT PLAN

## OUTLINE REHABILITATION PROGRAM

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# 1 INTRODUCTION

## 1.1 Overview

The Arrow Bowen Pipeline (ABP) is currently progressing through the project development cycle. The project has completed and lodged an EIS and has addressed relevant comments from submissions in a Supplementary Report to the Environmental Impact Statement (EIS) (Arrow 2012). Arrow Bowen Pipeline Pty Ltd (Arrow) will prepare and lodge an application for the Petroleum Pipeline Licence (PPL) and associated Environmental Authority (EA).

This Rehabilitation Program has been drafted in response to a commitment made in the ABP EIS and meets or exceeds the requirements of section 310D(3) of the *Environmental Protection Act 1994*.

## 1.2 Scope

The Rehabilitation Program establishes the strategic commitments and principles to be applied to the progressive rehabilitation of the proposed pipeline right of way (ROW).

- Post construction of the pipeline and temporary work spaces.
- Post operation when the pipeline will be decommissioned and surface infrastructure removed.

## 1.3 Purpose

The purpose of this Rehabilitation Program is to provide management measures to be implemented during the life of the project to rehabilitate the ROW for the ABP to meet relevant approval conditions.

The Rehabilitation Program will:

- address potential environmental impacts
- achieve the highest practicable level in rehabilitation
- identify strategies for determining final land use(s) and rehabilitation goals
- include acceptance criteria for significantly disturbed land.

The key objective of the rehabilitation works is to ensure that sites used for construction and operation are returned to a safe, non-polluting, stable and self-sustaining level, and ensure that all statutory requirements pertaining to rehabilitation and landscaping are met. This commitment will extend to all persons conducting rehabilitation works associated with ABP.

## 1.4 Variations to the Rehabilitation Program

This Rehabilitation Program will form part of the project Environmental Management Plan (EM Plan) and will be periodically revised and updated as part of the continuous improvement program. Consequently, this document is uncontrolled in hard copy.

## 1.5 Relationship between this program and other ABP management plans

The Rehabilitation Program supports the ABP EM Plan and is in turn directly supported by a number of other supporting management plans (MPs) as depicted in Figure 1 below.

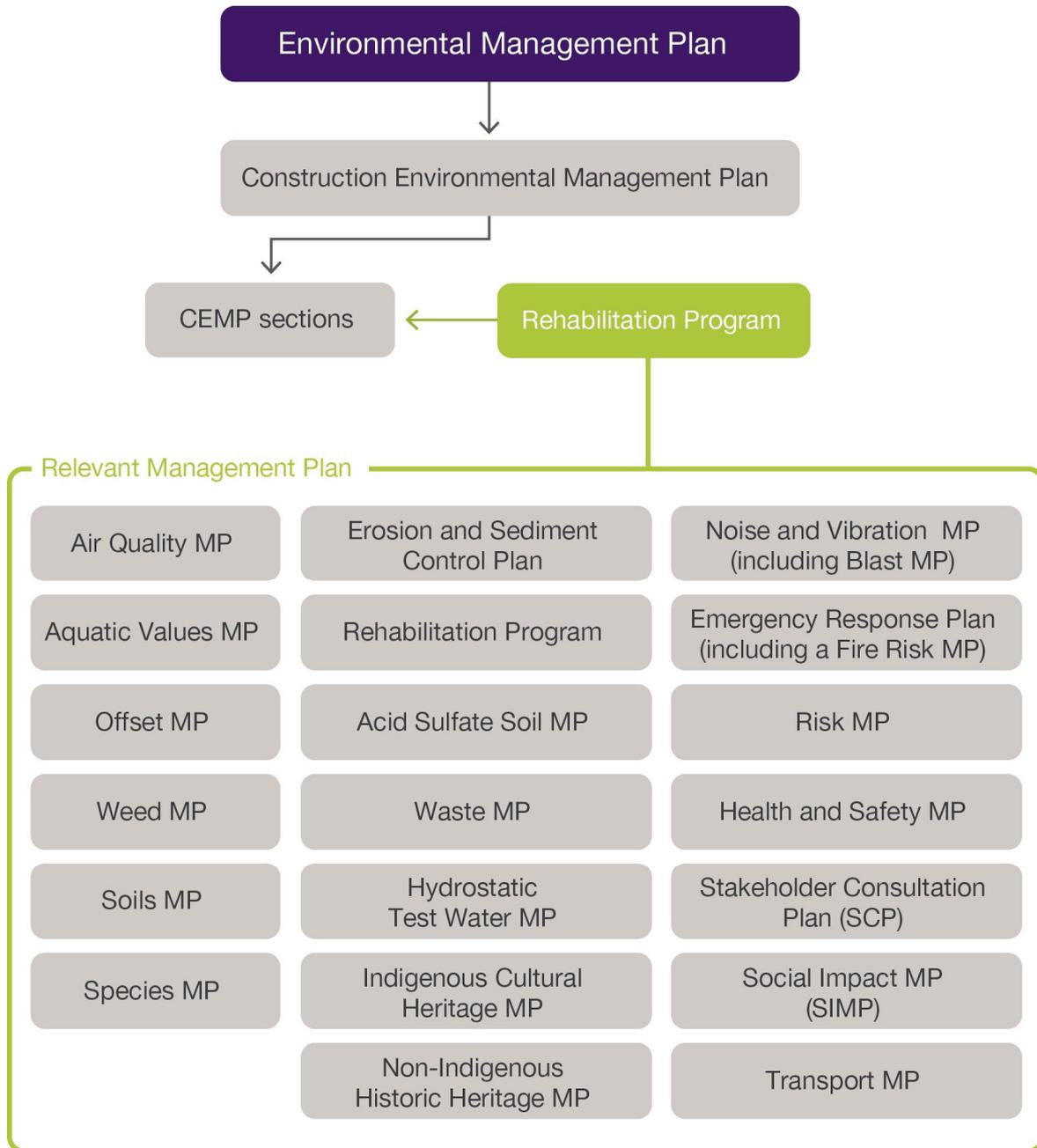


Figure 1: ABP EM Plan Management Plans

The Rehabilitation Program is part of a coordinated environmental management strategy developed under an EM Plan and related to site/activity based management plans. There will be interdependency between the Rehabilitation Program and a number of management plans including, for example:

- Soils Management Plan (which informs the Rehabilitation Program regarding treatment options for sodic or problem soils)
- Erosion and Sedimentation Control Plan which provides information on the erosion management measures which will apply to a particular area.

A more extensive overview of environmental documentation is presented in Figure 3.

## 2 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The EPC construction contractor will be required to develop and implement an Environmental Management System (EMS) (compliant with ISO14001). This will be aligned with Arrow’s EMS and project-specific standard operating procedures (SOPs) to proactively manage the environment, ensure compliance with all legislative requirements (including compliance with all requirements outlined in this Rehabilitation Program) and to ensure a process of continuous improvement for all matters pertaining to the project.

### 2.1 Arrow Energy’s Health Safety and Environment Management System

The Arrow Health Safety and Environment Management System (HSEMS), is the mandatory company-wide set of requirements that enable Arrow Energy to effectively manage their Health Safety and Environmental practices.

The HSEMS is a hierarchical document structure that describes what can be done and how it can be done, to keep everyone safe as illustrated in Figure 2. It is aligned with Australian Standard 4801 and International Standards Organisation 14001. The documents that make up the HSEMS are maintained in electronic format on a central server and is accessible via the Arrow Energy intranet site (The Reservoir).

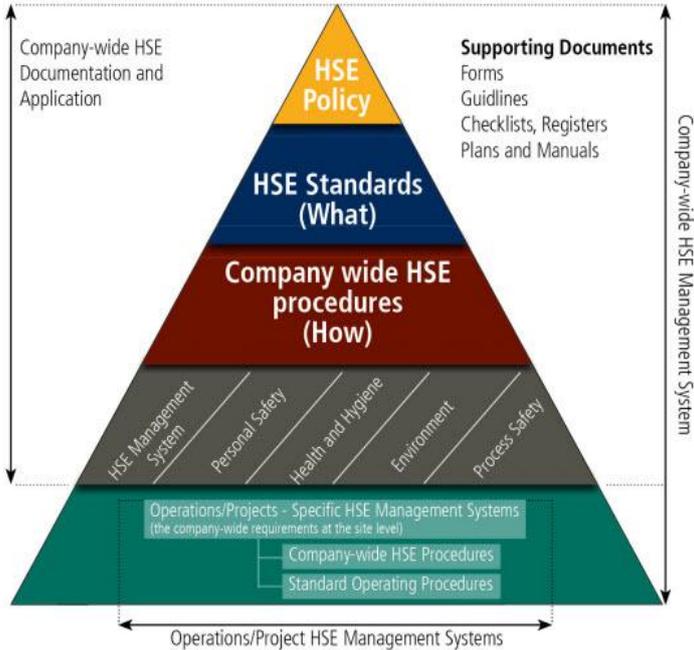


Figure 2: HSEMS hierarchical document structure

At the top of this structure are Arrow’s HSE policies, which set the overall direction of the business. These policies are supported by the HSE standards which gives instructions on how to comply with the company policies.

Beneath the standards are Arrow’s HSE procedures. These documents describe the mandatory requirements to address specific HSE processes or practices. As well as procedures there are

numerous tools (e.g. forms, registers and guidelines) which describe, in detail, what is expected of each employee and contractor to enable compliance with the HSEMS.

HSE goals and targets are set out in plans which sit across the HSEMS structure and range from legislatively required Safety Management Plans for many of Arrow Energy's operations assets to strategic and operational plans for other parts of the company.

The final and most important part of the HSEMS are Arrow's employees and contractors. They are vital to the implementation of the system as they develop and implement policies, standards, procedures, guidelines, forms, checklists, SOPs and plans.

The documents specifically related to the management of environmental values are presented in Figure 3.

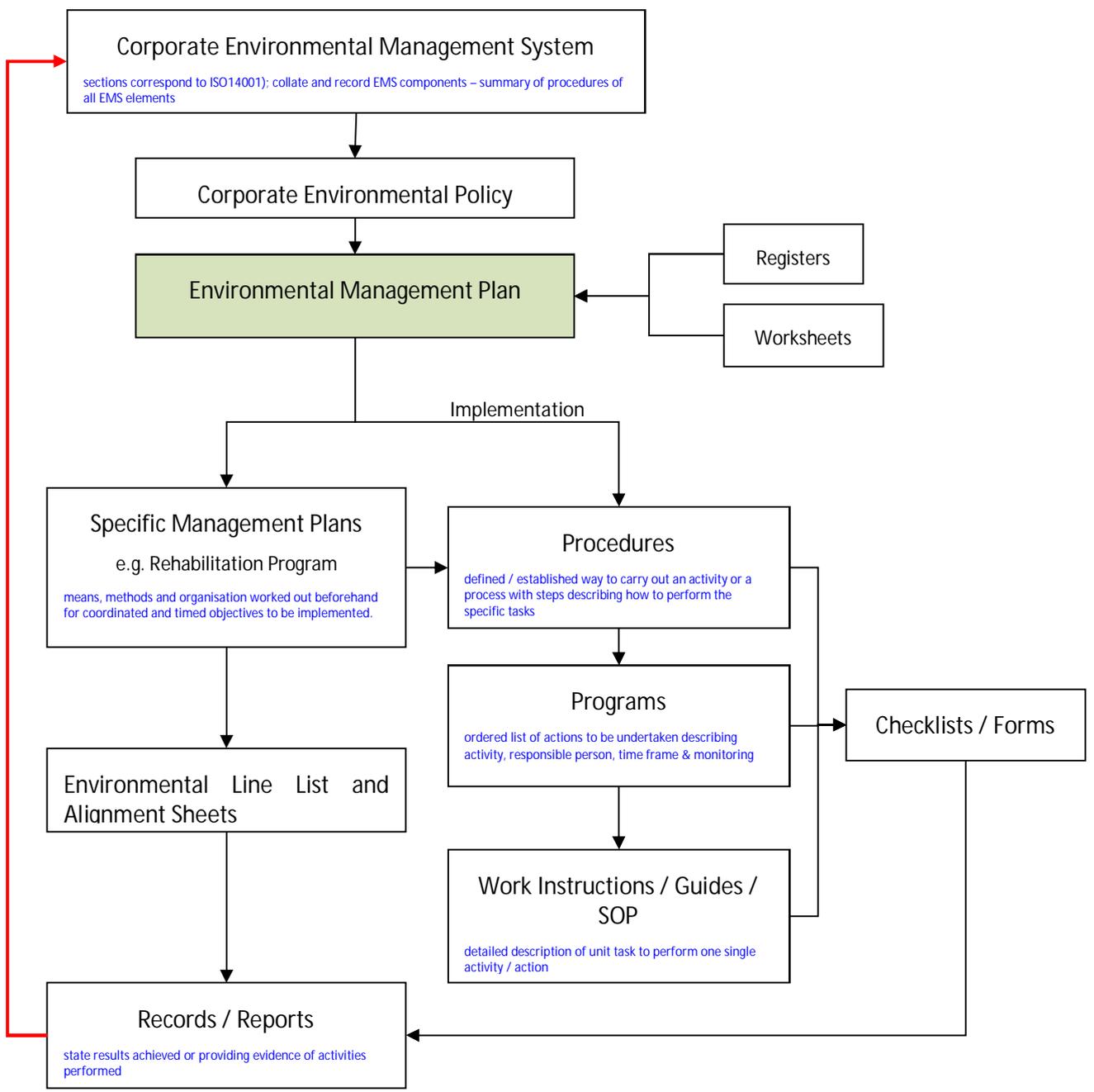


Figure 3: Overview of environmental documents supporting the EM Plan

### 3 EXISTING ENVIRONMENT

The design of the pipeline and the proposed route alignment for the project have considered ecological values of vegetation communities and habitat within and adjacent to the ROW. A number of opportunities for possible co-location of the proposed pipeline route with other planned pipeline corridors have been identified in the planning of the project.

#### 3.1 Flora

A desktop assessment and field studies were conducted by Ecosure in 2012 to determine the existing environment of the proposed pipeline route and a buffer zone.

The majority of the proposed pipeline transects cleared land, primarily used for cropping and grazing including approximately 114.5km of remnant vegetation (19.5%) and 30.1km of high value regrowth (HVR) (5.1%).

The study area was found to contain five state forests and four nature refuges, all of which lie at least 1.5km from the proposed ROW. Queensland Herbarium RE mapping recognizes 78 REs within the 5km buffer area and the field surveys and satellite imagery identified 29 REs within the 40m ROW. Field surveys identified three REs with an endangered biodiversity status and ten REs with an Of Concern biodiversity status.

The proposed route alignment transects the following three REs with an Endangered biodiversity status:

- One area of RE 11.4.8 – *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. Argyrodermon* on Cainozoic clay plains.
- One area of 11.9.1 – *Acacia harpophylla*-*Eucalyptus cambageana* open-forest to woodland on fine-grained sedimentary rocks.
- One area of RE 11.11.18 – semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding.

With regards to bioregional corridors, the proposed ROW contains 155.9km of bioregional corridors mapped by EHP, including 118.7km of corridor of state significance and 37.2km of corridor of regional significance.

Desktop and field investigations found 34 flora species to be Endangered, Vulnerable or Near Threatened (EVNT) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Nature Conservation Act 1992* (NC Act) actually or potentially occurring within the study area. Four EVNT flora species recorded within the study area include:

- *Cerbera dumicola* (Near Threatened under NC Act) – recorded from KP 61.9 to 62.1 and KP 63.1 to 63.6 within lancewood and bendee woodlands.
- *Desmodium macrocarpum* (Near Threatened under NC Act) – recorded from KP 59.8 to 60.0 and KP 64.7 to 64.9 in partially cleared areas of poplar box woodland. Additional populations were found elsewhere, adjacent to the ROW.
- *Dichanthium queenslandicum* (Vulnerable under the NC Act and EPBC Act) – recorded from KP 75.2 to 75.4 in mountain coolabah open woodland.
- *Eucalyptus raveretiana* (black ironbox) (Vulnerable under the NC Act and EPBC Act) – recorded along watercourse crossings containing RE 11.3.25 on the mainline KP 348.2 to 372.2 and the SGIC (NM 8.8).

The pipeline also transects referable wetlands, the majority of which lie along the fringes of riparian vegetation (RE 11.3.25) along streams. Non-riverine freshwater wetlands (RE 11.3.27) appeared to be ephemeral, with low abundance and diversity of aquatic vegetation. Surveys found 16 freshwater species, none of which were EVNT. Marine wetlands containing REs 11.1.1, 11.1.2, 11.1.4 were associated with several tidal creeks in the south of the mainline. Nine common marine flora species were found here.

### 3.2 Fauna

Of those EVNT fauna species known from the project area, ten have been identified as having the potential to be adversely impacted by the proposed works (EcoSM 2012). These species are presented in Table 1. Field surveys have identified six broad habitat types for fauna.

- Eucalypt Woodland and Open Forest on Alluvial Soils and old sand plains.
- Woodland and Open Forest on Rocky/Stony Soils.
- Rivers, creeks and wetlands, both permanent and ephemeral and including billabongs.
- Grasslands and woodlands on basaltic soils and clays.
- Estuarine habitats, namely mangroves and clay plains.
- Acacia woodlands on rocky substrates.

- Table 1 EVNT fauna species potentially impacted by the project

Class	Scientific name	Common name	NC <sup>1</sup>	EPBC <sup>2</sup>
Birds	<i>Epthianura crocea macgregori</i>	Yellow Chat	E	CE
Birds	<i>Ninox strenua</i>	Powerful Owl	V	-
Mammals	<i>Chalinolobus picatus</i>	Little Pied Bat	NT	-
Mammals	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	C	V
Mammals	<i>Xeromys myoides</i>	Water Mouse	V	V
Reptiles	<i>Acanthophs antarcticus</i>	Common Death Adder	NT	-
Reptiles	<i>Denisonia maculata</i>	Ornamental Snake	V	V
Reptiles	<i>Egernia rugosa</i>	Yakka Skink	V	V
Reptiles	<i>Hemiaspis damellii</i>	Grey Snake	-	E
Reptiles	<i>Paradelma orientalis</i>	Brigalow Scaly-foot	V	V

<sup>1</sup> NC- C- Culturally Significant, NT- Near Threatened, V- Vulnerable, E- Endangered.

<sup>2</sup> EPBC- M- Migratory, V- Vulnerable, E- Endangered, CE- Critically Endangered.

### 3.3 Watercourses and wetlands

The proposed pipeline route traverses three river basins including the Burdekin, Fitzroy and Calliope River basins with the majority of the proposed pipeline route being contained within the Fitzroy Basin. The route will cross a number of ephemeral watercourses including rivers, streams, floodplains and wetlands.

The route traverses, or lies adjacent to, numerous creeks, tributaries, gullies and rivers, including the Fitzroy River and the Isaac River. Many of the watercourses anticipated to be traversed by the proposed pipeline route are typical of Australian inland waters, being intermittent with little to no flow during the drier months.

The pipeline transects areas of mapped referable wetlands that contain non-remnant vegetation (in the Stanwell Gladstone Infrastructure Corridor) as well as those containing five REs.

- 11.1.1: *Sporobolus virginicus* grassland on marine clay plains (marine wetland).
- 11.1.2: *Samphire forbland* on marine clay plains (marine wetland).
- 11.1.4: Mangrove forest / woodland on marine clay plains (marine wetland).
- 11.3.25: *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines (riverine wetland).
- 11.3.27: Freshwater wetlands (non-riverine freshwater wetland).

The majority of wetlands observed within the alignment were narrow bands of fringing riparian vegetation along streams (RE 11.3.25). Non-riverine freshwater wetlands within the ROW (RE 11.3.27) appeared to be ephemeral, with low abundance and diversity of aquatic vegetation. Surveys detected 16 freshwater aquatic species, none of which are EVNT species.

Marine wetlands containing RE 11.1.1, 11.1.2 and 11.1.4 were associated with several tidal creeks in the southern section of the mainline. Surveys detected nine marine flora species, which are all common, widespread species.

### 3.4 Environmentally sensitive areas

Environmentally sensitive areas (ESAs) identified for ABP are presented in Table 2.

Table 2: Environmentally sensitive areas

Category	Environmentally sensitive area	Summary
B	Endangered REs	Endangered REs comprise 0.43km of the proposed pipeline route which equates to 0.07% of the proposed pipeline route.
C	Of Concern REs	Of Concern REs comprise 26.3km of the proposed pipeline route which equates to 4.5% of the proposed pipeline route.
C	Protected Area Estates	The proposed pipeline route does not transverse or lie adjacent to any Protected Area Estates, however, there are five state forests and four nature refuges within 5km of the proposed pipeline route. No national parks or world heritage areas occur within 5km of the proposed pipeline route.
C	Essential habitat	Essential habitat for <i>Eucalyptus raveretiana</i> (black ironbox), which is listed as Vulnerable under both the NC Act and the EPBC Act, occurs within the 5km buffer area and within the ROW. The ROW contains 0.7ha of essential habitat mapped by DERM near the crossing of Limestone Creek from KP369.2 to 370.1. Field surveys recorded black ironbox from one occurrence of mapped essential habitat from KP370.0 to 370.1.  Essential habitat for one fauna species, Little Pied Bat ( <i>Chalinolobus picatus</i> ), which is listed as Near Threatened under the NC Act, occurs within the ROW. The ROW contains 6.25ha of essential habitat for Little Pied Bat. The essential habitat area is located at KP75, an area found to support caves and ledges which provide habitat for a range of Microchiropteran species.

Category	Environmentally sensitive area	Summary
C	Referable Wetlands	<p>The pipeline transects areas of mapped referable wetlands that contain non-remnant vegetation (in the Stanwell Gladstone Infrastructure Corridor) as well as those containing five REs.</p> <ul style="list-style-type: none"> <li>■ 11.1.1: <i>Sporobolus virginicus</i> grassland on marine clay plains (marine wetland).</li> <li>■ 11.1.2: <i>Samphire forbland</i> on marine clay plains (marine wetland).</li> <li>■ 11.1.4: Mangrove forest / woodland on marine clay plains (marine wetland).</li> <li>■ 11.3.25: <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines (riverine wetland).</li> <li>■ 11.3.27: Freshwater wetlands (non-riverine freshwater wetland).</li> </ul> <p>The majority of wetlands observed within the alignment were narrow bands of fringing riparian vegetation along streams (RE 11.3.25). Non-riverine freshwater wetlands within the ROW (RE 11.3.27) appeared to be ephemeral, with low abundance and diversity of aquatic vegetation. Surveys detected 16 freshwater aquatic species, none of which are EVNT species.</p>

Management measures for threatened species and REs will be outlined in species specific management plans.

## 4 IMPACTS

The proposed pipeline route will require up to a 30m ROW with 10m additional working space in non-environmentally sensitive areas to support construction activities, including: clearing and grading, trenching and spoil placement, stringing, pipeline welding and laying. The construction of ABP would create a linear disturbance with a total footprint of approximately 2,320ha if the entire 40m was to be cleared for 580km. The final disturbance footprint is anticipated to be less than this as the clearing width will be minimised in sensitive locations.

Examples of impacts associated with the construction and operation of ABP are presented in Table 3.

Table 3: Impacts

Aspect	Impact (positive / negative)	
Vegetation clearing as a result of bulk earthworks	Negative	<ul style="list-style-type: none"> <li>■ Potential to alter biodiversity</li> <li>■ Fragmentation of vegetation communities</li> <li>■ Edge effects</li> <li>■ Establishment of pest species</li> <li>■ Loss of habitat</li> <li>■ Loss of local terrestrial, riparian flora</li> <li>■ Loss of local terrestrial fauna species</li> <li>■ Loss of topsoil</li> <li>■ Erosion and sedimentation resulting in degraded water quality</li> </ul>
Topsoil removal as a result of bulk earthworks	Negative	<ul style="list-style-type: none"> <li>■ Loss of native seed bank</li> <li>■ Exposure of subsoil and resulting increased erosion risk</li> <li>■ Sedimentation resulting in degraded water quality</li> </ul>
Restoration and rehabilitation	Positive	<ul style="list-style-type: none"> <li>■ Potential to establish new or enhance existing corridor linkages</li> <li>■ Establish native vegetation offset areas</li> <li>■ Re-establish soil stability</li> </ul>

## 5 REHABILITATION

### 5.1 Objective

The key objective of the rehabilitation works is to revegetate the sites to a self-sustaining level and to ensure that all statutory requirements are met. The proposed final land use will be determined by a number of factors including:

- relevant legislation and regulatory requirements
- the view of all stakeholders, particularly the current or future landowner and the local community
- the land use of surrounding areas and the needs of the local community
- the receiving environment
- the conservation, ecological and heritage values of the area.

#### 5.1.1 Clean up, restoration and rehabilitation

Clean up, restoration and rehabilitation measures will be applied to all areas disturbed during construction, including the ROW and access tracks, as soon as practical after pipe laying and backfill. Generally, clean up and rehabilitation will involve removal of foreign material (construction material and waste), surface contouring, respreading topsoil, respreading the cleared vegetation material and seeding/revegetation (typically with native grass or improved pasture species).

Generally the landscape will be rehabilitated to pre-existing contours (allowing for some settling) with natural drainage lines retained and protected (if required). In certain cases, rehabilitation will be tailored to site specific conditions in consultation with the landholder. To promote vegetation regrowth and protect against the loss of topsoil, the ROW surface will normally be lightly scarified or ripped (if required) prior to respreading of topsoil.

Temporary access ways and causeways will be removed following consultation with landholders.

Rehabilitation will be undertaken in accordance with broad ecological restoration principles described in the South East Queensland Ecological Restoration Framework guidelines and manual (Chenoweth EPLA and Bushland Restoration Services, 2012). Although the Arrow Bowen pipeline project is not in SEQ, there are broad principles described in these documents that are applicable to all rehabilitation. The rehabilitation methods will be targeted to achieve the following.

- Topsoil cover is re-established and all land and waterways disturbed by project activities are returned to a stable condition as soon as practicable after construction.
- Land is returned as close as possible to its previous productivity.
- Stable landforms are re-established to original topographic contours.
- Natural drainage patterns are reinstated.
- Erosion controls (e.g. contour banks) are installed in erosion prone areas.
- Native fauna habitat features such as hollow logs and woody debris retrieved from cleared vegetation are re-instated.
- Vegetation cover sufficient to stabilise topsoil is established.
- Declared weed species are controlled.
- Fences and gates are restored.
- Pipeline marker signs are installed.

### 5.1.2 Decommissioning

When, and if, the proposed pipeline is no longer required, it will be decommissioned in accordance with the regulatory requirements and accepted environmental best practices at that time. Currently, decommissioning procedures require the removal of all above ground infrastructure (including all scraper station plant and all pipeline valves and metering stations) and the restoration of associated disturbed areas. Section 560 of the P&G Act obliges the petroleum authority holder to remove equipment or improvements from land on relinquishment (other than a petroleum well, pipeline, water observation bore or water supply bore) unless the owner of the land otherwise agrees.

At the time of decommissioning, a decision will be made regarding the opportunities for future use of the pipeline. The following two options will be considered.

- Moth-balling – this would involve depressurising the pipeline, capping and filling with an inert gas (such as nitrogen) or water with corrosion inhibiting chemicals. The cathodic protection would be maintained to prevent the pipe corroding.
- Abandonment – this could involve purging the pipe of natural gas, disconnecting it from the manifolds and removing all above ground facilities. The pipe would then be filled with water and left to corrode in-situ. Removing the pipe from the ground is unlikely to be an environmentally or commercially-viable option. A detailed rehabilitation program would be developed and implemented in consultation with landholders and the regulatory agencies at the time of abandonment.

### 5.2 Implementation

An implementation strategy detailing how the rehabilitation works will be undertaken will be developed by the Principal Contractor and approved by the Principal prior to its implementation during the pre-construction phase of the project.

### 5.3 Mitigation and management measures

Table 4 identifies the proposed rehabilitation works that are relevant for ABP over the various stages in order to meet the rehabilitation objectives.

Table 4: Proposed rehabilitation mitigation and management measures for ABP – post construction

Element / issue		Post construction rehabilitation of the ROW and immediate surrounds.			
Rehabilitation goal	Rehabilitation objectives	Management strategies	Indicators	Completion criteria	Monitoring, auditing and reporting
Land					
To achieve a stable ROW landform.	<ul style="list-style-type: none"> <li>The landscape will be rehabilitated to pre-existing contours with natural drainage lines restored and protected. Land owners will be invited to comment on rehabilitation requirements for their property (C007).</li> </ul>	<ul style="list-style-type: none"> <li>Construction of the project will be progressed sequentially, with clean-up, restoration and rehabilitation initiated after backfilling is complete, while trenching and the other activities are advanced (C003).</li> <li>Beneficial use of cleared material will be maximised (C066).</li> <li>Compaction relief will be undertaken before spreading topsoil, to promote vegetation regrowth, protect against topsoil loss and to minimise rilling (EM044).</li> <li>The pipeline construction area will be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features.</li> <li>Pre-stripping and stockpiling of topsoil and bed material will be in accordance with the Soils Management Plan and stored above the bank where it will not be buried or damaged, with topsoil and bed material stockpiled separately (C048).</li> <li>Stock routes will be rehabilitated following completion of</li> </ul>	Land restored to a condition suitable for its intended land use.	<ul style="list-style-type: none"> <li>Disturbed land reinstated to the pre-disturbed soil suitability class.</li> <li>Landform is stable with no subsidence or erosion gullies.</li> <li>No complaints from landholders relating to land reinstatement or productivity.</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring activities include post-construction audits to be conducted annually for two years to evaluate re-vegetation, erosion control, weed control, watercourse integrity and success of bed and bank re-profiling (C004).</li> <li>Conduct annual reporting of the Rehabilitation Program to the administering authority.</li> <li>Post-construction audits to be conducted annually for two years.</li> </ul>

Rehabilitation goal	Rehabilitation objectives	Management strategies	Indicators	Completion criteria	Monitoring, auditing and reporting
		construction activities (EM045).			
Site is safe for humans and animals.	No injuries to humans or animals.	Construction of the project will be progressed sequentially, with clean-up, restoration and rehabilitation initiated after backfilling is complete, while trenching and the other activities are advanced (C003).	Landform re-established.	No subsidence or major erosion gullies.	<ul style="list-style-type: none"> <li>Visual inspection of rehabilitated sites for evidence of subsidence and/or erosion.</li> <li>Maintain records of subsidence and/or erosion.</li> </ul>
<b>Ecology</b>					
Land use is self sustaining.	Healthy crops and natural vegetation growth.	<ul style="list-style-type: none"> <li>Vegetation cover will be established to enable natural vegetation progression and minimal weed invasion.</li> <li>Native shrubs will be allowed to naturally regenerate.</li> <li>Re-vegetation/re-seeding efforts will be based on soil types, existing location vegetation characteristics and endemism of selected species (EM047).</li> <li>Local provenance seed (to be collected and stored by the EPC Contractor) wherever practicable.</li> <li>Where rehabilitation includes native vegetation and the area is not naturally regenerating, local indigenous species will be sourced preferably from a local seed bank (EM048).</li> <li>Where rehabilitation is not practicable, such loss will be offset by a variety of measures, as agreed with the responsible agencies (EM049).</li> </ul>	Restoration will be assessed by comparing the percentage cover and species diversity on the ROW with that of adjoining land.	<ul style="list-style-type: none"> <li>Establishment criteria will be developed for vegetation communities to ensure the rehabilitated area is resilient and self-sustaining.</li> <li>Monitor established vegetation at watercourse crossing/banks.</li> </ul>	<ul style="list-style-type: none"> <li>Rehabilitation success will be monitored until re-growth is established.</li> <li>Seeded areas will be monitored to ensure growth. Appropriate reapplication of seed will be carried out in areas of poor or no regrowth.</li> <li>Appropriate photo monitoring locations will be identified prior to construction.</li> </ul>
Land use is self-	Healthy crops and natural	<ul style="list-style-type: none"> <li>Implement annual treatment</li> </ul>		No introduction or spread of weeds	Monitoring will include an

Rehabilitation goal	Rehabilitation objectives	Management strategies	Indicators	Completion criteria	Monitoring, auditing and reporting
sustaining.	vegetation growth free from pests or weeds.	<p>program along the ROW where weed infestations are identified. Typically, this is implemented in conjunction with landholder spraying and weed control programs (EM046).</p> <ul style="list-style-type: none"> <li>Re-seed grazing areas with appropriate native or pasture seed mixes during rehabilitation to prevent weed species establishing (EM050).</li> </ul>		from rehabilitation activities.	assessment of the effectiveness of weed control measures.
<b>Waste</b>					
Non-polluting.	No soils, surface water or groundwater contamination.	<ul style="list-style-type: none"> <li>All pipeline packaging waste material (e.g. ropes and straps) will be removed from the Right of Way (ROW) and disposed in accordance with local government requirements (C020).</li> <li>General refuse shall be collected and transported to a Local Government approved disposal site (C023).</li> </ul>	Disposal of construction wastes in accordance with WPM.	<ul style="list-style-type: none"> <li>No waste materials within the pipeline construction area.</li> <li>No contamination to soils, surface water or groundwater, as indicated via monitoring and/or leak detection systems.</li> </ul>	Pipeline patrols will monitor the effectiveness of clean-up activities.
<b>Water</b>					
Stable.	Minimise erosion at watercourse crossings.	<ul style="list-style-type: none"> <li>Watercourse crossings will be undertaken in accordance with the Aquatic Values Management Plan (C042)</li> <li>Following construction banks will be rehabilitated in accordance with the Rehabilitation Management Plan (C046).</li> <li>Inspection and monitoring of watercourses will be ongoing during operation and remedial action will be initiated (C047).</li> </ul>	Stability of watercourse channel or bank erosion following site reinstatement.	Creek banks are stable with no subsidence or erosion gullies.	Daily visual inspections and photographic representation of bank reinstatement after construction of watercourse crossings. If bank erosion has occurred, immediately rehabilitate and stabilise watercourse banks.

Rehabilitation goal	Rehabilitation objectives	Management strategies	Indicators	Completion criteria	Monitoring, auditing and reporting
		<ul style="list-style-type: none"> <li>■ Trenching of watercourse crossings should be completed promptly and with due regard to the weather forecast. (C001).</li> </ul>			

## 5.4 Rehabilitation performance criteria

Monitoring activities include post-construction audits to be conducted annually for two years to evaluate re-vegetation, erosion control, weed control, watercourse integrity and access of bed and bank re-profiling. Areas of high erodibility will be monitored more regularly.

The EPC Contractor will develop performance criteria for restoration and rehabilitation to achieve the final land use objective. The landscape will be rehabilitated to pre-existing contours with natural drainage lines restored and protected if required. The criteria will be developed for both the end of year 1 and year 2.

## 5.5 Rehabilitation completion criteria

The rehabilitation completion criteria will be dependent on the land use prior to clearing, pre-existing health and integrity of the landscape and landholder requirements.

The aim of the rehabilitation works is to rehabilitate impacted environs to as a minimum, their pre-existing condition. This is a particular prerequisite for all significant ecological communities, protected areas and other sensitive areas identified within the ABP ROW.

In determining whether the completion criterion is met, the following factors will be used:

- the similarity between the rehabilitated landforms and the selected analogue sites
- the stability of the landform and its resistance to erosion
- whether appropriate drainage patterns have been developed, either naturally or through shaping activities during the rehabilitation program
- the degree to which the surface conditions are conducive to plant establishment
- whether the site conditions and existing habitat components provide resources, including for fauna movement, foraging habitat and/or shelter
- compliance with the relevant standards
- public safety issues (e.g. signage, fencing etc.).

At a minimum, ABP will:

- rehabilitate the ROW to an agreed final land use (e.g. reshaped to a stable landform similar to that of surrounding undisturbed areas with a self-sustaining vegetation cover, or capable of sustaining pre-disturbance farming practices)
- commit that all reasonable and practicable measures are taken to:
  - re-establish drainage lines
  - reinstate the top layer of the soil profile.
  - control erosion and weeds.
  - promote and establish a healthy and suitable vegetation growth.

Table 5 provides a high level overview of the rehabilitation goals, objectives, indicators and completion criteria proposed for pipeline corridors for ABP (DERM, 2010). These will be further expanded to describe specific indicators and completion criteria for the pipeline corridors and other major petroleum activities by the Contractor in the Contractor's Rehabilitation Program prior to the commencement of construction activities.

Table 5: Rehabilitation goals, objectives, indicators and completion criteria

Petroleum activity feature	Rehabilitation goal	Rehabilitation objective(s)	Indicators	Completion criteria
Pipeline corridors	Safe	<ul style="list-style-type: none"> <li>Site safe for humans and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Rehabilitated ROW landform is re-established</li> </ul>	<ul style="list-style-type: none"> <li>No subsidence or major erosion gullies</li> </ul>
	Non-polluting	<ul style="list-style-type: none"> <li>Sediment and erosion control structures in place</li> <li>Storm water runoff does not pollute nearby watercourses</li> </ul>	<ul style="list-style-type: none"> <li>Sediment traps and design of erosion control measures</li> <li>Surface water monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Certification from suitably qualified and experienced person</li> <li>Performance of control structures</li> <li>Monitoring of water releases meets release limits</li> </ul>
	Stable	<ul style="list-style-type: none"> <li>Minimise erosion</li> </ul>	<ul style="list-style-type: none"> <li>Re-establish surface drainage lines</li> <li>Vegetation cover</li> <li>Land use</li> </ul>	<ul style="list-style-type: none"> <li>No subsidence or areas of major erosion for at least x years</li> <li>Foliage cover compared against adjacent vegetation communities</li> <li>Land returned to pre-disturbance use</li> </ul>
	Self-sustaining	<ul style="list-style-type: none"> <li>Post activity land use or land suitability or land capability</li> </ul>	<ul style="list-style-type: none"> <li>Resumption of farming activities</li> <li>Resumption of pre-construction land use</li> </ul>	<ul style="list-style-type: none"> <li>Land productivity re-established.</li> <li>Landuse reinstated</li> </ul>

## 5.6 Constraints

Rehabilitation of the ROW will vary between areas depending on the level of clearing, the vegetation, habitat complexity and composition, landholder requirements and ongoing operation and maintenance requirements. Table 6 outlines several constraints that may influence rehabilitation works.

Table 6: Constraints

Constraint	Detail
Weather	Weather conditions (e.g. severe drought or floods) may affect the short term success of the rehabilitation strategy
Landowners	Rehabilitation and reinstatement works to be discussed with landowners to minimise interference with ongoing land use and to confirm rehabilitation strategy for the site.
Species re-establishment over pipeline	Selection of species used for re-planting over the pipeline to consider root structure to ensure no impact on structural integrity/damage to corrosion protection of the pipeline
Other infrastructure	Relevant stakeholder requirements to be considered during rehabilitation of areas where ABP intersects with other infrastructure (roads, rail, powerlines)

Constraint	Detail
Weeds	Implementation of Weed Management Plan.
Maintenance access tracks	Location of tracks to access easement during ongoing operations and maintenance negotiated with land owners.

## 5.7 Roles and responsibilities

The project construction manager will direct work in a manner that complies with all relevant environmental procedures, adheres to all legislative requirements, and ensures that the requirements of the EM Plan and the EA are implemented. The construction manager has 'stop task' and 'stop work' authority.

The environmental officer is responsible for monitoring and reporting the implementation of the construction EM Plan as well as other key environmental construction documentation (e.g. procedures and management plans). The environmental officer will also be responsible for implementation of the Complaints Register and for setting up compliance audits and monitoring programs. Construction compliance auditing of environmental aspects of the project will be conducted against the requirements of the EM Plan, the construction safe work method statements, licence and permit conditions.

The EPC Contractor will be required to provide a warranty for rework to be carried out in areas where rehabilitation has failed. This will be agreed in conjunction with the Environmental Officer and Construction Manager and will be in subject to conditions of approval.

## 5.8 Training and awareness

The success of the Rehabilitation MP depends on all those responsible for implementation and review being thoroughly conversant with its contents, interpretation and performance measurements. Arrow and its contractors will be responsible for ensuring that project personnel have sufficient knowledge and awareness to identify potential environmental issues, and that they are trained to take appropriate corrective action.

All staff, including construction and field staff, will complete a comprehensive project induction prior to commencing work on the project. The induction will include safety, access and a comprehensive review of environmental requirements (including nature conservation protection measures, soil management, waterway protection, cultural heritage management and weed control). Additional training will be provided to staff involved in key rehabilitation works. It is the responsibility of the Construction Manager to ensure records of training are maintained.

## 5.9 Inspections and reporting

The following inspection schedules are proposed for the ABP ROW.

- Once planting has commenced, regular weekly inspections will be carried out to monitor watering requirements at each location for a period of three months. Monthly inspections will then commence for a further period of six months.
- Weekly inspections will be conducted to monitor and record the success of planting regimes for a period of six months after plantings have commenced.

- Monthly photographs will be taken from monitoring points to determine the success or otherwise of the landscaping and rehabilitation works. These will be included in the monthly environmental report. This will be carried out for a minimum of two years after plantings have commenced.

A monitoring and evaluation report will be prepared and will include details on species survival, natural recruitment, percentage coverage of the rehabilitation area and percentage and species of weeds in the rehabilitated areas. In addition the following will also be recorded:

- planning and impact assessment details
- activity site location and site access details
- commencement and completion dates
- the area of native vegetation removed, and the amounts of material excavated and fill placed
- the disposal location/s and quantity of spoil material removed
- the disposal location/s and quantity of native vegetation removed
- impact management and rehabilitation details
- before, during and post activity photographs of the site
- any incidents of unanticipated failure of management methods and subsequent remedial action
- any notable fauna activity will also be recorded. Species of Conservation Interest will be recorded in a logbook and mapped in the supporting GIS database.

The Contractor will be responsible for developing and implementing a Rehabilitation Management Plan in accordance with the measures and principles identified within this ABP Rehabilitation Program. The Contractor's Rehabilitation Management Plan will set out specific details of rehabilitation goals, objectives, indicators and completion criteria.

Any incident that results in the injury or fatality of an animal will be recorded and reported to DEHP as relevant.

Annual reports on the rehabilitation will be submitted as part of annual returns on the Environmental Authority as required.

#### 5.9.1 Monitoring

Monitoring of the rehabilitation works will be ongoing and the rehabilitation program will be modified as required to address remedial works undertaken to action any non-conformances as necessary. Visual inspection and surveillance will be undertaken regularly during construction and operation of ABP.

Following construction, monitoring of rehabilitated areas will be undertaken in accordance with EA conditions and focus on performance criteria to achieve the completion criteria listed in Table 5.

Key performance criteria include, but are not limited to:

- public safety
- water drainage, subsidence and erosion
- physical stability of rehabilitated area
- biological structure and sustainability of vegetation communities.

#### 5.9.2 Ecological performance auditing

Both internal and external audits will be conducted during construction and operation of ABP.

### 5.9.3 Non-compliance

Should a non-compliance occur, an Improvement Notice will be issued by the Environmental Officer and corrective action implemented. Reporting will be in accordance with the HSEMS.

### 5.10 Continuous improvement

Continuous improvement of the rehabilitation objectives and completion criteria is encouraged to accommodate results of research/trials, changing technology and rehabilitation practice.

## 6 REFERENCES

Arrow Energy Pty Ltd, 2012. Arrow Bowen Pipeline Project - Environmental Impact Statement.

Chenoweth EPLA and Bushland Restoration Services, 2012. South East Queensland Ecological Restoration Framework: Guideline. Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane.

DERM, 2010. Preparing an EM Plan for CSG activities – Guideline, Department of Environment and Resource Management.

Ecosure, 2012. Arrow Bowen Pipeline Flora Assessment for Revision SR.

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