Attachment C: Management Plans

Westside Corporation Pty Ltd

DOCUMENT TYPE **MANAGEMENT PLAN**

DOCUMENT TITLE

Meridian Seam Gas Environmental Management Plan

DOCUMENT DETAILS

Dept. Origin	Environmental
Document #	MSG-GN00-HS-PLN-006
Intranet Folder	Health, Safety, Environment & Risk
Used by	All Relevant Westside Personnel

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Abbreviations

Abbreviation	
ACA	Anglo Coal (Dawson Management) Pty Ltd
AHD	Australian Height Datum
ALARP	As Low As Reasonably Practicable
AEP	Australian Energy Producers
ATP	Authority to Prospect
CEO	Chief Executive Officer
CHIMA	Cultural Heritage Investigation and Management Agreement
CHMP	Cultural Heritage Management Plan
CSG	Coal Seam Gas
CSG WMP	Coal Seam Gas Water Management Plan
^{0}C	Degrees Celsius
dB(A)	Decibels measured on the 'A' frequency weighting network.
DoR	Department Of Resources
DESTI	Department of Environment, Science, Tourism and Innovation
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
EA	Environmental Authority
EC	Electrical Conductivity
EIL	Environmental Investigation Levels
EMP	Environmental Management Plan
EMR	Environmental Management Register
EOW	End of Waste
EP Act	Environmental Protection Act 1994
EP Regulation	Environmental Protection Regulation 2019
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ERA	Environmentally Relevant Activity
ERE	Endangered Regional Ecosystem
ERP	Emergency Response Plan
ESA	Environmentally Sensitive Areas
ESD	Ecologically Sustainable Development
ESP	Exchangeable Sodium Percentage
EV	Environmental Values
FA	Financial Assurance
GQAL	Good Quality Agricultural Land
Ha	Hectares
IL	Investigation Levels
km	Kilometre
L	Litres
LGA	Local Government Authority
m	Metres
Mg/L	Milligrams per Litre
ML	Mining Lease
NEPM	National Environment Protection Measure
NES	National Environmental Significance
NOx	Nitrous Oxides
PL	Petroleum Lease
PPL	Petroleum Pipeline Licence
QGSO	Queensland Government Statistition's Office
QNP	Queensland Nitrate Plant

Abbreviation	
QR	Queensland Rail
QRC	Queensland Resources Council
RE	Regional Ecosystem
ROW	Right of Way
HSE	Health, Safety and Environmental
SPQs	Single Persons Quarters
SDS	Safety Data Sheet
TEP	Transitional Environmental Plan
TJ	Terajoules
TSP	Total Suspended Particulates
µg/L	Micrograms per Litre
µS/cm	Micrograms per Centimetre
WoNS	Weeds of National Significance
WQOs	Water Quality Objectives

1. Introduction

Westside Corporation Pty Ltd (Westside) operates the Meridian Seam Gas Fields, located in the Bowen Basin near Moura in Central Queensland. The gas fields are primarily located within Petroleum Lease (PL) 94 but also overlap into some sections of the adjacent Anglo Coal Dawson Coal Mine.

This Environmental Management Plan (EMP) has been developed for Westside's operation and development activities within the Meridian Seam Gas Fields. The EMP describes the environmental values of the area which may be affected by Westside's activities and the management measures to control and reduce potential impacts.

1.1 Scope

This EMP covers the activities and environmental impacts associated with the operation and development of the Meridian Seam Gas Fields. The EMP has been prepared for the entire Project but recent updates have been made focusing on the final 350 well heads for PL94 which is being assessed by the Department of Climate Change, Energy, the Environment and Water. The activities within the scope of this EMP includes the following components:

- Seismic activities
- CSG production from up to 600 wells, including drilling and completion of new wells
- Workover and stimulation of new and existing wells
- Well suspension and/or plug and abandonment as required
- Construction and operation of new and existing gas and water gathering lines
- Construction and operation of new and existing pipelines
- Construction and operation of new and existing gas compression and treatment facilities
- Water management facilities
- Construction and operation of new and existing access roads and tracks
- Use of laydown, stockpile and storage areas
- Progressive rehabilitation of infrastructure no longer required for production
- Accommodation facilities and associated services including sewage treatment.

2. Meridian Seam Gas Fields

2.1 Overview

The PL94 Meridian CSG field commenced operations in the late 1990s, and the first commercial production of CSG was from the Meridian Fields. Production targets the Baralaba Coal Measures and there has been modest and sustained production with progressive development of the fields. In 2010, Westside CSG A Pty Ltd and Westside CSG D Pty Ltd acquired a 51% interest in the Meridian Gas Fields from Anglo American and Mitsui Moura Investment Pty Ltd.

In a joint venture with Mitsui Exploration and Production Australia Pty Ltd (MEPAU), the PL94 is operated by Westside and held by the following entities:

- Westside CSG A Pty Ltd (25.5%);
- Westside CSG D Pty Ltd (25.5%); and
- MEPAU (49%).

PL94 was granted April 1996 under the *Petroleum Act 1923*.

Gas from the Meridian Seam Gas Fields is supplied to the GLNG Project and other customers in Gladstone, Queensland. The additional development of the gas fields will allow Westside to meet current gas supply contracts and future market demands.

2.2 Location

As shown in Figure 1, the Meridian Seam Gas Fields are located in the Bowen Basin in Central Queensland near the township of Moura. The fields are located directly to the west of, and in parts overlap the Anglo Coal Dawson Coal Mine mining leases (the co-development area) which occupy a 30km long north-south length section adjacent to PL94.

As shown in Figure 1, there are eight gas fields which are collectively known as the Meridian Seam Gas Fields:

- Hillview
- Dawson River
- Nipan
- Moura
- Mungi
- Pretty Plains
- Hillview
- Ridgedale

The Dawson River, Nipan, Moura and Mungi gas fields are located within PL94 while Pretty Plains, Hillview and Ridgedale gas fields are located in the co-development area on the Anglo Mining Leases (MLs).

The field development occurs as 'pods' within an area extending approximately 36km north to south and up to 8km east to west. The town of Moura is located within the PL94 tenure on the Western boundary and located 3.5km South of the northern PL94 boundary and 33km North of the Southern boundary.

The Meridian Seam Gas Fields are located within the catchment of the Dawson River, which flows north and northwest through PL94. A number of westerly flowing ephemeral tributaries cross the Dawson Mine and PL94 and discharge into the Dawson River.

Access to the gas fields is via public roads and associated secondary roads which provide access to local properties.

149°50'
150°
-24°30'
-24°40'
-24°50'
N

GLNG
Interconnect

PPL 166

PPL26 - PPL61
Interconnect Compound

Moura Office/Warehouse

Moura

PPL26

Mungi Laydown Yard

MR81 Moura M99
Booster Station

Moura Central
Compressor Station

Moura C
Booster

Nipan Booster

MERIDIAN SEAMGAS
PL94 AREA

Dawson River
Compressor Stati

Dawson River Water
Treatment Plant

Legend

Existing Facility and Infrastructure:

- Faclities
- Well pads
- PPL26 gas pipeline
- PPL166 gas pipeline
- Gas gathering pipeline

EPBC 2021/9217:

- PL94 Project Area

0 2 4 6 8 10 km

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Drawn:	J.Payne
Date:	27/02/25
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Approved:	M.Rodiger

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FIGURE 1 - PROJECT AREA AND EXISTING PL94 INFRASTRUCTURE MAP

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3. Legal and Other Requirements

3.1 Key Legislation

The key legislation applicable Westside's Meridian Seam Gas Field activities is summarised in Table 1 below, though the primary regulatory tool is the Environment Authority (EA) issued by the Queensland Government under the *Environment Protection Act 1994* (EP Act). Westside operates PL94 under EPPG00783713, the current version of which is effective from 25 June 2020, to incorporate Westside's development activities (drilling and stimulation of up to 600 CSG wells plus supporting activities).

Table 1 Relevant Environmental Legislation

Legislation	Requirement	Action
Federal		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) **EPBC Controlled Action Approval**	Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of national environmental significance without approval from the Australian Government Environment Minister or the Minister's delegate A referral must be made to the Commonwealth Government if actions may have a significant impact on matters listed in Part 3 of the EPBC Act. Under s130 of the EPBC Act the Minister will determine if the action is a controlled action.	Referral for 350 well heads has been submitted for PL94.
National Greenhouse and Energy Reporting Act 2007 **NGERS Reporting**	Reporting under National Greenhouse and Energy Reporting Scheme	Westside must report greenhouse gas emission, energy production and energy consumption to the Australian Government Clean Energy Regulator annually.
National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) **Site Assessment Protocol**	Site assessment protocol for contaminated sites	Westside to implement this NEMP in the assessment of contaminated sites
National Environment (National Pollution Inventory) Protection Measure 1998 **NPI Reporting**	Reporting under National Pollution Inventory NEPM	If reporting thresholds are met, Westside must report pollution data to the National Pollution Inventory annually.
National Weeds Strategy	Strategic plan for WONS species	Westside conducts activities in accordance with the

Legislation	Requirement	Action
Weeds of National Significance (WoNS)		management requirements for WoNS species.
State		
Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) *and* the *Petroleum Act 1923* **Petroleum Lease**	Various requirements under the P&G Act and Petroleum Act 1923	Westside operates PL94 in accordance with the Petroleum Act and P&G Act
Biosecurity Act 2014 (Qld)	Various requirements pertaining to invasive, restricted and prohibited matters, such as feral pests, plants and diseases.	Westside operates PL94 in accordance with the Biosecurity Act.
Environmental Protection Act 1994 (EP Act) **Environmental Authority**	Section 426A of the EP Act requires a person conducting a Chapter 5A (petroleum activity) activity to hold an environmental authority to carry out authorised activities for petroleum tenures under the P&G Act.	Westside operates under Environment Authority EPPG00783173 which provides approval for petroleum and associated activities on PL94, including development and stimulation of up to 600 CSG wells. Vegetation clearing under the *Vegetation Management Act 1999* is regulated through the EA. Westside is required to submit an annual return to assess performance against the EA.
Environmental Protection Act 1994 **Suitable Operator**	Under s316FA person may apply to be registered as a suitable operator for the carrying out of an environmentally relevant activity	Westside is a Suitable Operator.
Environmental Protection Act 1994 **Notification of conducting a notifiable activity / Contaminated land**	Under s371 of the EP Act the owner/occupier of contaminated land is responsible for notifying DETSI if a notifiable activity is being conducted on the land, there is a change in the condition of the land, or the land is being contaminated with a hazardous contaminant.	Westside will notify as per the requirements of the EP Act, noting that there are currently no known contaminated land sites within the gas fields.

Legislation	Requirement	Action
Environmental Protection Act 1994 **General obligations**	Obligations under the EP Act are provided in: ▪ s319 general environmental duty ▪ s320-320G duty to notify of environmental harm ▪ s437-439 offence of causing serious or material environmental harm ▪ s440 offence of causing environmental nuisance ▪ s440ZG offence of depositing prescribed water contaminants in waters and related matters ▪ s443 offence to place contaminant where environmental harm or nuisance may be caused	Westside will conduct activities in accordance with the obligations of the EP Act.
Waste Reduction and Recycling Act 2011 **Irrigation of Associated Water**	The end of waste (EOW) code for irrigation of associated water (including coal seam gas water) was made in accordance with s159, which provides requirements and conditions for when associated water stops being a waste and becomes a resource.	Westside currently utilises raw water under the EOW framework and Westside will implement the EOW application for CSG water irrigation activities.
Water Act 2000 **Water licence**	Section 808 of the *Water Act 2000* makes it an offence to take or interfere with water without an authorisation under the Act. s206 of the *Water Act 2000* allows for a water licence for taking water and using the water on any of the land or interfering with the flow of water on, under or adjoining any of the land. This licence can only be held by the owner of the land (not the petroleum holder) unless the water is associated water.	S185 of the P&G Act allows a petroleum holder to extract and use associated water for authorised petroleum activities without the need for a water licence. No action is required by Westside.
Water Act 2000 **Water Permit**	Section 808 of the *Water Act 2000* makes it an offence to take or interfere with water without an authorisation under the Act. s237 of the *Water Act 2000* identifies that a person may apply for a water permit to take water for an activity (not restricted to landowner). The activity must have a reasonably foreseeable conclusion date.	If required a water permit application will be applied for.
Water Act 2000 **Development Approval for Operational Work (Taking or interfering with water)**	Under s62 of the *Water Regulation 2016* self-assessable codes have been developed for 'Taking overland flow water to satisfy the requirements of an environmental authority or a development permit for carrying out an environmentally relevant activity'.	Westside will implement the 'Code for self-assessable development for taking overland flow to satisfy the requirements of an environment authority or development permit for carrying

Legislation	Requirement	Action
		out an environmentally relevant activity'.
Fisheries Act 1994 **Development Approval for Operational Works (Waterway barriers)**	S 135 of the *Fisheries Regulation 2019* requires following the *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (Oct 2018) The *Fisheries Act 1994* defines waterway barrier works to mean a dam, weir or other barrier across a waterway if the barrier limits fish stock access and movement along a waterway.	Westside will either obtain a Development Approval or follow the accepted development requirements for waterway barrier works, in the event waterway barrier works are required during the development of the gas fields.
Water Act 2000 **Riverine Protection Permit**	s814 of the *Water Act 2000* makes it an offence to destroy vegetation, excavate or place fill within a watercourse, lake or spring without a permit or an exemption	s96 of the *Water Regulation 2016* identifies exemptions relating to PPLs, PFLs ATPs and PLs granted under the P&G Act. No action required.
Water Supply (Safety and Reliability) Act 2008 **Registration as a Water Service Provider**	Under s20(2) of the *Water Supply (Safety and Reliability) Act 2008* an owner of infrastructure that produces and supplies recycled water that is CSG water is not required to apply for registration as a service provider unless it also owns other infrastructure for supplying a water service that is not CSG water.	Westside does not supply a water service that is not CSG water. No action required.

3.2 Standards and Codes

The following standards and codes are applicable to Westside's activities in the Meridian Seam Gas Fields:

- Australian Standard AS2885 – Pipelines Gas and Liquid Petroleum
- Australian Standard AS2187.2 Explosives – Use of Explosives
- Australian Standard AS3580 – Methods for Sampling and Analysis of Ambient Air
- Australian Pipelines and Gas Association Ltd (APGA) Code of Environmental Practice
- ANZECC Australian Guidelines for Water Quality Monitoring and Reporting (2000)
- APIA Code of Environmental Practice: Onshore Pipelines (2009)
- Code of Practice: For the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland (DNRME, 2018)
- Geoscience Australia Groundwater Sampling and Analysis – A Field Guide (2009:27 GeoCAt #6890.1)
- Queensland Government Noise Measurement Manual (2020)

- Queensland Manual for assessing Consequence Categories and Hydraulic Performance of Structures (ERS/2016/1933)
- Queensland Government Monitoring and Sampling Manual: Environmental Protection (Water) Policy (2018)
- Queensland Air Quality Sampling Manual and/or Australian Standard 4323.1:1995 Stationary source emissions method 1: Selection of sampling positions, as appropriate for the relevant measurement
- Guidelines for Surveying Soil and Land Resources, 2nd edition (McKenzie et al. 2008), and/or the Australian Soil and Land Survey Handbook, 3rd edition (National Committee on Soil and Terrain, 2009);

3.3 Westside Plans and Procedures

Westside conducts activities in accordance with the following Westside plans and procedures:

- Erosion and Sediment Control Procedure (WCL-0000-HS-PRC-029)
- Environmental Constraints Planning and Field Development Plan (MSG-GN00-HS-PLN-003)
- Permit to Disturb Procedure (WCL-0000-HS-PRC-036)
- Weed Management Procedure (WCL-0000-HS-PRC-034)
- Staff Induction Program
- Emergency Response Plan (WCL-HSE-PRO-0006)
- Environmental Complaints and Incident Management Plan (WCL-0000-HS-PLN-007)
- Noise Management Plan (WCL-0000-HS-PLN-009)
- Produced Water Management Plan (MSG-GN00-HS-PLN-002)

In addition, the following documents are also used to guide Rehabilitation activities:

- Permit to Disturb Non-Well Sites Form (WCL-0000-HS-FRM-036)
- Permit to Disturb Well Sites Form (WCL-0000-HS-FRM-037).
- Environmental Rehabilitation Plan (MSG-GN00-HS-PLN-004)
- Sump Rehabilitation Base Procedure (WCL-0000-HS-PRC-057)
- Soils Management Plan (WCL-0000-HS-PLN-010)

The following site-specific rehabilitation planning documents are also prepared:

- Site-specific Sump Rehabilitation Plans (Inspection Test Plan)
- Site Rehabilitation Inspection Checklist (WCL-0000-HSE-FRM-040)
- Site Rehabilitation Acceptance Form (WCL-0000-HSE-FRM-040).

4. Description of Activities

The activities covered by this EMP include the operational and development activities undertaken by Westside in the Meridian Seam Gas Fields. As per Table 2, the infrastructure currently approved in the PL94 EA (EPPG00783713 dated 20 December 2022) includes:

Table 2 Meridian Seam Gas Field Infrastructure

Authorised Resource Activities	**Scale**		**Intensity**
	Maximum size	**Location**	
Petroleum Activities			
Coal seam gas exploration and production	518ha	Within project area	600 wells
Specified relevant activities			
Stimulation activities	N/A	Within project area	600 wells
Operating fuel burning equipment (permanent, in isolation or combined in operation, or interconnected) that is capable of burning more than 500kg of fuel in an hour	15ha across 7 compressor stations	Within project area	4200kg.hr (total)
Sewage treatment works, other than no-release works, where treated effluent is discharged from the works to an infiltration trench of through an irrigation scheme of otherwise discharged	100EP per facility	Within project area	1 facility 1.25KL/day
Waste disposal onsite—operating a facility for disposing of greater than 50t of non-regulated waste in a year (mix-bury-cover where the drill muds do not have any substances that would make it a regulated waste	Combine disposal capacity for waste less than 10000t/year	Within project area	600 waste disposal locations
Water treatment facility	10.36ha	Within project area	1 water treatment facility Less than 5ML/day 3 brine storage tanks
Regulated Dam	2.73ha	Within project area	1 dam

Westside will progressively develop the Meridian Gas Seam Fields to provide additional gas over a 20 to 30 year period. The development activities will involve the construction, operation, decommissioning and rehabilitation of CSG wells and associated supporting infrastructure.

The final number, well type and location of these activities will be determined progressively over the life of the development. Ongoing field development planning principles which include consideration of agricultural values and land access agreements negotiated with landholders, environmental values, cultural heritage values, topography and constructability will be used to determine infrastructure locations.

Development activities are to be performed in line with all regulatory conditions.

4.1 Seismic Survey Exploration

Seismic surveys are undertaken for planning of drilling programs. Non-destructive vibro-seismic methodology is used to perform the seismic surveys.

Activities associated with a seismic survey include:

- Route planning and disturbance minimisation
- Cultural heritage clearances
- Landholder clearances
- Access line preparation for vehicles and equipment comprising of slashing lines of pastoral grasses only to a height of approximately 50mm and by approximately 5 metres in width (N.B. no tree removal or other environmental clearance is required to perform the seismic survey)
- Acquisition of seismic data
- Rehabilitation of the access lines.

4.2 Production Wells

CSG wells are located as clusters within a gas field, spaced approximately 1km apart for vertical wells and up to 3km apart for pad drilling with horizontal wells in each gas field. Current wells are at depths of approximately 375m to 800m.

Gas and water produced from the wellheads undergo initial processing at the wellhead production skid, to separate gas and liquid phases. Bulk water is removed in the wellhead separator. Gas is transported to compression facilities through buried HDPE gas gathering networks. Water is transported to storage through buried HDPE water pipelines.

Westside will increase the number of single lateral and multi-lateral CSG wells to 600 wellheads over the development period. Single well pads will result in a maximum 1ha disturbance during construction and a 0.6ha disturbance area post construction in accordance with the current standards.

Whilst multi-wells do create a larger disturbance area (both during construction and operation), overall, they result in a net reduction of land disturbance (Figure 2). Westside will adhere to the maximum disturbance limits for multi-well pads (with monitoring equipment and small tanks).

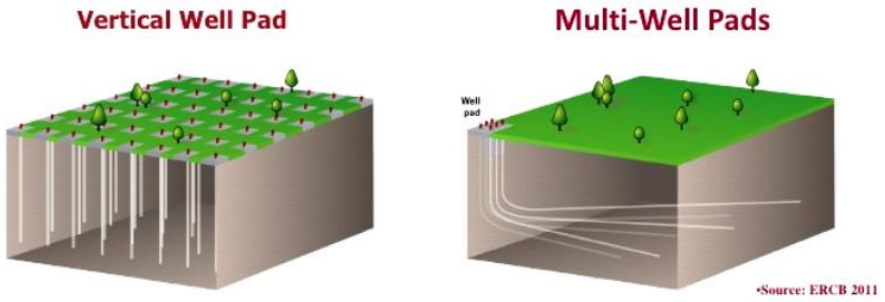

Figure 2 Hypothetical comparative between vertical well pads and multi-wells pad (not representative of well spacing)

Westside has conducted multiple trials of well and artificial lift configurations and studies, the preferred style of development wells are multi-lateral wells (refer to Figure 3 for a cross section view of a subsurface layout of a bi-lateral well). Westside have successfully constructed and operated over 100 single and multi-lateral wells since 2011.

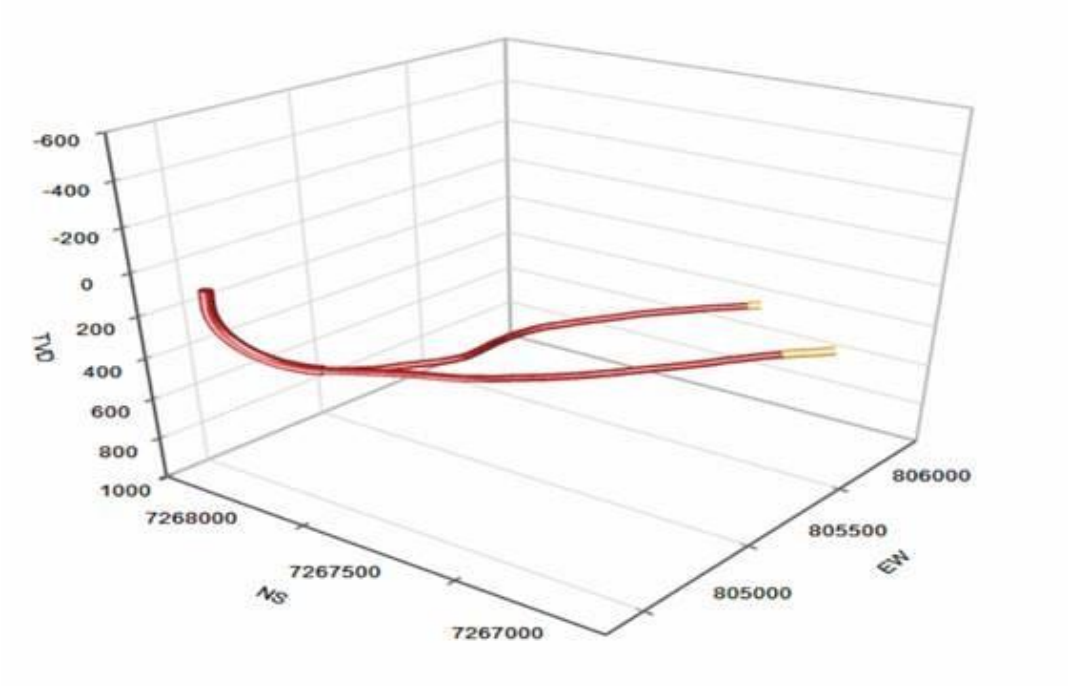

Figure 3 Cross-sectional view of subsurface layout for DLWs

Wells within the Meridian Seam Gas Fields may require stimulation over the life of the well. All well construction, maintenance and stimulation activities will be conducted in accordance with the EA conditions.

4.2.1 Lease Pad Preparation and Well Drilling

Before the drill rig is mobilised to site, the drill site or 'well lease' and access tracks are prepared. This includes three main steps:

1. Any vegetation is cleared within the well lease and for access tracks. Where larger vegetation is felled, a self-propelled mulcher or similar machinery is used and the mulch stored at the edge of the lease for later rehabilitation use. Recoverable hollow timber, larger rocks and other features will be stored for later microhabitat rehabilitation.

2. Topsoil is removed using earthmoving equipment. This is stockpiled to one side of the lease and/or access track for later rehabilitation use.

3. Earthmoving equipment moves in to cut and fill the lease site where necessary and imported hardstand material is compacted in layers to complete the lease.

4. Following lease preparation, drilling activities commence. A small rig sets conductor pipe (large diameter pipe to prevent the near-surface material from collapsing).

5. The drill production well drilling rig then mobilises and sets up over the conductor pipe. The drill rig is usually made up of:
    - a diesel motor that drives the rigs operation
    - a derrick, a vertical tower used to manage the long pieces of drill pipe for the drilling process
    - a mud pump which pumps drilling mud through the drill pipe and brings the cuttings to the surface. There the mud is circulated into tanks or ground sumps, where the drill cuttings settle out and the mud is re-used.
    - an iron roughneck, which tightens the pieces of drill stem together as the hole is drilled deeper
    - a generator to maintain power to equipment and associated ancillary site buildings.

The drill rig first drills the surface section of the hole and surface casing is then cemented in place by pumping cement into the casing and circulating back through the surface wellbore. This cement isolates any shallow surface aquifers from the hydrocarbon bearing formation and prevents cross contamination.

The second stage is to drill the production section of the hole, which is cased and cemented inside the surface casing in the same manner. Above the target formations the casing is cemented back to surface, which isolates the formation. The lateral section of the well is then drilled “horizontally” following the coal seam, with a perforated fibreglass liner installed between the production casing and the well’s TD.

If required, well stimulation techniques such as hydraulic fracturing, may be used in vertical wells as part of the completion of a well to improve the gas flow rate. Noting this is not Westside’s preferred approach. Such stimulation will be undertaken in accordance with the existing State EA (EPPG00783713), under which it is permitted. Additionally, Westside will comply with any regulations associated with this process.

A completion rig installs the downhole completion.

During the life of a well, a similar rig may need to be mobilised to the well lease to work-over the well to replace the down-hole pump or remediate a down-hole problem. Stimulation of the well may also be required throughout the life of the well.

4.3 Gas and Water Gathering Lines

To transport the produced gas and associated water from the production wells to the gas and water facilities, Westside will utilise new and existing gathering infrastructure. Gathering lines are low pressure networks that are buried to a depth that enables unchanged grazing or farming operations.

Construction of new gathering lines will be undertaken using a combination of conventional earthmoving equipment and specialist pipeline trenching equipment. Gathering lines will be HDPE pipe of between 100 mm and 1,000 mm. Gas gathering lines will be designed and constructed to comply with:

- Australian Standard AS2885 – Pipelines Gas and Liquid Petroleum
- Code of Practice: For the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland (DNRME, 2018)
- Australian Pipelines and Gas Association Ltd (APGA) Code of Environmental Practice (2017)
- Australian Pipelines and Gas Association Ltd (APGA) Code of Practice for Upstream PE Gathering Lines in the CSG Industry.

4.4 Gas Compression and Treatment Facilities

The fields contain two types of gas plants:

- Field Compressor Stations (FCSs) which consist of inlet separation and compression. The compression is sufficient to transport gas to a CPP.
- Central Processing Plants (CPPs) consist of inlet separation, multiple stages of compression, gas dehydration and coalescing filtration. The compression is sufficient to transport gas to market.

Details of current gas processing capacity is provided in Table 3, with capacity summarised below:

- Moura C NCS has a nominal capacity of 6 TJ/day
- Nipan NCS has a nominal station capacity of 3 TJ/day
- Hillview CPP capacity is rated at 21 TJ/day
- Moura Central CPP (high suction pressure – old side) has capacity of 8 TJ/day. An expansion Moura Central CPP increased capacity by nominally 21 TJ/day (29 TJ/day total at the Moura Central CPP)
- Moura Central CPP TEG unit capacity is rated at 32 TJ/day, with standby 8 TJ/d TEG unit (original unit) located on the site. Typical operation has all gas treated with the New TEG unit only, the 8 TJ/day unit is operated when the New TEG unit is offline for major maintenance.
- Dawson River CPP compression and TEG capacity is rated at 9 TJ/day.

Table 3 Existing Gas Processing Capacity

Station	Separation	Compression	Dehydration
Moura C NCS	V110 Slug catcher and V140 Inlet Gas Filter	Gardner Denver SSUG99C(4.6Vi) rotary screw compressor with gas engine (Caterpillar) drive	None
	Buried slug catcher and on skid separator	Ariel RG357-M screw compressor with gas (Caterpillar) engine drive	None
Nipan NCS	None	Ariel JGA/2 with gas engine drive	None
MER36 Pad NCS	Low point drain with LPD max (automated)	LeRoi HG17XXXVIEP rotary screw compressor with gas engine	None

Station	Separation	Compression	Dehydration
Moura Central CPP	Inlet Separator	Ariel JGT/4 with gas engine; Gemini FE650D-4 with gas engine;	2+6 TJ/day = 8 TJ/d
	Water slug catcher & Filter Coalescer	3 x BHGE WH66 4 stage 6 throw reciprocating compressors (K301/K302/K-303) Waukesha P9394 2500 hp gas engine	21 TJ/d current expandable to 32 TJ/d
Dawson River CPP	Inlet Separator	Ariel RG357-M screw compressor with gas (Caterpillar) engine drive upstream of 2 × Gemini FE650D-4 with gas engine drive	1 × 9 TJ/d
Hillview CPP	Inlet filter	7 x Ariel JGK/4 with electric motor	21 TJ/d

Gas is exported along a network of high-pressure gas pipelines (PPL 26 and PPL 61) with delivery points to the Meridian delivery station to the Queensland Gas Pipeline (QGP – PPL30) and GLNG Gladstone Transmission Pipeline (GTP – PPL166).

Additional gas compression is intended to be developed in both the Moura Central Processing Plant and Dawson River Central Processing Plant (Table 4) to increase the pressure of gas prior to transmission.

Table 4 Additional Compression at Moura Central and Dawson River Central Processing Plants

Station	Increased capacity
Moura Central CPP	8 TJ/d
Dawson River CPP	24 TJ/d

Gas collected from the field will pass through nodal gas compression facilities and the central processing plants to meet specifications for transmission and supply to market. The compression process involves filtration, dehydration, compression and cooling. A flare system will be used as a safety measure in the event of an emergency.

4.5 Flaring and Venting

Flaring of CSG gas can occur during the commissioning, workovers and/or stimulation of a well or during a process upset at the well gas compression and/or treatment facilities. Flaring of gas is the preferred method of discharging CSG gas as it reduces the GHG intensity of released CSG compared to venting.

Westside vents that were installed prior to 2015 are in compliance with the regulations. Any new processing facilities post 2015 require flares.

4.6 Fugitive Emissions

Fugitive emissions occur via leaks from equipment or emissions from CSG water tanks. CSG is also intermittently vented from the water gathering lines via relief valves.

4.7 Produced Water Management

The current water management program at Westside has a mix of beneficial use applications, evaporation and storage. The current water management program relies on tank storage and trucking water around the field. The end use of the water has several scenarios:

- Water is captured in above ground water tanks at the well and then gathered through a water gathering network. The water is aggregated into above ground storage tanks strategically located throughout the field
- For water produced in the southern fields, the water is treated at the Dawson water treatment plant. The permeate is stored in tanks for beneficial use. The retentate water is returned to the above ground storage tank.

There are currently no CSG storage dams within the gas fields.

The current beneficial uses of CSG produced water include:

- Stock water for local landholders;
- Beneficial use for dust suppression; and
- Beneficial use for construction activities (drilling activities etc).

In line with the End of Waste (EOW) Guideline (ESR/2016/3323), and specifically the EOW Code "Irrigation of Associated Water (including CSG water) (ENEW07546918)", Westside is undertaking an assessment of the suitability of irrigation of CSG water to meet the "standard water quality parameters" from the EOW Code and an assessment of the approach to management (irrigation rates and duration) to mitigate potential impacts.

The EOW framework under Chapter 8 and Chapter 8A of the Waste Reduction and Recycling Act 2011 promotes resource recovery opportunities and aims to transform the perception of waste from being seen as waste to being valued as a resource.

CSG produced water is managed under the Westside Produced Water Management Plan.

4.8 Access Roads and Tracks

Westside seeks to maximise the use of existing access roads and tracks. Upgrades to existing roads and tracks may be required to enable construction and operational traffic, associated with the new activities.

The construction activities associated with roads and access tracks includes:

- Upgrading of existing access tracks
- Excavation and filling
- Preparation of road surface
- Installation of drainage, such as culverts.

4.9 Laydown, Stockpile and Storage Areas

The main laydown yard is located at the Mungi Yard ~2.5km south of Moura on the Theodore-Moura Road. Two additional contractor laydown areas are located in the Pretty Plans Field ~0.4 km North of the Gibhi Road entrance. The laydowns are generally used for stockpile and storage areas and some general

maintenance of equipment may be undertaken. In some cases where the laydown yards are not in close proximity and to improve logistics in the field, well pads maybe used as temporary laydown areas.

4.10 Accommodation Facilities and Associated Services

Moura is the central hub for accommodation facilities and associated services. Westside promotes local content and the use of the Moura's accommodation and facilities.

Westside does have an approval for a sewage treatment plant for up to 100 EP associated for a camp. In periods of high workloads a temporary camp will be set up at the Mungi Yard.

4.11 Disturbance Footprint

The total area of PL94 is approximately 24,284ha. The current total area of disturbance is approximately 400 ha. Of this, there has been:

- No significant disturbance to Category A, Category B or Category C environmentally sensitive areas outside of what is approved in the current EA (EPPG000783713)
- No significant disturbance to prescribed environmental matters
- No significant disturbance to high value regrowth
- No significant disturbance to remnant vegetation
- 3036 m2 of significant disturbance to Category B ESA buffers for the Nipan Booster Compressor Station (2500 m2), Nipan Tank Farm (500 m2) and Nipan Telemetry Tower (36 m2)

The increase of wells and associated infrastructure will see an increased disturbance across the gas fields. Table 5 provides a high-level assessment of the different lease developments and their potential disturbance contribution to disturbance.

Table 5 Single and Multi-well Pad Disturbance

Scenario	Westside preference	Number of leases	Lease size	Total area	% PL94 area
Single well lease	Least preferred	400	1 ha	400 ha	1.9%
Multi-well pad (2+ well heads)	Preferred	80	2 ha	160 ha	0.8%

Considering both lease development options, the disturbance contribution for PL94 with 600 wells would be approximately:

- Single well: 1040 ha (5% of PL94).
- Multi well pad: with the additional associated infrastructure the total disturbance is estimated to be 800 ha (3.82% of PL94).

The footprint for the increase in compression is expected to be 8 ha. This area will adjoin existing facilities and will be incorporated into the overall facility footprint.

Progressive rehabilitation would see this disturbance reduce further.

4.12 Chemical Use and Storage

The main chemical storage area is located at Mungi Yard. Small amounts of chemical is stored at the Moura Office in the stores. In addition, chemicals required for the water treatment are stored at the water treatment plant.

All petroleum products and other hazardous goods are stored in bunded areas sized in accordance with AS1940 Storage and Handling of Flammable and Combustible Liquids.

4.13 Water Usage

Potable water is commercially sourced for drinking water use in camps and offices.

Produced water from petroleum activities is used for drilling activities and if produced water is not available water is purchased from a landowner.

Produced water is also used for dust suppression under the PL94 EA conditions and the end of waste code for dust suppression off the PL 94 tenure.

Produced water and treated water are used in the construction of petroleum infrastructure.

4.14 Waste Management

4.14.1 General Wastes

General wastes are managed in accordance with the waste and resource management hierarchy as prescribed in the *Waste Reduction and Recycling Act 2011* (Qld). In summary:

I. Waste avoidance and reduction: practices are introduced into all aspects of the operation which aim at reducing the amount of wastes produced
II. Waste reuse: practices are encouraged and monitoring of industry developments identifies any opportunities for external reuse programs
III. Waste recycling: a recycling program has been implemented which aims at recycling all waste materials which have some value. Goods such as drums, metals, oils and solvents, glass, paper and plastic materials are included in the recycling program
IV. Waste to energy: developments within the industry are monitored to identify potential opportunities for this practice
V. Waste disposal: non-recyclable wastes generated are disposed of in a Council Landfill.

Other commitments for general waste management include:

- A Waste Management Plan and Waste Management Site Practice
- Register of all chemicals stored on site
- Licensed waste contractors are employed to collect, transport and dispose of waste from the site. The waste management contractor/s are required to dispose of the waste to a licensed waste management facility, with reporting requirements on the final destination of the waste
- Wastes are not burned or allowed to be burned on site.

4.14.2 Regulated Waste

Regulated waste management practices at Westside include the following:

- No oil or synthetic based drilling muds are used in operations
- All petroleum products and other hazardous goods are stored in bunded areas sized in accordance with AS1940 Storage and Handling of Flammable and Combustible Liquids
- Regulated wastes are tracked using the Waste Transport Certificates as required under the environmental protection legislation
- Regulated wastes are stored in designated locations to ensure that there is a minimal risk of accidental release of regulated wastes to land
- Regulated wastes are only removed from site by a licensed regulated waste contractor and taken to an appropriate licensed waste disposal facility
- A register of hazardous materials and their corresponding locations is kept on site.

The waste streams and their sources that are likely to be produced during the activities are discussed in Table 6 below.

Table 6 Waste Streams and their Sources

Waste Stream	Generating Activities
Clean General	Scouting, Land clearing for Road and Track construction, Seismic and Geophysical Activities, Well Installation and Development, Pipeline Construction and Operations, Gas Separation

Waste Stream	Generating Activities
	and Treating Operations, Water Treatment Operations, Onsite Waste Treatment and Disposal Operations
General Recyclable Goods	Scouting, Land clearing for Road and Track construction, Seismic and Geophysical Activities, Well Installation and Development, Pipeline Construction and Operations, Gas Separation and Treating Operations, Water Treatment Operations, Onsite Waste Treatment and Disposal Operations
Scrap Steel	Well Installation and Development, Pipeline Construction and Operations,
Waste Hydrocarbons	Land Clearing for Road and Track Construction, Well Installation and Development, Pipeline Construction and Operations, Gas Separation and Treating Operations , Onsite Waste Treatment and Disposal Operations,
Waste Chemicals	Gas Separation and Treating Operations, Water Treatment Operations, Onsite Waste Treatment and Disposal Operations
Sanitary Waste	Well Installation and Development, Gas Separation and Treating Operations, Pipeline Construction and Operations, Gas Separation and Treating Operations
CSG Water	Well Installation and Development, Well Operations – CSG Production, Onsite Waste Water Treatment and Disposal Operations
CSG Water Concentrate	Waste stream of the Waste Water Treatment Plant
Hydrotest water	Integrity testing of new pipelines.

Waste stream definitions:

- General recyclable wastes: paper, cardboard, recyclable plastics, glass, aluminium and steel cans.
- Scrap steel waste: used drums, and metal scraps from wells and pipelines
- Waste hydrocarbons: Drilling Fluids, Surfactants, Spent filter
- Waste chemicals: non hydrocarbon fluids
- CSG Water Concentrate: waste stream of the CSG Water Treatment Plant
- Hazardous wastes: hazardous substances, biohazard (medical) waste

Westside use licensed contractors for the transport and / or processing of the listed wastes to the following facilities in the region:

- JJ Richards – Gladstone
- Cleanaway – Rockhampton
- Toxfree – Services

4.15 Environmental Monitoring

All monitoring required by the EA will be conducted by a suitably qualified person and all required laboratory analyses and test will be undertaken by a NATA accredited laboratory. Where there no NATA accredited laboratories for a specific analyte or substance, then duplicate samples will be sent to at least two separate laboratories for independent testing or evaluation.

Regulatory monitoring and sampling will be carried out in accordance with the following documents:

- For waters and aquatic environments, the Queensland Government's Monitoring and Sampling Manual 2009
- For groundwater, Groundwater Sampling and Analysis – A Field Guide (2009:27 GeoCAt #6890.1)
- For noise, the Environmental Protection Regulation 2019
- For air, the Queensland Air Quality Sampling Manual and/or Australian Standard 4323.1:1995 Stationary source emissions method 1: Selection of sampling positions, as appropriate for the relevant measurement
- For soil, the Guidelines for Surveying Soil and Land Resources, 2nd edition (McKenzie et al. 2008), and/or the Australian Soil and Land Survey Handbook, 3rd edition (National Committee on Soil and Terrain, 2009);
- For dust, Australian Standard AS3580.

5. Environmental Management System

Westside's Health, Safety and Environmental (HSE) Management System has the following components:

- HSE Policy Statements
- HSE Standards
- HSE Procedures e.g. Incident Reporting & Investigation, Risk Management Procedures and their supporting forms, checklists
- Standard Operating Procedures and their supporting forms, checklists
- Job Safety and Environment Analysis and Risk Assessments.

This system applies to all Westside activities and is illustrated in Figure 4

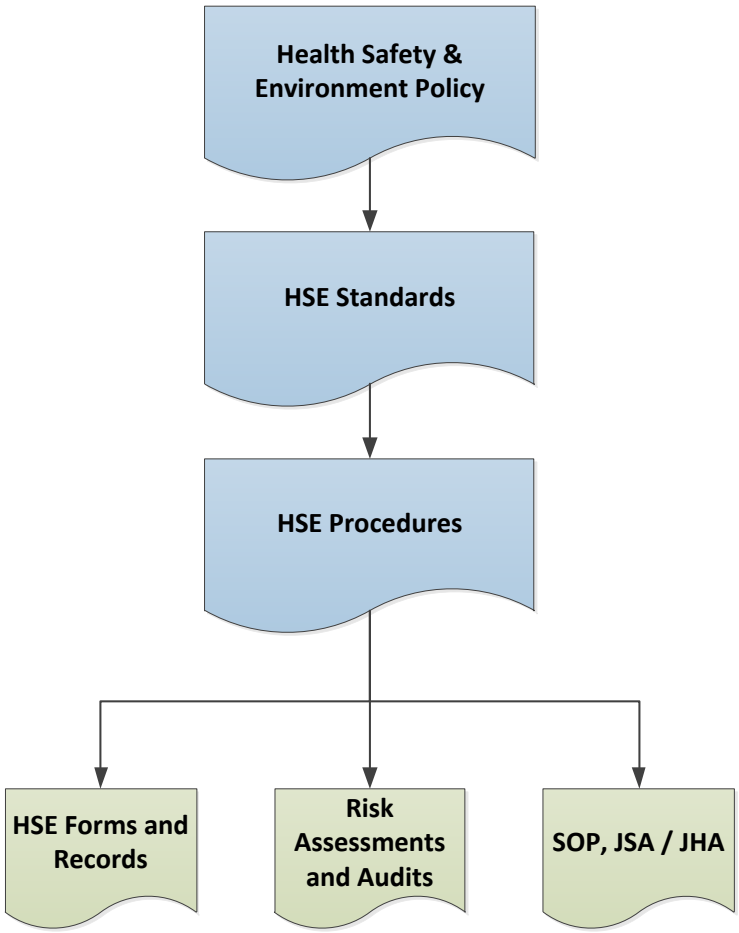

Figure 4 Structure of HSE Management System

A number of standards and procedures have been developed to support the HSE policy and operations at Westside. These are reviewed, as a minimum, every five (5) years to currency to operations, and amended if necessary. The HSE standards and procedures are maintained by the Westside HSE Department. They are publicised and made readily available to all Westside personnel.

The HSE Management System Standards are summarised in Figure 5 and Table 7 below.

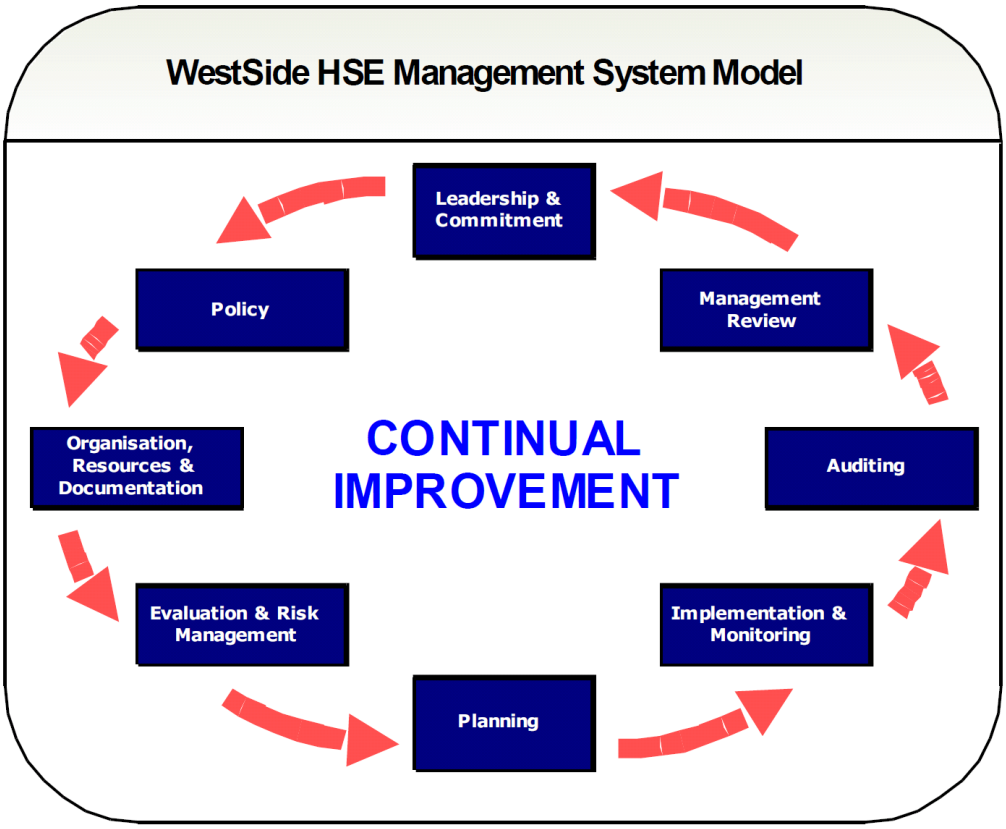

Figure 5 HSE Management System Model

Table 7 HSE Management System Standards

1. Leadership and commitment	
2. Policy and strategic objectives	
3. Organisation, resources and documentation	3.1 Organisational structure and responsibilities
	3.2 Management representative(s)
	3.3 Resources
	3.4 Competence
	3.5 Contractors
	3.6 Communication
4. Evaluation and risk management	4.1 Identification of hazards and effects
	4.2 Evaluation
	4.3 Recording of hazards and effects

	4.4 Objectives and performance criteria
	4.5 Risk reduction measures
5. Planning	5.1 General
	5.2 Asset integrity
	5.3 Procedures and work instructions
	5.4 Management of change
	5.5 Contingency and emergency planning
6. Implementation and Monitoring	6.1 Activities and tasks
	6.2 Monitoring
	6.3 Records
	6.4 Non-compliance and corrective action
	6.5 Incident reporting
	6.6 Incident follow-up
7. Auditing and Reviewing	7.1 Auditing
	7.2 Reviewing

5.1 Compliance Management

Compliance management is current and available to demonstrate evidence of compliance with environmental authorities and environmental approval conditions that relate to Westside's activities.

Permit Intel hosts the Westside compliance obligations and schedules the obligations to ensure they are met. The DoneSafe system is used to report potential compliance issues, incident reporting and audit actions.

For identified any non-compliances identified during the annual return review, these must be:

- Reported to the Line Managers and HSE Manager
- Raised as an incident in the DoneSafe system which tracks actions to rectify the non-compliance
- Actions based on risk to avoid repeat occurrences must be developed.

5.2 Annual Return

Westside is required to submit an annual return to the Queensland Government in accordance with the conditions of the EA.

5.3 Hazard Identification and Risk Management

Westside as a company strives to integrate risk management processes into all facets of its operations. The aim is to reduce any risk to As Low As Reasonably Practicable (ALARP) and to manage risk to maximise opportunities and minimise adverse impact.

This risk assessment process is the primary tool for treating all risk. Priority is given, during the risk management process, to the elimination of hazards or the means by which they are initiated. Control measures are then used for those hazards where elimination is considered impractical. The order of priority adopted when considering hazard management is as follows:

1. Elimination wherever possible;
2. Substitution by a less hazardous process, substance etc;
3. Engineering controls;
4. Administrative controls; and
5. Prevention / minimisation of impacts e.g. barriers.

Risk management protocols apply across all Westside activities including routine tasks, maintenance activities, plus those associated with combined or simultaneous operations and non-routine activities.

The effectiveness of the risk control measures employed will be regularly reviewed during environmental inspections, hazard identification workshops, HSE meetings and where deficiencies are identified these are addressed accordingly.

Any environmental risk assessment performed will be in accordance with the Risk Assessment and Risk Management Procedure (WCL-HSE-PRO-0001) and will be recorded in the Risk Register.

5.4 Contractors, Suppliers, Partners and Visitors

Suppliers and contractors will be required to deliver services in accordance with legislative requirements, Westside or relevant contractor policies and procedures.

5.5 Crisis and Emergency Management

The Emergency Response Plan (WCL-HSE-PRO-0006) (ERP) details the approved response procedures for any operational emergency event which occurs in the course of Westside activities and operations.

Emergency events or incidents which will be handled in accordance with the ERP include:

- serious injury or illness of personnel;
- major property or facility damage; or
- environmental damage.

The objectives of the ERP are:

- to decrease the level of risk to life, property and the environment;
- to control any incident and minimise its effects; and
- to provide the basis for training of site personnel who could be involved in any emergency.

The ERP compliments and supports the safety, health and environmental management elements of the Westside Safety, Health and Environmental Management System. The ERP is in place and maintained, in line with regulatory requirements.

5.6 Incident Management and Learning

An environmental incident is any occurrence that has resulted in or has the potential to result in adverse consequences to the environment including air, water, land, natural resources, flora, fauna, habitats, ecosystems and/or biodiversity. Incident types include (but are not limited to):

- Defined by EAs as reportable incidents
- Material spills on a non-engineered hard stand/surface (Note: An engineered hard stand is defined as a surface/substrate that provides containment and prevents the release of contaminants to the environment)
- Death or injury to native fauna
- Complaints regarding environmental amenity or nuisance
- Any non-compliance with any condition of approval or offence under environmental legislation
- Any other unauthorised environmental harm

All environmental incidents, including near misses and stakeholder complaints will be recorded and investigated in accordance with the Westside's incident management system (DoneSafe). Information gathered from the investigation will be used to develop prevention programs. Corrective and preventative actions taken to eliminate the cause of potential incidents will be commensurate with the magnitude of the environmental risks.

The results of all incident investigations will be communicated to Westside personnel at HSE meetings and the progress of corrective action close-out monitored regularly.

5.7 Environmental Incident Reporting

The Department of Environment, Science Tourism and Innovation (DETSI) is notified by Westside on being made aware of any incidents or non-conformities which contravene the EA conditions trigger notification thresholds or where environmental harm has been caused or may be threatened as per the obligations of the EP Act.

Westside will notify DETSI's Pollution Hotline (1300 130 372) and any affected landholder, occupier, or their nominated representative as soon as possible, but within 24 hours, after becoming aware of:

- Any release of contaminants not in accordance with the conditions of an EA;
- Any other non-compliance with any condition of an EA; and
- Any event where serious or material environmental harm is caused or threatened.

The following spills of contaminants (including but not limited to hydrocarbon, CSG water or mixtures of both) will be reported to the administering authority:

Unauthorised releases of volumes of contaminants, in any mixture, to land greater than:

i. 200 L of hydrocarbons

ii. 200 L of stimulation additives

iii. 500 L of stimulation fluids

iv. 1 000 L of brine

v. 5 000 L of untreated coal seam gas water

vi. 5 000 L of raw sewage

vii. 10 000 L of treated sewage effluent.

All third-party contractors are responsible for reporting all such incidents to ensure reporting to DETSI within the time limits specified in the EA and EP Act.

Westside will notify the Department of Climate Change, Energy, the Environment and Water as soon as possible, but within 48 hours, after becoming aware of:

- Any death or injury of MNES fauna
- accidental clearing of MNES above maximum disturbance limits
- clearing of MNES habitat in a way that contravenes the patch viability/connectivity
- potential accidental contamination of MNES habitat

5.8 Complaints

Complaints received from external stakeholders will be investigated. The results of the investigation will be communicated back to the complainant within a reasonable timeframe with a record of the complaints and any actions taken recorded in the Complaints and Grievances Register.

The following process, which is consistent with *Australian Standards ISO 10002:2006 -Customer Satisfaction – Guideline* for complaints handling in organisations, will be used to record any complaints. The following will be recorded for received complaints:

- Name, address and contact number for complainant
- Time and date of complaint
- Reasons for the complaint as stated by the complainant
- Investigations undertaken in response to the complaint
- Conclusions formed
- Actions taken to resolve complaint
- Any abatement measures implemented to mitigate the cause of the complaint
- Name and contact details of the person responsible for resolving the complaint

5.9 Performance Management, Reporting and Assurance

Environment performance with HSE obligations is managed by a range of assurance processes in accordance with the Westside HSE Improvement Program. Environmental reporting requirements (both internal and external) are also identified in the Permit Intel System, which is a software program that holds the obligation and schedules the action to meet the obligation.

5.10 Management Structure and Responsibility

An Organisation Chart is maintained by Westside to clearly identify the internal business lines of communication and associated reporting structure.

The Chief Executive Officer (CEO) is responsible for ensuring adequate resources are provided to implement and maintain the HSE Management System and comply with this EMP.

Ensure that the HSEMS details the various appointments and responsibilities assigned to Westside employees and contractors. Position descriptions are also developed for each position at Westside and at a minimum detail the following:

- Role
- Responsibilities (including HSE requirements)
- Qualifications and experience required for that position.

Specific environmental roles and responsibilities are shown in Table 8 and will be communicated to all Westside personnel.

Table 8 Environmental Roles and Responsibilities

Role	Reports to	Responsibility
Chief Executive Officer (CEO)	Westside Board	Ensure compliance with Westside Policy and Standards. Ensure overall compliance with this EMP. Participate in Management Reviews.
Chief Operating Officer (COO)	Chief Executive Officer	Monitor all activities. Ensure compliance with Westside Policy and Standards. Ensure overall compliance with this EMP including provision of inductions and compilation of reports. Responsible for reporting incidents to DETSI as required and ensuring incident investigations are undertaken (as appropriate). Assist in the development of a response strategy in the event of an environmental emergency. Participate in inspections/audits to ensure compliance with this plan. Participate in Management Reviews.
Moura Operations Superintendent	Chief Operating Officer	Ensure all Meridian CSG activities are conducted in an environmentally responsible manner. Ensure compliance to all relevant environmental legislative requirements, commitments, conditions and procedures as stated in this EMP.

Role	Reports to	Responsibility
		Conduct inspections/audits to ensure compliance with this EMP Responsible for reporting externally reportable incidents to the COO. Responsible for recording all environmental incidents, participating in investigations and ensuring follow-up actions are carried out. Manage and coordinate emergency response activities.
HSE & Risk Manager	Chief Operating Officer	Complete environmental statutory reporting requirements. Provide advice on environmental matters and corrective actions as requested. Review statutory compliance and ensure all approvals in place. Monitor the implementation and effectiveness of EMPs and the HSE Management System. Conduct environmental monitoring and coordinate training. Organise and participate in environmental audits Develop and implement the environmental management systems/manuals/procedures. Review and update the EMP. Participate in Management Reviews. Monitor the implementation and effectiveness of the HSE Management System. Conduct OHS monitoring and training. Organise OHS audits. Develop and implement the OHS management manuals/procedures/plans. Review and update the HSE Management System. Conduct auditing inspections, monitoring and training. Undertake Risk Reviews. Participate in Management Reviews.
Moura HSE Advisor	HSE & Risk Manager	Monitor operations for EA compliance Environmental monitoring program (soil & water sampling, soil and vegetation assessments)

Role	Reports to	Responsibility
		Environmental monitoring, inspections, continuous improvement Organise vegetation assessments prior to disturbance including field assistance, travel and accommodation for ecologist. Assist in delivery of all environmental and related programs Investigate environmental issues, complaints and events
All personnel and contractors	Managers / Supervisors	Take responsibility for HSE in the workplace. Responsible for ensuring they are adequately trained to carry out any task set or mitigation measure they may have to carry out, or seek training or re-allocation of responsibility Undertake work activities with reasonable care and in accordance with procedures to ensure no adverse impacts to the environment Report all incidents, near-misses and hazards to immediate supervisor as soon as possible Participate in the development of work procedures. Participate in workplace inspections. Maintain housekeeping standards.

Additionally Westside utilises the services of external HSE professionals (e.g. engineers, ecologists, agronomists etc.) to provide HSE expertise and assistance as required.

5.11 Training and Awareness

This document is reviewed periodically for effectiveness and amended where appropriate. Managers and Supervisors are responsible to ensure employees/contractors have the skills and competence to undertake their identified roles and responsibilities. If the personnel do not have appropriate skills to undertake the identified responsibilities, training will be provided or they will be replaced with competent personnel.

All personnel, including contractors, will complete an induction prior to the commencement of work. The induction will include health, safety and environmental information specific to the Meridian Field and will aim to ensure an understanding of:

- the importance of conforming with Westside policy, standards and procedures and regulatory requirements
- the potential impact and significance of environmental aspects associated with Westside's activities
- personnel roles and responsibilities for environmental performance
- the relevant objectives and requirements of the EMP
- the emergency response system.

Records are maintained of all training provided to individuals and of any qualifications or certificates that they hold. This information is recorded in the 'Training Register'. It is the responsibility of each individual to ensure that copies of training and competency records are forwarded for incorporation in the Training Register and employee files.

5.12 Communication and Consultation

The Westside Moura Operations Superintendent will be responsible for keeping the workforce informed about environmental issues, acting as a focal point for personnel to raise environmental issues, and consulting and involving all personnel in the following:

- issues associated with the implementation of the EMP;
- any proposed changes to equipment, systems, or methods of operation of plant, where these may have environmental implications; and
- any proposals for the continuous improvement of environmental protection, including the setting of environmental objectives and training schemes.

Regular HSE meetings will be held on site and the issues discussed and actions taken will be recorded. The minutes of each meeting, including action items from the meetings will be made available to all personnel.

Other forms of internal communication include toolbox meetings which are undertaken before every critical or new job. This meeting includes all personnel involved in the task and will include aspects such as vegetation management and spill prevention requirements.

5.13 Records and Reporting

Records will be kept on the Westside servers for a minimum of 5 years.

Reporting will be conducted in accordance with the relative obligations and are scheduled in the Permit Intel System.

5.14 Audit and Review

Environmental audits are conducted regularly, based on the risk profile to test the performance of our environmental controls. Westside conducts internal audits and third party audits to assure the business is in compliance and the controls are adequate. Non-conformances identified during environmental audits will be documented and corrective actions tracked and closed out.

6. Environmental Management

6.1 Climate

Climate monitoring data collected by the Bureau of Meteorology is available for the Moura Post Office (Station No. 039071) located in the northern area of PL94. The climate of the surrounding region is subtropical, with warm to hot summers and mild winters. The average annual rainfall at the Moura Post Office Station since 1980 is 685 millimetres (mm), of which the majority falls in the warmer months of the year (November to February). Mean daily pan evaporation in the summer season reaches 8mm in December and 3mm in June. Average daily evaporation of 5.8mm/day (2117mm/year) exceeds mean rainfall throughout the year, the highest moisture deficit occurring during summer.

6.2 Land

6.2.1 Environmental Values

The environmental values (EVs) of the land within the PL to be protected or enhanced are:

- Integrity of undisturbed land and ecosystems within the Meridian Seam Gas Fields
- Integrity of the topsoil as a resource to be used in rehabilitation
- Stability of disturbed land and ensuring it is non-polluting
- Integrity of soil physical and chemical attributes relative to vegetation establishment and growth
- Integrity of soil stability and structure for erosion protection
- Suitability of the land for continued agricultural use post CSG operations.

6.2.2 Existing Environment

Topography
The topography of the area is flat to gently undulating, with an elevation of between 100m and 150m Australian Height Datum (AHD). The elevation increases slightly in the southwest of the PL as it approaches the Dawson Range, with areas on eastern boundary of the PL also higher in elevation, due to the adjacent Moura Mine overburden emplacements. In contrast to the surrounding landscape, the overburden emplacement areas of the Moura Coal Mine are steep and rocky.

Vegetation
The region has been extensively cleared for agriculture and livestock, with small patches of remnant vegetation present along the Dawson River and its tributaries and in isolated fragments across the balance of the landscape. A nature refuge is present in the south eastern corner of the PL, while the Moura Coal Mine is located adjacent to the eastern PL boundary.

Drainage
Surface water drainage in the area includes the Dawson River and its tributaries, with major creeks including Huon and Kianga Creeks, which flow through the PL. Several other small ephemeral creeks and drainage lines are also present.

Soils and Geology
A survey of the geology, soils and vegetation communities in the area was undertaken by T29 in 2019, with a summary of the findings shown in Figure 6 and Table 9 below.

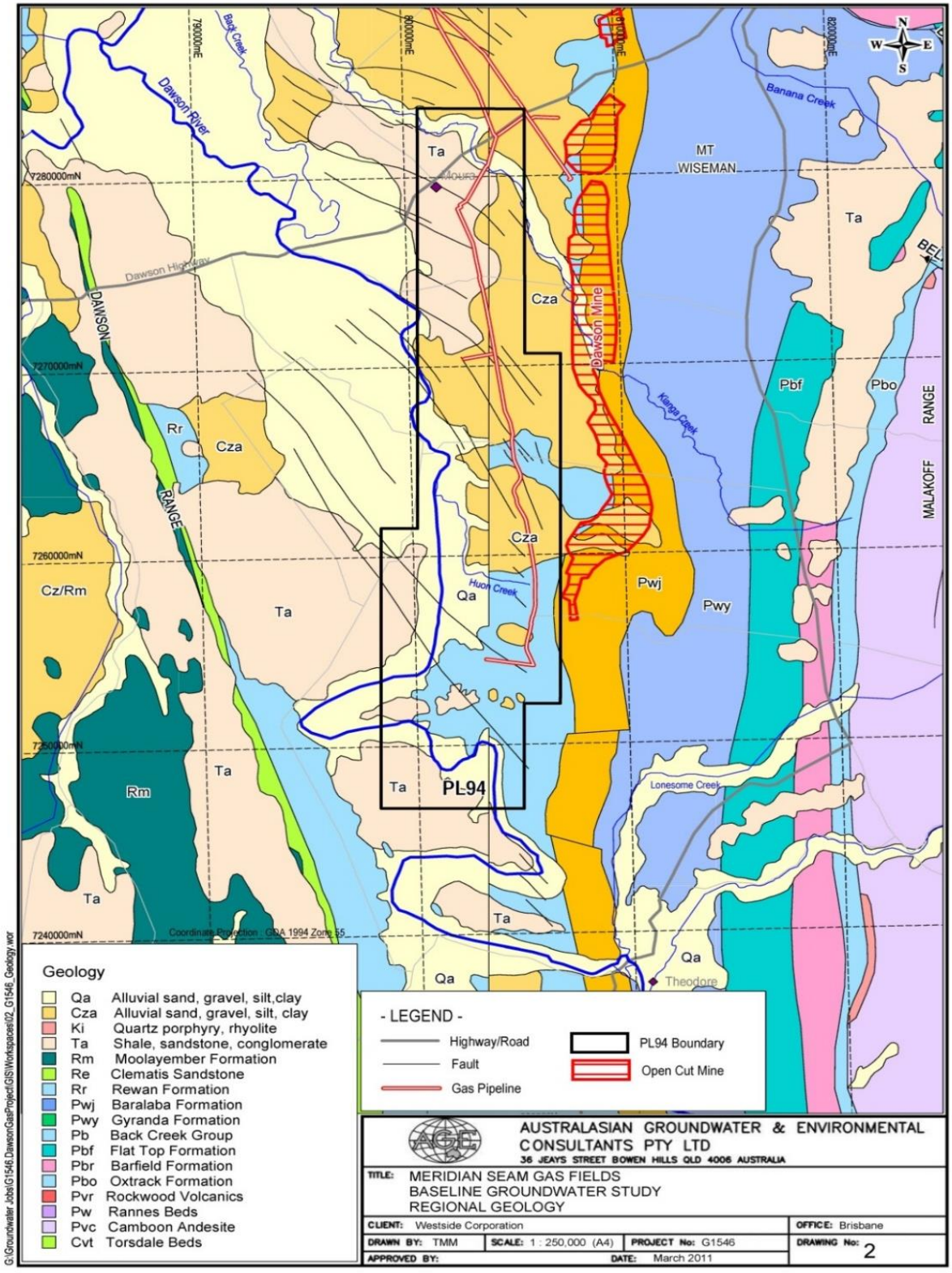

Figure 6 Regional and Local Geology

Table 9 Geology, Soils and Vegetation

Geology	Soils	Remnant Vegetation
Alluvial plains	Alluvial cracking clays, non-cracking clays, duplex soils, gradational soils, loams and sands	Alluvial plains – Eucalypt Woodlands, Blue Gum, Coolabah, Poplar Box, Moreton Bay Ash
Tertiary and Jurassic to Permian sedimentaries	Mainly grey cracking clays and deep duplex soils, minor shallow duplex soils and shallow stony soils in some areas	Mixed Brigalow Plains – Brigalow, Dawson gum, Yapunyah, Bauhinia, Belah, Yellow Wood
Tertiary basalt, Permian volcanics and Triassic to Permian sedimentaries	Mainly brown and dark non-cracking clays, shallow stony soils and dark cracking clays, minor duplex soils	Softwood Scrub Uplands – Brigalow and Eucalypt Woodlands of Narrowleaf Ironbark, Long Fruited Bloodwood, scattered closed forests of Lancewood
Tertiary basalt, lower Permian volcanics and minor sedimentary rocks	Mainly dark cracking clays	Eucalypt Clay Uplands – Silver Leaf Ironbark, various Bloodwoods, Moreton Bay Ash, Poplar Box, Brigalow
Laterised, undifferentiated sedimentaries	Mainly red and yellow earths, minor shallow stony soils, duplex soils and deep sands	Lateritic Plateaus – Narrowleaf Ironbark, Long Fruited Bloodwood, scattered closed forests of Lancewood
Mountains, hills and dissected plateaus on Jurassic to Devonian sedimentary and igneous rocks	Mainly shallow stony soils, shallow duplex soils and rocky outcrops, minor deep duplex soils and non-cracking clays	Ranges – Narrow and Silver Leafed Ironbark Woodlands, Eucalypt forests, Lancewood forests in closed areas

Tenure

The underlying land tenure of PL94 is mostly Freehold, with Leasehold, Reserve, State Land and Stock Routes also occurring within the PL. Detailed background tenure information, including lot and plan descriptions, and names of the landholders underlying the PL, are maintained by Westside.

Current Land Use

Land uses in the region surrounding PL94 include a variety of agricultural uses such as cotton, grain, cattle production and coal mining (see Figure 7). Additionally, the PL encompasses the Moura township, with the Banana and Theodore townships 20km to the north east and 10km to the south-east respectively.

Other land uses in the area include transport infrastructure such as highways and railways, state forests and conservation parks as shown in Figure 7.

Of these, the Roundstone State Forest and Theodore State Forest are 10km to the west and 20km to the south-west of the PL respectively, with the Theodore State Forest situated between the Palmgrove and Isla Gorge National Parks. The Highworth Bend Conservation Park is located on the Dawson River approximately 3km to the west of the southern part of the PL, with the Dawson River Conservation Park located 10km to the west of the northern part of the PL. A further 10km to the west of the Roundstone State Forest is the Roundstone Conservation Park.

Parts of the PL and the surrounding region (mostly in the vicinity of the Dawson River), have been identified as strategic cropping land under the relevant regional plan, and are shown in Figure 8.

Stock routes are present within the PL aligned with the road reserves of the Dawson Highway, Theodore Baralaba Road, Gibihi Road and Nipan Road.

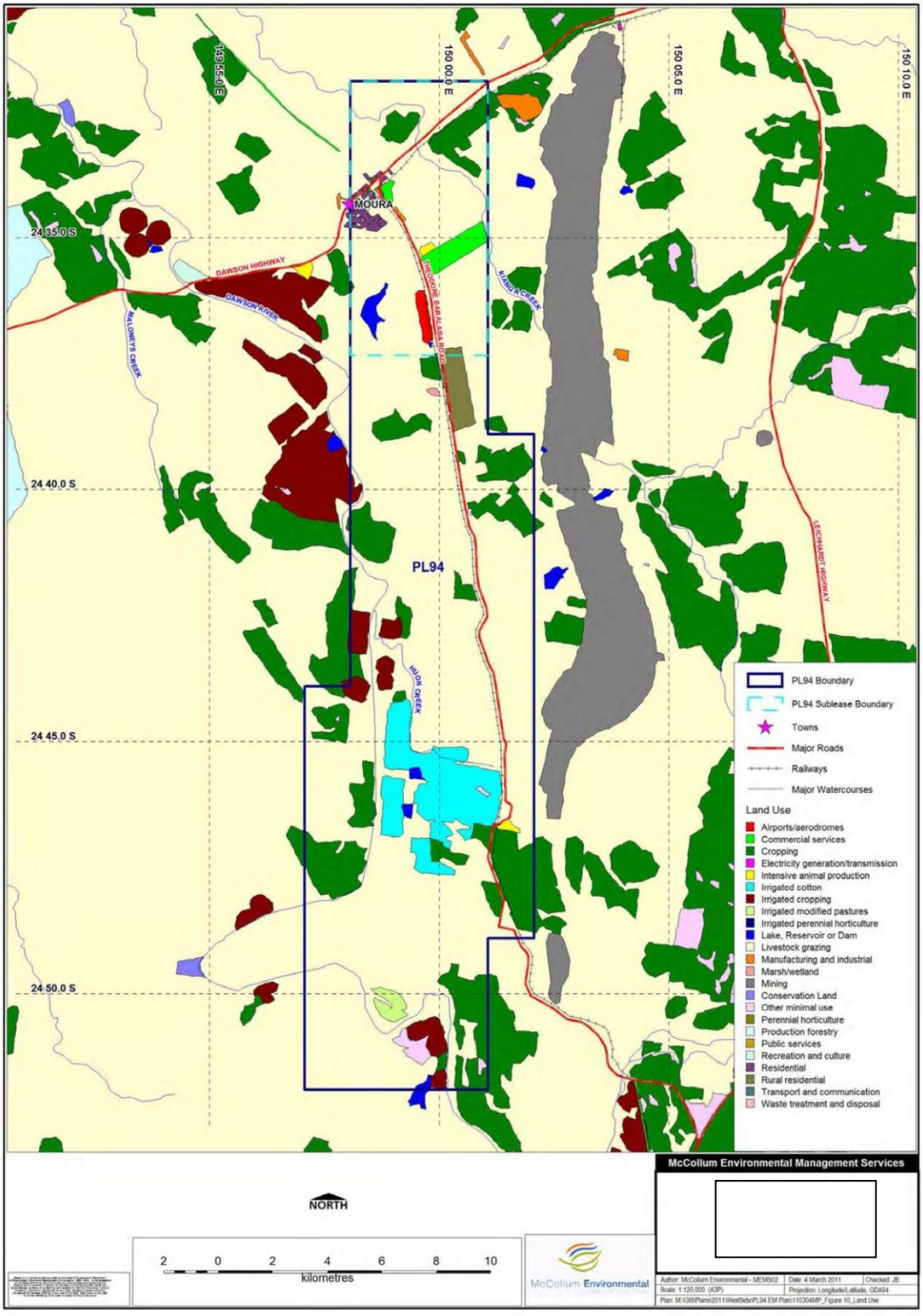

Figure 7 Land Use Map

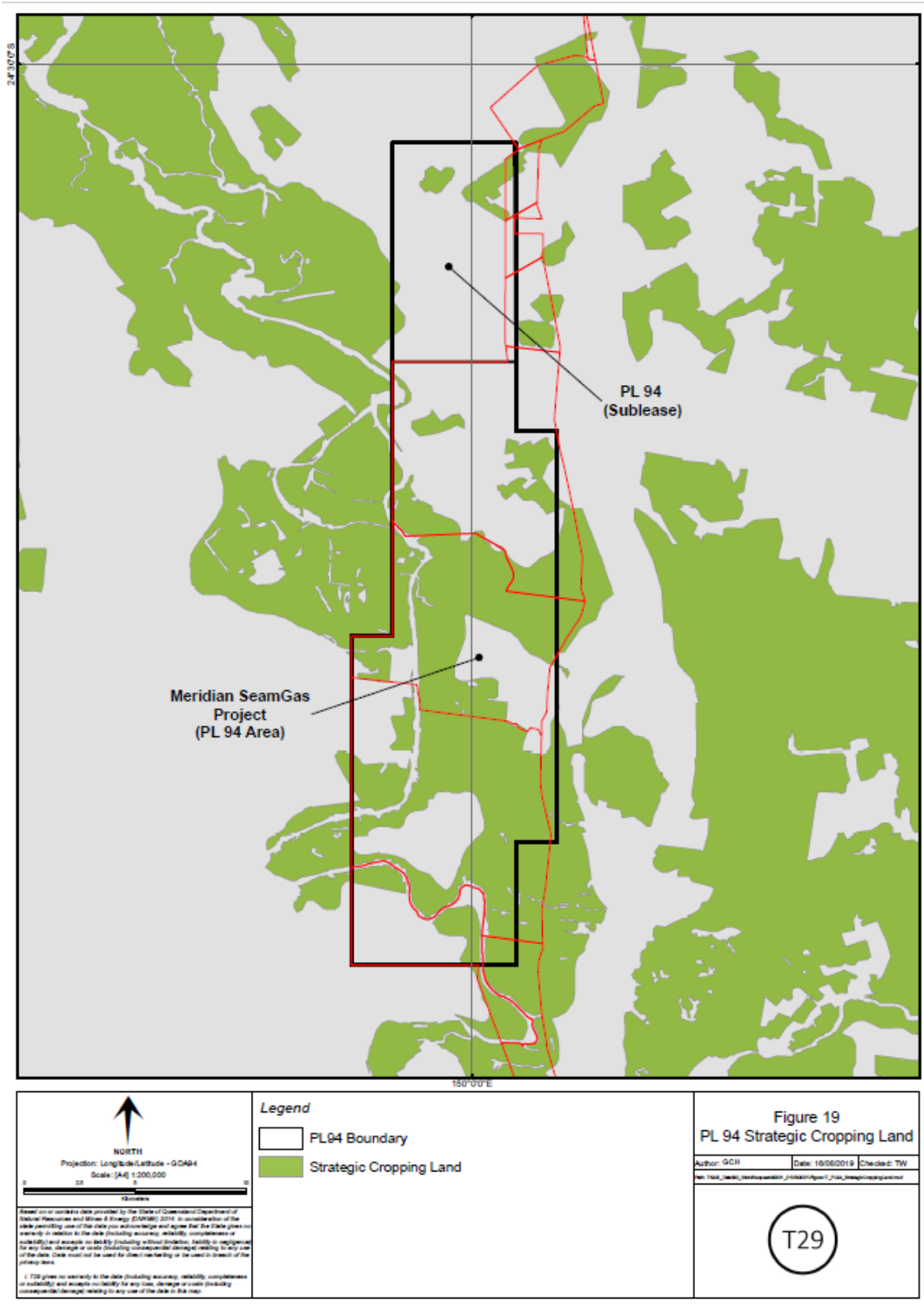

Figure 8 Strategic Cropping Land on PL 94

Existing Infrastructure
Infrastructure in the region primarily consists of the Moura township, with associated transport infrastructure including the Dawson Highway, Theodore Baralaba Road and Dawson Valley Branch Railway. The road and rail systems support transport requirements for the mining, gas and agricultural industries of the area. Approximately 3km south of the town is Moura Airport.

Infrastructure supporting agricultural activities is also present on a number of properties both within and surrounding the PL, including homesteads, irrigation structures, groundwater bores and dams. The Moura Weir is also located on the Dawson River north of the Dawson Highway.

Petroleum activity infrastructure includes CSG wells, water gathering piping systems, above ground tanks, water treatment plant, gas gathering piping systems, compressor stations and processing plants (compressors and gas dehydration equipment).

Land Contamination Assessment
There is currently no anecdotal or physical evidence of contaminated sites within the gas fields.

Land Suitability
Agricultural land suitability of the study area has been assessed largely using criteria provided in the *Guidelines for agricultural land evaluation in Queensland* (Queensland Department of Primary Industries, Land Resources Branch, 1990). The classification does not necessarily reflect the existing land use. Rather, it indicates the potential of the land for such uses as crop production, pasture improvement and grazing.

There are 5 classes described in the guidelines, as outlined below.

Class 1: Land with negligible limitations, which is highly productive requiring only simple management practices to maintain economic production.

Class 2: Land with minor limitations which either reduce production or require more than the simple management practices of Class 1 land to maintain economic production.

Class 3: Land with moderate limitations which either further lower production or require more than those management practices of Class 2 land to maintain economic production.

Class 4: Marginal land with severe limitations which make it doubtful whether the inputs required to achieve and maintain production outweigh the benefits in the long term (presently considered unsuitable due to the uncertainty of the land to achieve sustained economic production).

Class 5: Unsuitable land with extreme limitations that preclude its use for the proposed purpose.

Most land lies within Classes 3 and 4.

Regional Interests
Priority agricultural areas (PAA) and strategic cropping areas (SCA) of regional interest under the Regional Interests Planning Act 2014 (Qld) (RPI Act) are mapped throughout the PL and the surrounding region. The townships of Moura to the north and Theodore to the south are priority living areas (PLA) and there are provisions regarding obtaining approval under the RPI Act for undertaking resource activities in these areas. There are no strategic environmental areas in the region. Note areas mapped as PLAs, PALUs and SCAs are subject to ground truthing for actual presence on PL94.

Erosion Potential
The area is not identified as a high erodibility area.

Good Quality Agricultural Land
The lease area, and immediately surrounding land, were also assessed to identify potential Good Quality Agricultural Land (GQAL) in accordance with the *Guidelines for the Identification of Good Quality Agricultural Land* (Qld DPI & DHLG&P, 1993) (referred to as the Good Quality Agricultural Land guidelines).

Agricultural land is defined as land used for crop or animal production, but excluding intensive animal uses (i.e. feedlots and piggeries). GQAL 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. GQAL is that land which meets the criteria of Class A or B in Table 10.

The DPI guidelines have been introduced to provide local authorities and development proponents with a system to identify areas of GQAL for planning and project approval purposes.

Descriptions of the agricultural land classes are provided below in Table 10.

Table 10 Agricultural Land Classes

Class	Description
Class A	**Crop land** - Land that is suitable for current and potential crops with nil to moderate limitations to production.
Class B	**Limited crop land** - Land that is suitable for a narrow range of current and potential crops due to severe limitations, but is highly suitable for pastures. Land may be suitable for cropping with engineering or agronomic improvements.
Class C	**Pasture land -** Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.
Class D	**Non-agricultural land -** Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rocky outcrop, poor drainage, salinity, acidic drainage or is an urbanised area.

All classes of land exist to some extent over the gas fields tenure.

6.2.3 Potential Impacts

Potential impacts on land resources from CSG related disturbances include:

- Possible land suitability changes
- Possible land use changes
- Possible land contamination.

These potential impacts could result from the following:

- Contamination of land from storage and handling of hydrocarbons and chemicals
- Contamination from waste material
- Erosion from either wind or water
- Change in vegetation communities
- Disturbance of existing areas of contamination (e.g. cattle dip)
- Reduction in the productivity of land for post CSG operations
- Loss of topsoil through poor topsoil management practices
- Compaction of soil in hardstand and facility locations and along access tracks
- Degradation of downstream water quality
- Degradation of groundwater quality
- Reduced groundwater availability.

Post CSG Operations Land Suitability and Use

The existing land uses of cropping and grazing will be impacted upon by CSG activities, resulting in a post CSG landscape including water storages and remaining infrastructure.

During CSG activities the operational footprint will be minimised wherever possible. Agricultural land suitability will primarily be affected by a reduction in the available agricultural land. After decommissioning of CSG activities, land will be rehabilitated to its prior land use or otherwise, in consultation with the landowner and government as required.

Possible Land Contamination

Following the completion of CSG activities, all wells, pipelines, equipment, structures and buildings not required by the landowner following the cessation of CSG activities will be decommissioned. A contaminated site assessment will be conducted and will form part of the Final Rehabilitation Report and any necessary remedial action taken.

6.2.4 Management Plan

Environmental Protection Objectives	To development, operate in a manner that has minimal impact to geology, topography, geomorphology, soils and land resources. To operate in a manner that has minimal impact to the PL land, surrounding properties, biodiversity and downstream surface water and groundwater quality.
Performance Standards	• No complaints from landholders or third parties • No land degradation • No unauthorised direct or indirect release of contaminants to land or water • Return land to its previous land use quality, or otherwise in consultation with land owners
Control Strategies	
Topsoil Management	• Clearing and topsoil removal will only be undertaken where necessary for ongoing operations or drilling • Clearing will only commence when suitable erosion and sediment control measures are in place • Topsoil will be recovered ahead of disturbance and stockpiled (or reused directly where possible) in a secure area

	• Topsoil stockpiles will be located away from drainage channels, operational activities, and stormwater flow, standing vegetation and vehicle movements so that it is available in later rehabilitation • Topsoil stockpiles will be limited to 3m in height, be clearly identified as a topsoil stockpile and will be fenced to exclude cattle • Current best practice for erosion and sediment control measures will be undertaken in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control (BPESC) document to minimise the potential for sedimentation of receiving waters • Where soil will be stockpiled for a long period of time, it will be revegetated to protect the soil from erosion and maintain active populations of beneficial microbes • Cleared vegetation or soil will not be pushed up against trunks of trees or stored against fence lines • Soil stockpiles will not be placed within the bed or banks of watercourses • Soil and surface stability will be maintained at all times (e.g. temporary erosion control berms, drains and sediment barriers will be installed as necessary and maintained until final construction clean-up is completed) • Regular inspection of disturbed areas will be undertaken to ensure any erosion problem areas are identified and repaired as necessary • The period of time between trenching and backfilling will be minimised to prevent erosion of exposed soils • Development of an erosion management plan including requirements for rehabilitation of eroded areas.
Land Management	• Clearing will be limited to the minimum required. Trees will be trimmed rather than felled whenever possible, however some trees will be required to be felled. • A permit to disturb system is in place to ensure all vegetation clearing and surface disturbance is approved by the appropriate level of management • All clearing boundaries will be illustrated on construction drawings and clearly marked/flagged in the field • Cleared vegetation will be stockpiled away from operational activities, drainage channels and vehicle movements so that it is available for use in rehabilitation • Existing access tracks will be utilised wherever possible, to minimise the disturbance footprint • All vehicle movements will be restricted to designated access roads, hardstand areas and easement areas • All cleared and disturbed areas will be regularly inspected to assess the effectiveness of environmental protection measures.
Pipelines	• Pipeline operation and maintenance will be in accordance with the relevant section of the APIA Code of Environmental Practice: Onshore Pipelines (2009), AS2885 and APGA code of practice (HDPE gas gathering network). • Pipeline trenches will be backfilled and topsoil reinstated within three months after pipe laying

	• Reinstatement and revegetation of the pipeline right of way (ROW) must commence within 6 months after the pipeline construction. The pipeline ROW will be a table landform, reprofiled to a level consistent with surrounding soils, reprofiled to original contours and established drainage lines and vegetated with groundcover which is not a declared pest species, and which is established and growing.
Chemical and Dangerous Good Management	• Storage and spill containment facilities for all chemicals and fuels will be designed and constructed in accordance with Australian Standard AS1940: The storage and handling of flammable and combustible liquids • Spill control kits will be provided at all hydrocarbon and chemical storage areas, with personnel trained in their correct use • All key personnel will undergo inductions and training in safe work practices for handling or transporting chemicals or hydrocarbons, minimising the risk of spills and emergency response procedures • Chemicals will be assessed for their potential safety and environmental impact prior to introduction to site • Periodic reviews will be conducted to determine whether alternative substances or procedures are available • SDS for all chemicals and dangerous goods will be available on-site • Sites will be designed to contain and isolate spills within the site • Any hydrocarbon, chemical or industrial waste spillage from storage areas and construction equipment will be contained, treated or remediated in accordance with the requirements of the contaminated land provisions of the EP Act • All lots on which Notifiable activities will be undertaken will be listed on the Environmental Management Register (EMR) • Records on the location and quantities of chemicals and dangerous goods will be maintained • Regular inspections will be undertaken to ensure that dangerous goods storage facilities are compliant. • The integrity of storage facilities for hazardous materials and wastes and all bunded or doubled skinned areas will be routinely inspected by Operations.
Corrective Actions	• Where contamination has occurred, an investigation to identify the material and cause of contamination will be undertaken and an appropriate management strategy including impact mitigation measures developed • Validation sampling of any remediated area will be used to establish the site as “clean” as per relevant DETSI guidelines • Any spillage from storage areas will be reported in the Westside reporting (DoneSafe) System • Other incidents relating to releases to land will be managed through Westside’s reporting (DoneSafe) System.

6.3 Biodiversity

6.3.1 Environmental Values

The EVs to be protected or enhanced are the terrestrial and aquatic flora and fauna of the ecosystems in the vicinity of the gas fields.

The EV of the area in relation to flora and fauna habitat is diminished due to the substantial historical clearing that has occurred. However, remnants of vegetation communities, habitat and faunal species of significance are present within and surrounding the proposed petroleum lease.

6.3.2 Existing Environment (Flora)

Vegetation surveys of PL94 has been undertaken by Umwelt in 2020. The PL is located within the Dawson River Downs subregion of the Brigalow Belt South Interim Biogeographic Regionalisation for Australia bioregion. This bioregion is broadly characterised by mixed eucalypt woodland with areas of brigalow (Acacia harpophylla) scrubs and open Mitchell grasslands. Cattle grazing is the major land use in the bioregion. Vegetation includes remnant and regrowth woodland and forest communities as well as non-remnant pasture.

Brigalow woodland is present as discontinuous patches, largely upon gently undulating, cracking clay soils, but also as a fringing woodland along waterways. These woodlands are generally characterised by a closed canopy of brigalow and the presence of species such as belah (*Casuarina cristata*), wilga (*Geijera parviflora*), false sandalwood (*Eremophila mitchellii*) and currant bush (*Carissa ovata*). Gilgai formations are often a common feature in brigalow woodland.

Riparian woodlands dominated by forest red gum (*Eucalyptus tereticornis*) and coolibah (*Eucalyptus coolabah*) are situated along major waterways and drainage lines within the PL. These woodlands typically comprise an open shrub layer and conspicuous grassy layer of species such as green panic grass (*Megathyrsus maximus*) and sabi grass (*Urochloa mosambicensis*). Tree species present in these woodlands can include river oak (*Casuarina cunninghamiana*) and river tea-tree (*Melaleuca bracteata*). Large scale land clearing has occurred in the region leaving few remaining natural vegetation remnants. The majority of the area is under improved pasture with typical species including Green Panic (*Panicum maximum*), Buffel Grass (*Cenchrus ciliaris*) and Rhodes Grass (*Chloris gayana*). Some areas of Mitchell Grass (*Astrebla spp*), tussock grassland and Black Spear Grass (*Heteropogan contortus*) may occur on the low-lying plains, interspersed by riverine woodland of Eucalypt trees. Other than improved pasture, parts of the gas fields are currently under broad acre cropping (irrigation and rain fed) including wheat, sorghum, sunflower, cotton, peanuts and forage crops.

Flora Species (Nature Conservation Act (NC ACT))
Values pertaining to threatened flora species, listed under the NC Act as potentially occurring within the gas fields or known to occur within the area include:

- Known occurrence of three flora species listed as Endangered under the NC Act (*Solanum dissectum*, *Solanum elachophyllum* and *Xerothamnella herbacea*).
- Two flora species listed under the NC Act as Vulnerable or Endangered were identified as having a moderate or high likelihood of occurring, including:
    - *Solanum johnsonianum* (high)
    - *Cadellia pentastylis* (moderate)

Eleven exotic flora species considered restricted invasive species under the Biosecurity Act 2014 (Qld) were identified during a recent field survey (Umwelt, 2020). Of these, four are listed as Weeds of National Significance parthenium (*Parthenium hysterophorus)*, velvet prickly pear (*Opuntia tomentosa*), common prickly pear (*Opuntia stricta)* and rubber vine (*Cryptostegia grandiflora)*). The Banana shire recognise 33 exotic flora species as priority weed species for the region.

Vegetation Communities (Vegetation Management Act (VMA)

Database searches identified that eighteen Regional Ecosystems with a Biodiversity Status of Endangered (Category B ESA) or Of Concern (Category C ESA) may exist within the gas fields (Figure 9). These include:

- ERE: 11.3.1, 11.3.11, 11.3.17, 11.3.21, 11.4.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9a, 11.9.1, 11.9.12, 11.9.4a and 11.9.5
- OCRE: 11.3.2, 11.3.3, 11.3.4, 11.9.7 and 11.10.8.

Essential Habitat as described under the *Vegetation Management Act 1999,* is not present within the gas fields.

Threatened Flora (EPBC Act)

The desktop assessment identified threatened flora species as potentially occurring. Field surveys (Umwelt, 2019) have confirmed three threatened flora species within PL94:

- *Xerothamnella herbacea* (Endangered)
- *Solanum dissectum* (Endangered)
- *Solanum johnsonianum* (Endangered)

The above threatened species were all recorded from within *Acacia harpophylla* woodlands. Notable habitat features from these locations included the presence of ground timber (presumably affords protection from cattle trampling), abundant leaf litter and sparse grass cover. *Xerothamnella herbacea* was only recorded from *Acacia harpophylla* woodlands along drainage lines and waterways.

PL94 is situated within the Dawson River drainage sub-basin. Within this sub-basin, 207 wetland indicator flora species are noted on the Wetland*Info* database. Of these species, two are listed under the EPBC Act:

- *Phaius australis (lesser swamp-orchid)*
- *Eriocaulon carsonii subsp. orientale (salt pipewort).*

The above species are not likely to occur due to the absence of suitable habitat and generally high degree of disturbance within PL94 (Umwelt, 2020) .

Threatened Ecological Communities (EPBC Act)

The desktop analysis identified five threatened ecological communities (TEC) of MNES as potentially occurring within the gas fields, with two TECs confirmed during field survey (Table 11) (DSEWPC, 2019).

Table 11 Threatened Ecological Communities

Threatened Ecological Community	EPBC Act Status	Likelihood of Occurrence
Brigalow (*Acacia harpophylla* dominant and co dominant)	Endangered	Known
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Low
Weeping Myall Woodlands	Endangered	Low
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Known
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	High

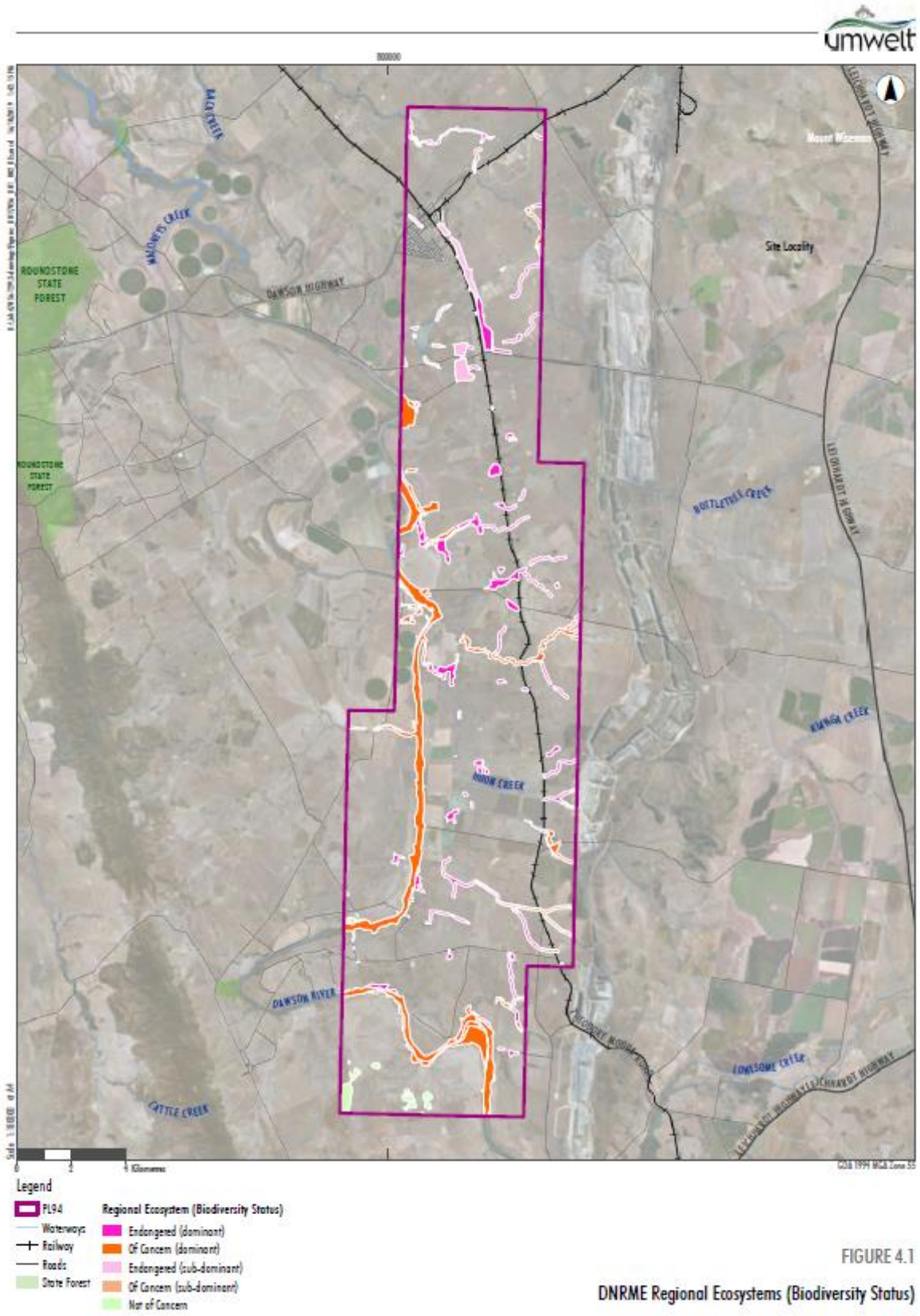

Figure 9 Regional Ecosystem (Biodiversity Status)

6.3.3 Existing Environment (Fauna)

The extent of habitat clearing throughout the region and subsequent agricultural and grazing land uses, have severely impacted on native fauna. In addition, feral cats and dogs and introduced species, such as the fox, prey on native animal species. Native fauna primarily utilise the riparian vegetation and isolated remnant vegetation for habitat and shelter, although some species have adapted to artificial habitats and food sources (Environmental and Licensing Professionals, 1996a).

Threatened Fauna (NC Act)

A search of the DETSI database for rare and threatened state-significant fauna (as defined under the NC Act) was conducted. Two species, the Ornamental Snake (*Denisonia maculata*) and Brigalow Scaly-foot (*Paradelma orientalis*) are listed as vulnerable.

Threatened Fauna (EPBC Act)

Umwelt (2024) evaluated the likelihood of occurrence for threatened fauna species identified in the EPBC Protected Matters Search Report. One threatened fauna species was confirmed during the field survey while four threatened species have a high likelihood of occurring (Table 12). Seven have a moderate likelihood of occurring.

Table 12 Threatened Fauna Species

Scientific Name	Common Name	EPBC Act Status	Likelihood of Occurrence
Denisonia maculata	Ornamental snake	Vulnerable	Known
Petauroides volans	Greater glider	Endangered	High
Phascolarctos cinereus	Koala	Endangered	High
Elseya albagula	White-throated snapping turtle	Critically Endangered	High
Rheodytes leukops	Fitzroy River turtle	Endangered	High
Geophaps scripta scripta	Squatter pigeon	Vulnerable	Moderate
Grantiella picta	Painted honeyeater	Vulnerable	Moderate
Hirundapus caudacutus	White-throated needletail	Vulnerable/ Migratory	Moderate
Rostratula australis	Australian painted snipe	Endangered	Moderate
Petaurus australis australis	Yellow-bellied glider (south-eastern)	Vulnerable	Moderate
Egernia rugosa	Yakka skink	Vulnerable	Moderate
Adclarkia dawsonensis	Boggomoss snail	Critically Endangered	Moderate

Migratory Species (EPBC Act)

Nine migratory species are either known to PL94 or were identified as having a moderate to high likelihood of occurring based on the presence of suitable habitat and recent or nearby records (Umwelt, 2024) (Table 13).

Habitat modelling for two migratory fauna, fork-tailed swift (Apus pacificus) and white-throated needletail (Hirundapus caudacutus)) was not undertaken as the species are almost exclusively aerial and are known to fly over broad habitat types.

Table 13 Migratory Species

Scientific Name	Common Name	EPBC Act Status	Likelihood of Occurrence
Plegadis falcinellus	Glossy ibis	Migratory	Known
Hydroprogne caspia	Caspian tern	Migratory	Known
Actitis hypoleucos	Common sandpiper	Migratory	High
Apus pacificus	Fork-tailed swift	Migratory	High
Gallinago hardwickii	Latham's Snipe	Migratory	High
Rhipidura rufifrons	Rufous fantail	Migratory	Moderate
Calidris acuminata	Sharp-tailed sandpiper	Migratory	Moderate
Myiagra cyanoleuca	Satin flycatcher	Migratory	Moderate

Pest Fauna

Due to the high degree of existing disturbance, as well easy access to water resources (dams) and food sources, numerous introduced fauna are likely to occur, including rabbit (*Oryctolagus cuniculus*), hare (*Lepus europaeus*), cat (*Felis catus*) and pig (*Sus scrofa*).

6.3.4 Potential Impacts

CSG activities have the potential to impact adversely on the conservation value of the area. Potential impacts to terrestrial and aquatic ecology during construction and operation of the gas fields may include:

- Clearing of vegetation, which may lead to:
  - habitat loss, edge effects and fragmentation
  - impacts on rare, threatened or migratory species, populations and communities
  - increased competition for roosting sites and tree hollows used for nesting with other species displaced by clearing
- salinisation of areas downslope of clearing.
- Barriers to movement and entrapment of wildlife in trenches or other open excavations
- Translocation or increase of weed species
- Increase in feral animals
- Noise, dust, vibration and night lighting
- Increased vehicle collisions with fauna
- Soil and water contamination from oil, fuel or chemicals
- Altered surface and groundwater environment
- Increased mobilisation of sediments and nutrients to watercourses
- Bushfires
- Brine pond overflows.

Potential impacts beneficial to nature conservation values may result from the activities include:

- habitat enhancement and protection through proactive land management practices including avoidance of unnecessary clearing, erosion control and weed control
- sound rehabilitation strategies involving revegetation using native flora species complementary to remnant habitat.

Vegetation Clearing

The installation of temporary and permanent infrastructure will avoid clearing of significant vegetation wherever possible. However, if the avoidance of significant vegetation is not possible, the amount of disturbance will be minimised. New infrastructure will be located within areas historically cleared for agricultural activities wherever possible to minimise clearing of vegetation. Although the land is already highly disturbed due to agricultural activities, it is possible that some species of conservation significance, including the flora species listed in the tables above, may exist in the vicinity of the gas fields.

Clearing must be conducted in accordance with the conditions of the EA and the *Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions – Version 2*. In order to mitigate the impact of development, on limited occasion, it may be necessary to propose an appropriate offset in accordance with the *Policy for Biodiversity Offsets*. The area contains a variety of ecological communities as remnants, potentially including the listed threatened communities outlined in the tables listed above.

The area may also contain habitat suitable for some listed species. However, the potential for listed communities and species to be present is greatly reduced by the extensive land clearing which has historically occurred in the area for the development of agriculture.

Wildlife Movements

The installation of temporary and permanent infrastructure may result in disruption to wildlife movement from the disturbance of habitat clearing. In most cases, there is anticipated to be minimal disturbance to wildlife movement because wells and infrastructure will be located within areas historically cleared for agricultural activities. However, other potential impacts, particularly for reptiles and mammals, is becoming trapped in trenches or other excavations that remain open for any period of time. This may lead to mortality by exposure, starvation, thirst or predation by other species.

Translocation of Weeds

Weed control is a major concern for landholders, in particular the spread of *Parthenium.* When a vehicle or machine is driven through a weed-infested area, seeds may become lodged in cracks and crevices including tyre treads, radiators, licence plates and the chassis. The seeds may then be carried hundreds of kilometres before dislodging in new areas. Although many weed species are widely spread throughout Queensland, the aim is to prevent the spread of weeds and eradicate new infestations. It is an offence to move or transport a vehicle on a road, if it is known, or ought to be known, that it or its load is contaminated with a declared plant, unless the load is contained.

The development and implementation of procedures in relation to weed management will ensure vehicles are appropriately cleaned to prevent transportation of weeds to or from the gas fields.

Feral Animals

Land disturbance along with waste production have the potential to attract highly competitive and/or predatory feral animals. The siting of stockpile areas, temporary accommodation facilities, offices, spills dumps, refuse areas and vehicle parking areas will be where possible within areas already cleared or proposed to be cleared to minimise feral animal occurrences.

Noise, Dust, Vibration & Lighting

Noise, dust, vibration and lighting all have the potential to affect habitat adjacent to operational areas due to ground disturbance, the operation and movement of machinery and traffic. Suppression of dust for habitat quality reasons will be administered as required, dependent of weather factors. Working beyond daylight hours will require night lighting, which may affect behaviour of both nocturnal and diurnal fauna, both vertebrate and invertebrate. This includes interfering with birds that migrate at night, altering reproductive

behaviours of frogs, disrupting communication between mammals and birds, focusing the foraging activities of insectivores and increasing the likelihood of predation of some species.

Vehicle Collisions with Fauna

An increase in traffic, both heavy vehicles and construction workers in light vehicles, during operation could contribute to increased animal/vehicle collisions on local roads. Species particularly susceptible to traffic collisions include larger and slow-moving snakes, monitors and other large lizards, macropods and frogs. Speed limits of 40km/h will apply to operational areas. Speed limits on all other council and state roads will be adhered to. Westsides expectations for drivers is a focus in site inductions, making it clear to all personnel on site to drive to the appropriate driving conditions.

Land Contamination

Fuels and chemical spills from storage areas and oils from heavy machinery can enter the environment, affecting habitats where the spill occurs. Potential further contamination can result causing more widespread impact if contaminants reach waterways. Issues in relation to land contamination will be managed via the Emergency and Crisis Management Plan (WCL-000-HS-PLN-005-10).

Changes to Surface and Groundwater Quality

Changes to the natural flow regimes for both surface and groundwater can occur as a result of construction and operation. Erosion of watercourses creating increased scouring, runoff and increased turbidity has the potential to impact on sources of water for vegetation habitats and loss of habitat generally. Largely, changes to alluvial groundwater quality can impact on groundwater dependent ecosystems. The appropriate management of surface activities eg waste and fuel/oil storage, will assist in minimising the potential for contamination of soil and groundwater.

Bushfires

Bushfires in the area of PL94 is a low to medium risk. No areas within the PL were designated as high risk. Should a bushfire occur in the area, potential impacts may include losses of property, wildlife and infrastructure. Potential causes of bushfires include:

- Natural causes such as lightning strikes;
- Construction activities including cutting and welding;
- Operation of mobile or fixed equipment;
- Operation of vehicles; and
- Pipeline rupture or explosion.

Biodiversity Incidents

Any non-compliance of the potential impacts listed above will be regarded as an incident relating to biodiversity and will require an incident report and investigation. These incidents will be managed in accordance with Westsides Incident Management System (Section 5.6) and any regulatory requirements.

6.3.5 Management Plan

Environmental Protection Objectives	To develop and operate the CSG field in a manner that minimises impact and ultimately protects the qualities of the natural environment by: • Protecting flora and fauna species native to the site, particularly those identified as conservation significant fauna

	• Minimising the disturbance to remnant vegetation, particularly of concern and endangered Regional Ecosystems and EPBC-listed threatened ecological communities • Protecting significant fauna habitat values located within the CSG fields, including watercourses and wetlands, significant habitat corridors and rocky outcrop.
Performance Standards	• No unauthorised vegetation clearing • No incident involving protected species
• Control Strategies	
Planning	• Vegetation and soil assessments are conducted and evaluated as part of all infrastructure planning and design • Vegetation and soil assessments are conducted in line with EA conditions prior to construction of infrastructure • Where new significant disturbance is required, the area will be ground-truthed by a suitably qualified ecologist in accordance with state and commonwealth assessment guidelines, and activities will proceed on the basis of the ground-truthed conditions. • Inputs are part of the Environmental Constraints Planning and Field Development Protocol (MSG-GN00-HS-PLN-003) and the permit to disturb process.
Vegetation Management	• Induction program to include information on nature conservation and weed control issues • Maximising the use of historically cleared areas for infrastructure development • Restriction of clearing to only that which is essential for the development of CSG activities • Clearing of remnant vegetation will only be undertaken for areas required for CSG and associated activities where no appropriate alternative exists • Vegetation clearing will only be authorised in accordance the Permit to Disturb system to ensure that the Environmental Representative has reviewed all proposed clearing activities • Limit the extent of disturbance within the riparian zone of the sites' watercourses • Where disturbance to vegetation communities is unavoidable, disturbance will be managed such that the minimum area required for safe access and operation is cleared. Trees and other vegetation will be removed only where required and vegetation outside operation areas will remain undisturbed • Cleared vegetation will be windrowed outside the operational area. Cleared vegetation may be directed to rehabilitation areas to enhance the development of habitat values for those areas • Disturbance to Environmentally Sensitive Areas (ESAs) will be conducted in accordance with the EA conditions, which places restrictions on the types of activities that can be conducted, depending on the Category of ESA, and authorises specific disturbance location and areas for PL94 infrastructure • Only low impact petroleum activities will be conducted within matters of State environmental significance, and there will be no significant residual impacts to prescribed environmental matters.

Fauna Management	• Clearing will be conducted in a sequential manner to allow fauna to naturally escape. • Vehicle speed on the site access tracks is limited to 40km/hr.
Pest Management	• Weeds will be controlled in all areas of the site, targeting species declared under legislation in accordance with the requirements of that legislation • All earthmoving equipment brought onto site or transported between sites will be thoroughly washed down prior to arriving at site to ensure all spoil and plant matter has been removed • Conduct feral animal control programs as required.
Bushfires	• All field operators will undergo appropriate fire training during the induction process • All vehicles will be fitted with fire fighting equipment • Regular fire safety testing of all facilities and equipment will be undertaken • Fire detection and suppression systems will be installed in all relevant areas (control rooms etc) • Firebreaks will be maintained at all sites in consultation with the landowner and local authorities • Implementation of Emergency and Crisis Management Plan (WCL-000-HS-PLN-005-10) addressing bushfire risks and prevention • Monitoring of bushfire weather forecasting and observation of fire bans for high risk days.
Corrective Actions	• Incidents relating to biodiversity will managed according to Westside's incident management system and regulatory requirements.

6.4 Air and Greenhouse Gas Emissions

6.4.1 Environmental Values

Air quality impacts from petroleum activities and processing have been identified as potentially adversely affecting public amenity without adequate control strategies.

The *Environmental Protection (Air) Policy 2008* aims to protect or enhance EVs relating to air including:

- Quality of the air environment that are conducive to protecting the health and biodiversity of ecosystems
- Quality of the air environment that are conducive to human health and wellbeing
- Quality of the air environment that are conducive to protecting the aesthetics of the environment including the appearance of buildings, structures and other property
- Quality of the air environment that are conducive to protecting agricultural use of the environment.

6.4.2 Existing Environment

A background air quality survey was carried out in June 1996 prior to the commencement of petroleum development operations and measured background dustfall and Total Suspended Particulates (TSP). Background TSP levels measured at several residences showed large variations reflecting the spatial and temporal variability of air quality in the rural landscape. The major sources of air contaminants were farming activities such as driving on unsealed roads, cropping, clearing, grazing, burn offs and mining operations adjacent to the area (Environmental and Licensing Professionals, 1996b).

There are approximately 55 sensitive receptors located on PL94. These primarily consist of rural homesteads, however also include the Moura township, Moura airport and industrial facilities such as cotton yards. The nearest sensitive receptors are identified in Figure 10.

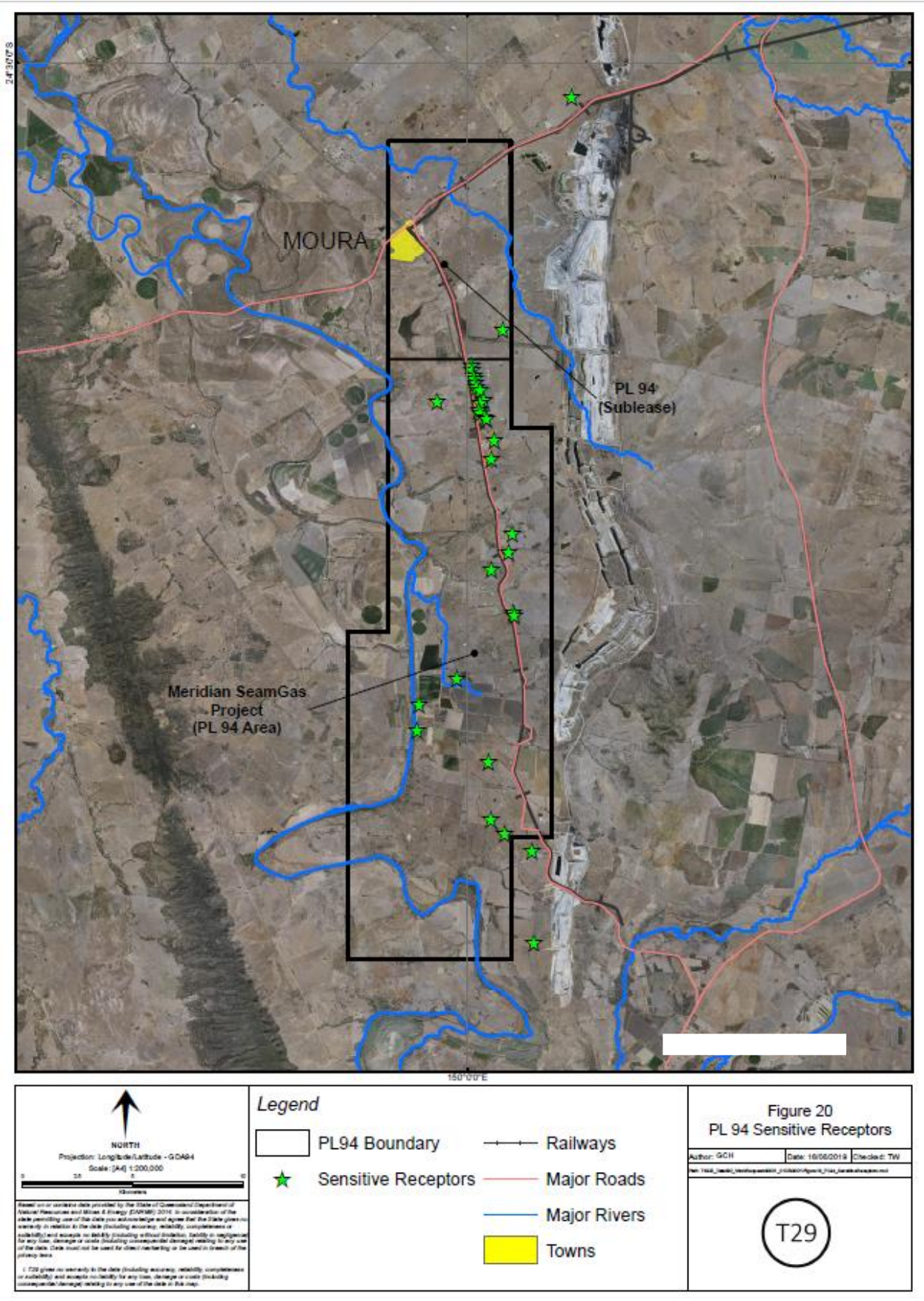

Figure 10 Sensitive Receptors

6.4.3 Potential Impacts

Combustion emissions

Potential air emissions from exploration and operational activities include the following combustion emissions:

- Combustion products from flaring
- Exhaust emissions from gas and diesel generators
- Vehicle and plant exhaust emissions
- Exhaust emissions from drilling/rig equipment
- Exhaust emissions from compressor turbines and power generation turbines.

The main categories of combustion emission sources include mobile and stationery plant. The fuel type used is predominantly gas with some diesel. Emissions of nitrous oxides, sulphur oxides and carbon monoxide associated with the exhaust of the drilling/completions rig, the diesel generator and vehicles will occur. These emissions are both temporary and minor in quantity and are not likely to result in significant air quality impacts, provided sufficient control strategies are in place

CSG exploration wells may be flared for a short amount of time prior to being connected to the collection system or prior to being plugged or capped. These emissions are not likely to have a significant impact on air quality.

The most significant continuous source of combustion air emissions is from gas engines driving compressors and generators. Nitrous Oxide (NOx) is the main pollutant of concern as gas engines emit very low quantities of particulate matter and carbon monoxide. The emission of sulphur oxides is also low as there is a negligible amount of sulphur in the coal seam gas used as fuel.

Other emissions to air include:

Dust emissions

- Dust emissions from vehicle movement on unsealed roads
- Dust emissions from earthworks
- Dust emissions from vegetation removal and areas of exposed soil.

Personnel will be required to slow to appropriate speeds to minimise dust generation. If required, unsealed access roads (or other areas of exposed soil) will be watered to minimise the potential for dust nuisance. It is not anticipated that dust impacts will cause a significant long-term impacts.

Odour emissions

- Incomplete combustion of hydrocarbons
- Fire or explosion
- Anaerobic activity in dams.

Greenhouse gas emissions

Greenhouse gas (GHG) emissions are either Scope 1 or Scope 2 emissions for the purposes of NGERS reporting. Scope 1 are direct emissions generated at the site, while Scope 2 are indirect emissions. Sources of GHG emissions from Westside's activities include:

- Combusted CSG for power generation (Scope 1 emissions)
- CSG venting, flaring and leakages (Scope 1 emissions)
- Fugitive emissions of CSG from storage tanks (Scope 1 emissions)
- Diesel combustion, including that for transport, power generation and other purposes (Scope 1 emissions)

- Vegetation clearing
- Purchase of grid electricity (Scope 2 emissions)

6.4.1 Management Plan

Environmental Protection Objectives	To construct and operate the CSG fields in a manner that has minimal impact to the qualities of the air environment that are conducive to: • Human health and wellbeing • Protecting the health and biodiversity of ecosystems • Protecting the aesthetics of the environment, including the appearance of buildings, structures and other property • Protecting agricultural use of the environment.
Performance Standards	• No excessive dust emissions during construction • No air quality-related complaints from nearby landholders • Annual NPI and NGERs reporting completed • Annual Air Receiving Environment Monitoring Program (AREMP) conducted and maximum ground level concentrations met (Table 14) • No significant unplanned venting events.
Control Strategies	
Construction/ road use	• Consult with and advise any landholders with the potential to be impacted by construction dust emissions prior to the commencement of activities • Construction sites and access roads will be watered on as-required basis to minimise the potential for environmental nuisance due to dust. Watering frequency will be increased during periods of high risk (e.g. high winds) • Extent and period of exposed surfaces will be minimised • Exposed surfaces will be promptly restored following construction to stabilise the disturbed surface and limit the potential for dust generation • Vehicle speeds will be restricted to 40km/hr on site roads and the speed limit will be followed on other roads • Vehicles and machinery will be fitted with appropriate exhaust systems and emission control devices. The equipment and devices will be maintained in good working condition • No burning of vegetation will be undertaken on site by Westside • Regular visual monitoring of dust emissions will be conducted.
Operations	• Planning processes for any permanent production installations will include an assessment of the impact on any sensitive receptors • Fuel burning and combustion equipment point sources (capable of burning at least 500 kg/hour) will have stacks directed vertically upwards without any impedance or hindrance • Field operation protocols are established to minimise flaring and venting • New and/or refurbished flares will use an automatic ignition system, have the flame visible at all times while the waste gas is being flared, and ensure there is no visible smoke emissions other than for a total period of no more than 5 minutes in any two hours; or, use an enclosed flare. • Ongoing maintenance of equipment occurs to maintain operating efficiency and reduce fugitive emissions

	• Periodic surveys are conducted to check flowline integrity • Monitor compressor station emissions and ensure compliance with regulatory EA conditions • Leak detection programs implemented • Various components of the CSG infrastructure and associated access areas will be regularly inspected to assess the effectiveness of air quality mitigation measures • Up to date, Westside CEO or delegate certified, register of fuel burning and combustion equipment (capable of burning at least 500kg/per) will be maintained. The register will contain fuel burning/combustion equipment name and location, stack emission height, minimum efflux velocity, mass emission rates and contaminant concentrations as per the EA conditions • An annual AREMP has been developed and implemented to monitor air quality in accordance with EA conditions.
Corrective Action	• Where the AREMP shows that the EA ground level concentrations are not met, Westside will assess the impacts of the exceedance, take corrective actions and have the assessment certified by a suitably qualified person as required by the EA. The assessment will be submitted to the administering authority within 5 business days from finalisation of the report • Other incidents relating to air quality will managed according to Westside's incident management system (Donesafe) and regulatory requirements.

Table 14 Maximum Ground Level Concentrations

Contaminant	Concentration at 0^0C	Units	Averaging Time
NOx as Nitrogen Dioxide	250	µg/m^3	1 hour
NOx as Nitrogen Dioxide	33	µg/m^3	1 year
Carbon Monoxide	11	mg/m^3	8 hours

6.5 Noise and Vibration

6.5.1 Environmental Values

The key EVs for noise are as outlined in the *Environmental Protection (Noise) Policy 2019*, which states that the values to be enhanced or protected are those qualities of the acoustic environment that are conducive to:

- Protecting the health and biodiversity of ecosystems; and
- Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following –
    - Sleep
    - Study or learn
    - Be involved in recreation, including relaxation and conversation
- Protecting the amenity of the community.

6.5.2 Existing Noise Environment

A noise survey was conducted in 1996 by Environmental and Licensing Professionals in accordance with AS1055.1 (1997). That study found the acoustics of PL94 were representative of the rural environment. Ambient and audible noises included those originating from farming equipment and fauna (including domestic farm animals, birds and insects). There are also noise contributions from the adjacent mine and from traffic.

Long-term background noise level monitoring has not been undertaken as part of this project and in the absence of more recent acoustic surveys on PL94, the deemed background levels nominated in EA (EPPG00783713) and EHP's guideline *Prescribing noise conditions on environmental authorities for petroleum activities* have been adopted as being representative of the ambient acoustic environment. The deemed background levels are as follows:

- 7:00am – 6:00pm 35dB(A)
- 6:00pm – 10:00pm 30dB(A)
- 10:00pm – 6:00am 25dB(A)
- 6:00am – 7:00am 30dB(A)

There are approximately 55 sensitive receptors located on PL94. These primarily consist of rural homesteads, however also include the Moura township, Moura airport and industrial facilities such as cotton yards. The nearest sensitive receptors to the operations are located identified in Figure 10**.**

6.5.3 Potential Impacts

The noise survey conducted found that due to the remote location of the gas fields, minimal noise and vibration impact to sensitive receptors is anticipated. The sources of noise and vibration are anticipated from the following activities:

- Drilling of exploration, appraisal and production wells
- Operation of plant such as compression stations, power generation and gas/water treatment facilities
- Construction, demolition, rehabilitation
- Blasting activities
- Vehicle and equipment movements
- Earthworks
- Seismic recording
- Flaring
- Venting
- Production and processing.

It is concluded that airblast overpressure and ground vibration from blasting activities can be managed to comply with the legislative criteria through the adoption of appropriate blasting design techniques.

6.5.4 Management Plan

Environmental Protection Objectives	• To ensure that there is no unreasonable intrusive noise or vibration attributable to the operations at the nearest noise and vibration sensitive locations • Control noise and vibration sources at the site to enable achievement of the statutory environmental protection objectives

Performance Standards	• No noise and vibration complaints received • No emissions of noise and vibrations above nuisance levels as defined by the EA conditions
Control Strategies	
Noise	• Activities to be conducted in accordance with Westside's Noise Management Plan (WCL-0000-HS-PLN-009) • To the extent that it is reasonable to do so, noise must be dealt with in the following order of preference – 1. Avoid (e.g. locating an activity in an area that is not near a sensitive receptor); 2. Minimise in the following order of preference: i. Orientate an activity to minimise noise (e.g. facing a part of an activity that makes noise away from a sensitive receptor or using a natural attenuating feature such as a gully); ii. Use best available technology (e.g. noise abatement barriers or enclosures); and 3. Manage (e.g. using heavy machinery only during business hours). • All equipment will be kept well maintained • All mobile equipment to be fitted with appropriate silencing equipment; • Blast design will ensure that the relevant airblast criteria are complied with at the surrounding sensitive receivers • Blasting will generally only be permitted during the hours of 9am and 3pm, Monday to Friday, and from 9am to 1pm on Saturdays. • Investigate all noise complaints expeditiously and respond to the complaint • All noise surveys will be compliant with the most recent edition of the Queensland Government Noise Measurement Manual • Alternative arrangements with landholders if necessary • Training of staff and contractors in noise management practices
Vibration	• Blast design will ensure that the relevant vibration criteria are complied with at the surrounding sensitive receivers • A Blast Management Plan will be developed for each blasting activity in accordance with Australian Standard 2187 • Vibration standards have been selected based on the EPP (Noise) criteria and will form the basis for response monitoring assessment. Those standards are: a) Blasting operation will be conducted in accordance with Australian Standard *AS2187.2 Explosives – Use of Explosives* b) Blast design be designed to not exceed a ground borne vibration peak particle velocity of 10mm/s at any time, when measured or extrapolated to any sensitive place. • Blasting will generally only be permitted during the hours of 9am and 3pm, Monday to Friday, and from 9am to 1pm on Saturdays. Blasting will not generally take place on Sundays or public holidays • Appropriate warning will be given prior to blasting in accordance with legislative controls

	• Alternative arrangements with landholders if necessary
Corrective Actions	• Investigate all non-vexatious vibration complaints expeditiously and respond to the complainant • In the event that a complaint is found to be neither frivolous nor vexatious, a noise management plan will be developed within an appropriate timeframe • Valid complaints about tonal or impulsive or low frequency noise must make adjustments to the measured/nuisance noise level as per the EA • Alternative arrangements with landholders if necessary • Initially, vibration complaints will be investigated through a review of blast records to determine if the complainant is in relation to a blast from the site. If it is determined that the complaint correlated to a blast event at the site then a suitability qualified consultant will be engaged to undertake further monitoring and to make recommendations. Monitoring of airblast overpressure and ground vibration will be undertaken at the complainant's residence in accordance with the recommendations stated in the DETSI Guideline – Noise and Vibration from Blasting • All complaints will be recorded into the site Complaints and Grievances Register •

Table 15 Nuisance Noise Limits at Sensitive Receptors

Time period	Metric	Short term noise event (dBA)	Medium term noise event (dBA)	Long term noise event (dBA)
7am-6pm	$L_{Aeq,adj,15mins}$	45	43	40
6pm-10pm	$L_{Aeq,adj,15mins}$	40	38	35
10pm-6am	$L_{Aeq,adj,15mins}$	28	28	28
	Max $L_{Aeq,adj,15mins}$	55	55	55
6am-7am	$L_{Aeq,adj,15mins}$	40	38	35

6.6 Water

6.6.1 Environmental Values

The waters that occur on PL94 are classified as the 'Lower Dawson Main Channel Regulated Reaches' and these have their own specific EVs and WQOs. The EVs and associated WQOs are based on stakeholder consultations undertaken by the Queensland Government and the Fitzroy Basin Association to identify EVs and WQOs in the Fitzroy Basin.

The EVs for surface waters on PL94 are listed in Table 1 of the *Lower Dawson Plan* which accompanies *EPP Schedule 1 Basin 130*. The scheduled EVs are:

- Protection of aquatic ecosystems (aquatic ecosystem EV)
- Irrigation
- Farm
- Stock water
- Aquaculture
- Primary recreation
- Secondary recreation
- Visual recreation
- Drinking
- Human consumers of wild or stocked fish, shellfish or crustaceans
- Cultural and spiritual values, including Traditional Owner values of water
- Industrial use.

The scheduled EVs for Lower Dawson groundwaters are listed in the *EPP (Water) Groundwater Plan* which accompanies *EPP Schedule 1 Basin 130*:

- Protection of aquatic ecosystems (aquatic ecosystem EV)
- Irrigation
- Farm
- Stock water
- Aquaculture
- Primary recreation
- Drinking
- Cultural and spiritual values, including Traditional Owner values of water.

Note that there is no 'CSG layer' EVs for Lower Dawson groundwaters. Groundwater from the Baralaba Coal Measures is saline and has relatively low value. Groundwater from the Quaternary Alluvium is better quality water and as such, has a higher EV.

6.6.2 Existing Environment (Surface Water)

Watercourses

Several watercourses of varying capacity intersect the Meridian Seam Gas Fields (Figure 11). Most dominantly, the Dawson River (stream order 8) meanders along the western edge of the lease, flowing from south to north. The Dawson River and associated creeks and tributaries including Kianga Creek (stream order 4) and Huon Creek (stream order 2) may provide suitable aquatic habitat for a range of species including fish, turtles, crustaceans and aquatic mammals. Riparian vegetation associated with watercourses may support a range of habitat features such as large hollows, a dense understorey and a variety of macrophytes (Umwelt, 2020). The total catchment area is estimated to be 43,965km^2. Apart from areas in the vicinity of watercourses, the land has a low relief with gentle slopes (0.5 to 1 degree) and typical slope lengths of several hundred metres (Environmental and Licensing Professionals, 1996a).

Wetlands

The EPBC Protected Matters Search Tool identifies no Wetlands of International Importance within the search area. As described by Umwelt (2020), the PL94 contains several palustrine and lacustrine wetlands which are of natural and agricultural origin. As represented in the DETSI wetland mapping layer, wetland values within PL94 vary with the majority being of low conservation value. No wetlands of High Ecological Significance were identified. Wetlands and waterbodies within PL94 likely support a range of fauna species including fish, crustaceans, turtles and birds. Palustrine and lacustrine wetlands including dams and marshes also provide suitable habitat for wetland indicator species which are described by the DETSI as species which rely on a water resource for some or all stages of their lifecycle .

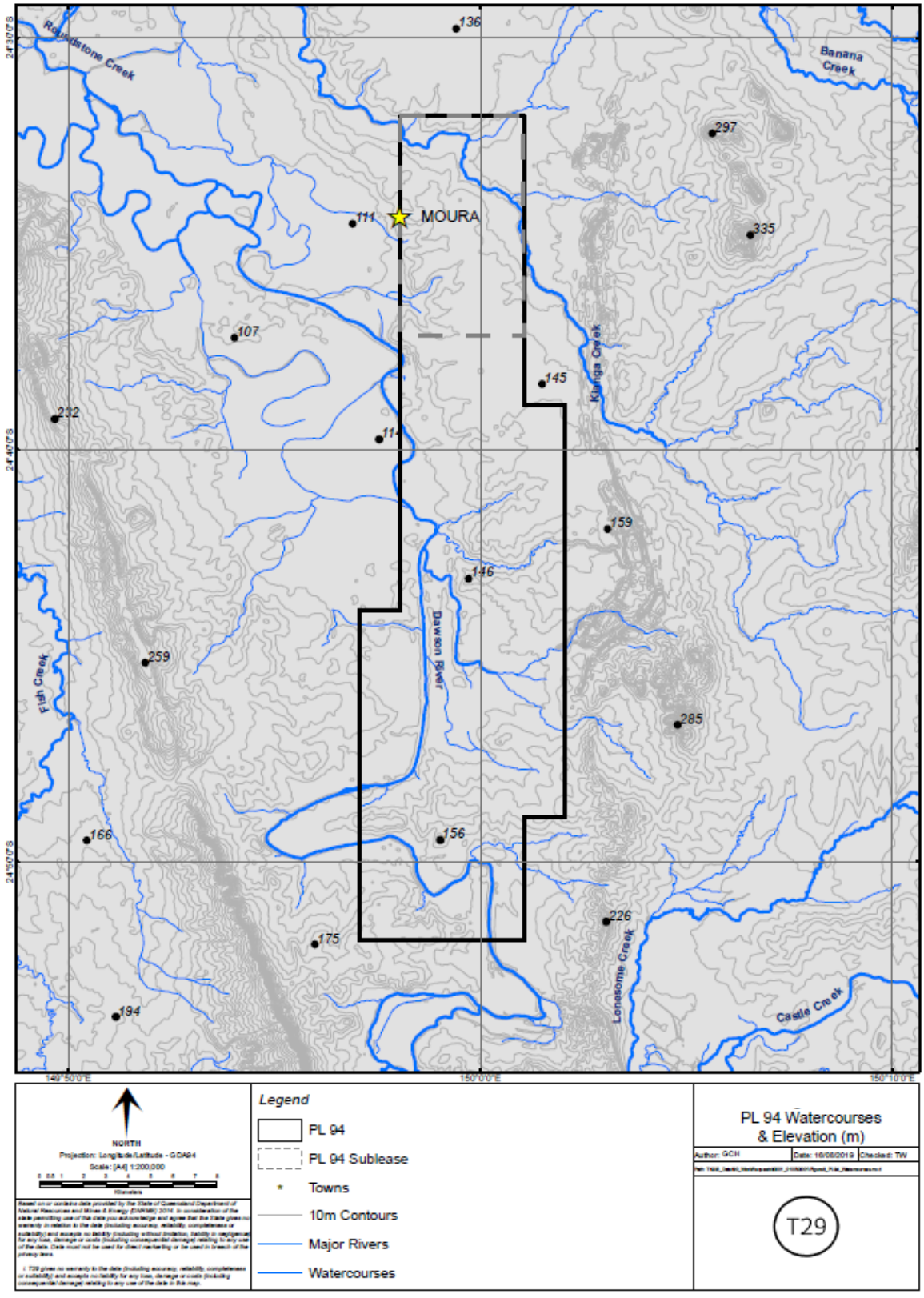

Figure 11 Watercourses

6.6.3 Existing Environment (Groundwater)

Local Hydrogeology

The Quaternary Alluvium, formed of soils, sandy clays and fine to medium silty sand (AGE, 2011) is considered a minor aquifer. The Quaternary alluvial aquifer is regarded as an unconfined aquifer, where the major recharge mechanism is expected to be through direct diffuse rainfall infiltration and via seepage from the Dawson River in the alluvium during high flow and rainfall events. Insufficient data is available to characterize groundwater flow within this unit, but the AGE (2011) report provides a likely scenario, that when rainfall is high groundwater within this formation likely flows towards the Dawson River, while during times of low recharge, the groundwater flows within the alluvium towards the north.

The Rewan Group is predominant in fine grained rocks (siltstone and shale) with minor sandstone. The Rewan Group is present as outcrops over the majority of PL94 area, but is overlain by alluvial sediments in the northern part of the area. Based on an estimated dip for the Baralaba Coal Measures of 5°, the thickness of this unit within PL94 area ranges from negligible at the eastern boundary of the Site to 600m or more in the northwest of the Site and greater than 1500m in the southwest.

The Baralaba Coal Measures is considered to be a confined aquifer and comprises the target coal seams interbedded with sandstone, siltstone and shales, which are termed interburden or overburden depending on its spatial distribution relative to the coal seam. The fine grained shale and siltstone rocks are typically of low permeability and function as aquitards, while the target seams are generally more permeable. Given the presence of both permeable and impermeable units, the Baralaba Coal Measures can be described as follows:

- the siltstone and shale that form interburden or overburden are hydrogeologically “tight” and low yielding;
- the coal seams are range in permeability from low to moderate and are the predominant water bearing strata. Groundwater storage and movement occurs with coal seam cleats and fissures, and with fractures.

Stratigraphic studies from Dawson Mine show that the coal seams are generally up to 6.0m thick, while the interburden is variable in thickness, ranging from 15-60 meters. The target coal seams occur at relatively shallow depths of less than 100m in the southeast of PL94 but increase to depths of 600m or more in the northwest of the Site and greater than 1500m in the southwest.

6.6.4 Potential Impacts

Surface Water

Existing impacts on surface water quality within the Dawson River catchment, in particular Huon Creek include:

- Contribution of salts from regional soils;
- Sediment loads resulting from soil erosion within the region;
- Contribution of nutrients and salts from fertiliser usage and livestock waste within the region; and
- Addition of salts and other contaminants from mine process water introduced via controlled releases from existing CSG operations.

CSG operations have the potential to impact the surface water quality within Huon Creek and the Dawson River catchment through the following processes:

- Increased impervious areas and associated increased runoff from site potentially causing sedimentation of watercourses and degradation of aquatic habitats and water quality;
- Hydrocarbon or chemical spills and/or runoff potentially causing degradation of aquatic habitats and water quality;
- Increased stormwater runoff volumes and/or discharge of process water potentially modifying natural flow regimes and geomorphic characteristics (including bank stability);
- Changes in water quality and flow potentially causing impacts on downstream surface water users (licensed water users and the receiving environment); and
- Changes in water quality and flow potentially causing impacts on aquatic ecology and terrestrial riparian ecology.

Groundwater

An Underground Water Impact Report (UWIR), and the Groundwater Monitoring Program within, are developed on a three yearly basis as required under the Water Act 2000. The three yearly updates of the UWIR and groundwater monitoring program are subject to change throughout the development of PL94. The current UWIR is available at https://environment.qld.gov.au/management/activities/non-mining/water/groundwater/approved-underground-water-impact-reports.

Section 8 of the PL94 UWIR details the groundwater monitoring program required for PL94. The groundwater monitoring program identifies the groundwater parameters, the monitoring frequency and the groundwater bores that are required. Section 8.1.3 of the PL94 UWIR details the monitoring thresholds criteria that is used to identify adverse impacts to groundwater.

Groundwater Monitoring is in place as per the recommendations of the UWIR and is reported to the Queensland Government in an annual report required under the UWIR.

Existing impacts on groundwater quality within the region include:

- Limited availability of groundwater for stock watering and domestic applications
- Nutrient and salt contamination from historic fertiliser application in the region
- Addition of salts and other contaminants from existing CSG operations.

CSG operations have the potential to impact the groundwater quality within the region through the following processes:

- Hydrocarbon or chemical spills potentially causing contamination of groundwater

- Gas wells potentially causing operational drawdown of groundwater levels and decreasing the yield rates of existing bores
- Gas wells potentially modifying groundwater-surface water connectivity
- Gas wells potentially causing fugitive gas migration
- Operations potentially causing aquifer compaction and land subsidence
- Process water spills and/or seepage potentially causing impacts on groundwater quality and groundwater ecosystems
- Increased impervious areas potentially causing a reduction in groundwater recharge
- Poorly constructed or faulty gas wells potentially causing inter-aquifer leakage and/or groundwater level changes
- Drilling activities potentially causing connection and cross-contamination between aquifers and impacts on groundwater quality

6.6.5 Management Plan

Environmental Protection Objectives	• To maintain the existing chemical, physical and biological integrity of water quality within acceptable parameters, so as to minimise potential impacts to the principal environmental value of stock watering and irrigation • To maintain and preserve the 'ecological integrity' of freshwater ecosystems, including biological diversity, relative abundance and ecological processes.
Performance Standards	• No direct or indirect environmental harm to a wetland as a result of groundwater extraction • No unauthorised release of any volume of prescribed contaminants to waters, which includes CSG produced water and salt and/or brine from CSG produced water. • No exceedances of water the water quality objectives of the Lower Dawson Main Channel Regulated Reaches as per the Environmental Protection (Water) Policy 2009 Dawson River Sub-basin Environmental Values and Water Quality Objectives Basin No.130(part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment (2011) • Groundwater monitoring program implemented and results show no exceedance of trigger thresholds.
Control Strategies	
General	• Only construction or maintenance of linear infrastructure is permitted in or within any wetland or other environmental value or in a watercourse according to the conditions of the EA • Routine and regular frequent monitoring will occur when undertaking works in a waterway or wetland. If results show an increase of greater than 25% of background result (EA condition), works must cease and water quality be rectified • No petroleum activities will occur in or within 200m of a Wetland of high ecological significance, Great Artesian Basin Spring, Subterranean cave groundwater dependent ecosystem • Fuels and chemicals will be stored in accordance with Australian standards such as AS1940:2004 – The storage and handling of flammable and combustible liquids

	• Fuel and chemical storage facilities are located at the Main office warehouse (28 Okano St Moura) or for bulk storage at Mungi Yard (Theodore Moura Rd, Kianga). These locations are not be situated in proximity to any surface water bodies (>300m away) • Clean water diversion drains will be installed up gradient of the disturbance to direct clean water runoff away from operational/disturbed areas, the diversion drains will be installed in accordance with IECA best practice guidelines • An Erosion and Sediment Control Plan (ESCP) will detail control measures for reducing the potential for sedimentation of surface waters, ESCP are developed on a site by site basis with take into account the local topography • Operational areas will be constructed with sediment control drains to prevent sediment runoff from leaving the site • Discharges of water during the construction and maintenance of linear infrastructure must comply with the EA release limits • Chemical treatment of water will be minimised and the chemicals used will be selected to have a low potential to harm the environment • Waters and aquatic environments monitoring and sampling will be conducted in accordance with the Queensland Government's Monitoring and Sampling Manual.
Surface Water	• Implement the Produced Water Management Plan • Stormwater management structures will be maintained • Piezometers will be installed where CSG water or brine ponds are utilized to detect any seepage of pond water • The site selection process for new wells, flowlines, facilities and any other infrastructure will include an assessment of impact on natural drainage patterns and the potential for surface water pollution • Temporary drainage works (channels and bunds) together with sediment and erosion control will be installed for new disturbance areas • Pumps will be used to maintain dry working conditions in temporary excavations, rather than constructing temporary open channels for gravity drainage • Vegetation clearance will be restricted to the smallest area necessary in accordance with the Westside Field Development Constraints Protocol and maximum disturbance limits • Cleared areas not required for development activities will be stabilised with vegetation, groundcover or appropriate surface treatments following clearing to minimise erosion • Seeding of long-term topsoil stockpiles will be carried out with an appropriately designed seed mix • Provision of appropriate storage areas for fuels and dangerous goods with spill cleanup kits, and ensuring that relevant personnel are trained in appropriate handling of such materials and spill prevention • Maintenance and process areas will be built on paved and bunded areas, all transfer of fuels will occur within a bunded area • Bund sumps will not be discharged to grade unless water quality testing shows that it is suitable to do so. If it cannot be discharged it will be removed for treatment • Natural surface runoff will be diverted around facility sites

	• An internal surface water drainage system will be established to separate clean and potentially contaminated water, and to minimise flow velocities through the site and at the outlet point • Maintenance will be undertaken of all permanent infrastructure and drainage structures including tracks and roads and their drainage, and stormwater flow control and containment structures • Monitoring requirements for erosion and sediment control will include routine visual inspections (in particular pre and post significant storm events). Inspections will include the integrity of diversion measures, sediment fences, bunds and drains and cover housekeeping to ensure stormwater runoff does not contain rubbish or contaminants.
Groundwater	• Groundwater levels will be monitored and compared to trigger thresholds established in the UWIR. Investigations will be undertaken in order to identify the source and extent of impacts if trigger thresholds are reached • UWIR's will be established and updated as per DETSI and legislative requirements • Gas migration studies will be conducted if required and control measures developed • Drilling fluids will be water based and biodegradable • Manage the sewage treatment system to minimise the potential biological impacts on groundwater quality • Production well design will minimise the potential for inter-aquifer leakage and pressure transmittal; • Production wells will be constructed in order to maintain hydraulic isolation between water-bearing formations • A risk assessment of all planned fracture stimulation activities will be undertaken prior to their commencement • Alternative water management technologies including the injection of treated and blended process water back into aquifers will be investigated (potential EA amendment required) • CSG water ponds and other water storage infrastructure will be appropriately designed, constructed and operated to reduce leakage, seepage and prevent overtopping • Impacts from groundwater extractions will be assessed over the life of the fields • A Groundwater Monitoring Program will be developed and implemented to establish baseline water quality and levels • Groundwater quality indicators will be determined based on background groundwater quality monitoring from selected bores in the area • Initial drilling fluid waste will line the soil surface with a layer of bentonitic clay that will reduce seepage into the surrounding soil. Additional bentonite can be spread, as required, to further seal the soil.
Corrective Actions	• Any complaints regarding groundwater impacts potentially caused by Westside operations, will be investigated in accordance with the site Complaints and Grievances Register • Incidents involving surface and/or groundwater will be managed according to Westside's incident management system and regulatory requirements.

6.7 Dams

6.7.1 Environmental Values

The environmental values relevant to dams within the PL to be protected or enhanced include:

- The integrity of undisturbed land and ecosystems on the PL
- The integrity of the topsoil as a resource to be used in rehabilitation
- The stability of disturbed land and ensuring it is non-polluting
- The integrity of soil physical and chemical attributes relative to vegetation establishment and growth
- The integrity of soil stability and structure for erosion protection
- The integrity of water quality parameters within the surrounding environment
- The integrity of animals, livestock and crops within the surrounding agricultural areas
- The suitability of the land for continued agricultural use post CSG operations.

6.7.2 Existing Environment

There are currently no regulated dams in service within the Meridian Seam Gas Fields.

6.7.3 Potential Impacts

Potential impacts on land and water resources from CSG related disturbances include:

- Possible land suitability changes
- Possible land use changes
- Possible land contamination
- Possible contamination of downstream water quality
- Possible contamination of groundwater quality
- Addition of salts and other contaminants from CSG process water introduced via un-controlled releases.

These potential impacts could result from the following:

- Contamination of land and water resources from dam seepage
- Contamination of land and water resources from inappropriate waste disposal
- Erosion and contamination from un-controlled dam release
- Change in vegetation communities
- Reduction in the productivity of land for post mining land use
- Loss of topsoil through poor topsoil management practices
- Compaction of soil in and around dam locations
- Degradation of downstream water quality
- Degradation of groundwater quality
- Impact to fauna health
- Reduced groundwater availability.

6.7.4 Management Plan

Environmental Protection Objectives	▪ To manage dams within the PL areas so as to minimise impact on surrounding properties and downstream surface water and groundwater quality ▪ To minimise erosion ▪ To protect future land use values of areas by ensuring that only land within the lease area required for CSG activities is disturbed ▪ To ensure CSG activities do not adversely affect surrounding agricultural production or product quality ▪ To progressively rehabilitate land disturbed by CSG activities consistent with the post operations land use objectives ▪ To minimise water quality impacts from the CSG activities on groundwater and surface water environmental values ▪ To ensure that adverse impacts on the nature conservation and biodiversity value of the area is minimised ▪ The rehabilitation success of the disturbed areas is optimised ▪ To minimise and manage potential soil contamination during the development of the CSG dams ▪ To ensure dam waters and contaminants do not cause environmental harm.
Performance Standards	▪ No complaints from landholders or third parties ▪ No seepage of waters form any regulated dam ▪ No uncontrolled dam releases into the surrounding environment.
Control Strategies	
General	▪ Dams will be designed, constructed and operated in accordance with appropriate Queensland guidelines and regulations ▪ Dams will be designed, constructed and operated in accordance with the Queensland Manual for assessing Consequence Categories and Hydraulic Performance of Structures ▪ The hazard level of any dam will be determined by a suitably qualified and experienced person, prior to the design and construction, upon any change of its stored contents or purpose and at least once every two years after its construction ▪ Following the construction of a hazardous dam, the design plans will be kept in accordance with regulatory requirements for the life of the dam until it is decommissioned ▪ A register of Regulated Dams will be maintained for each individual regulated dam on PL94 for the life of the dam or until it is decommissioned ▪ Regulated dams will be designed to have suitable control measures (such as fencing, bunding, and escape arrangements) for the protection of wildlife and livestock ▪ All dams will be rehabilitated to a standard consistent with the post operations land use objectives or to a level agreed upon by the regulatory authority and landholder.
Corrective Actions	▪ Incidents involving dams will be managed according to Westside's incident management system and regulatory requirements.

6.8 Community

6.8.1 Environmental Values

The community and social values relating to the Meridian Seam Gas Fields include the amenity, liveability, sense of community, and access to social, community services and infrastructure in the region surrounding the gas fields, including economic conditions and benefits within the affected community.

6.8.2 Community Consultation

In order to facilitate an understanding of community values and concerns so that they can be addressed and incorporated into appropriate environmental management commitments, Westside will endeavour to undertake consultation with affected and interested stakeholders during the life of the gas fields.

The primary stakeholders identified to be affected or interested in the gas fields are:

- Landholders – segments of their property and property access are covered by PL94;
- Banana Shire Council – provider of infrastructure and services to all users i.e. landholders, public, mining and oil & gas industry;
- DETSI – environmental management and regulation of the coal seam gas industry in Queensland is administered through the provisions of the Environmental Protection Act 1994;
- DNRME – administration of land access and tenure processes; and
- Native title and Aboriginal cultural heritage parties – Gangulu People/Gaangulu Nation People and the Wulli Wulli People.

The purpose of the consultation process is to identify issues, including social and community issues and discuss potential impacts in order to minimise the impacts and to develop strategies to ensure ongoing mitigation and/or minimisation of the identified impacts. This process will enable strategies to be developed within the EMP in recognition of the specific issues of concern relating to relevant stakeholders. The consultation program will also provide an opportunity for identification of contact points for stakeholders seeking information regarding the activities.

The key issues of concern to stakeholders that are anticipated by Westside based on issues highlighted by stakeholders communications for other projects recently developed within the area are discussed. Westside acknowledges the multiple benefits that can be achieved from a properly conducted and focussed community consultation program and is committed to developing and maintaining a consultation program during ongoing operations.

The key objectives of ongoing community consultations throughout ongoing operations is to ensure that issues of concern and/or complaints regarding Westside's activities are appropriately addressed. The issues identified through this process can be utilised for the ongoing refinement of the program.

6.8.3 Existing Community Environment

The Meridian Seam Gas Fields are located in the Moura-Theodore district of the Banana Shire, Queensland. The gas fields lie near and within the vicinity of the town of Moura in the Bowen Basin. Moura is located approximately 200km south-west of the Rockhampton and is a small township covering an area of 8.7km2

with an estimated resident population of 1,993 (ABS,2021). Industry in the Moura district includes cattle, cotton, grain production and coal, with coal being mined in the area since 1961. Moura has the second largest grain depot in Queensland and is residence to the Queensland Cotton Gin and Queensland Nitrates Ammonium Nitrate Plant.

The Banana Shire Council Local Government Area (LGA) Statistical Profile (July 2017) provides information about social, demographic and economic activity and is produced by the Queensland Government Statistician's Office (QGSO). The key indicators for the township of Moura based on the Statistical Profile 2017 and 2021 Census data (Australian Bureau of Statistics, 2021) are summarised below:

- As at 30 June 2015, the population of Banana Shire was 15, 209 with an estimated 1,993 residents residing in the township of Moura
- Mining was the largest industry of employment for Moura's usual residents
- Agriculture, Forestry and Fishing was the largest industry of employment for Banana Shire usual residents with approximately 40% of the town's employed labour workforce
- Unemployment in the town was approximately 3.8%
- The main method of transport to and from work was by car with approximately 73% of Moura residents choosing this mode of transportation
- The majority of accommodation in Moura consisted of separate house dwellings with similar proportions of these being either fully owned, being purchased or rented.

Existing accommodation in the Moura Township consists of a majority of separate house dwellings as well as other dwelling types. Accommodation provided for the mining/petroleum industry consists of Single Persons Quarters (SQPs) or camp accommodation.

Facilities and services in the Moura district include the following:

- Moura State Primary School and Moura State High School
- Moura Hospital and Community Welfare Service
- Moura Retirement Village
- Moura Post Office
- Banana Shire Library
- Four Churches
- Several sporting clubs and fields.

6.8.4 Potential Impact

The main issues of concern to stakeholders include, but is not limited to:

- Land access and compensation agreements
- Housing and accommodation
- Road impacts and traffic generation
- Cumulative impact on community services and (recreation facilities) infrastructure
- Public amenity.

Land Access and Compensation Agreements

Throughout the life of the gas fields, Westside will require access to facilities and infrastructure on landholders' properties. Land access will be addressed with entry notices and negotiated Conduct and Compensation Agreements prior to the commencement of any petroleum activities in accordance with the *Mineral and Energy Resources (Common Provisions) Act 2014* (Qld). For existing activities, these agreements are already in place.

Housing and Accommodation

Accommodation options provided by industry usually include the following:

1. Employment of local staff, with accommodation arrangements left up to each employee

2. Provision of houses, often for key company personnel and group housing
3. Rent subsidies or purchase assistance for private accommodation
4. Provision of SPQs or camp accommodation, including some shared arrangements including hot bedding and motel style arrangements.

Westside will endeavour to utilise existing vacant accommodation where available within Moura to house its current and future workforce.

Roads and Traffic Generation
During construction and operations, the anticipated traffic generated will increase , but will not have a an impact on the carrying capacity of the current road network.

Community Services and Infrastructure
CSG projects can produce impacts that are both direct and indirect. Consequently, the emergence of multiple and overlapping proposals for CSG and other resource sector developments may result in significant cumulative impacts for communities and regions (DNRME, 2009). These impacts as identified under the Blueprint for Queensland's LNG Industry include:

- Demands on infrastructure – roads, energy, urban water supply
- Demands for government services – health, school, police, emergency services
- Changes in housing availability and affordability
- Impacts on rural landholders
- Conflicts over groundwater and the impacts of produced water
- Community services and social fabric
- Safety issues relating to wells, pipelines, processing plants and shipping.

Public Amenity
The range of potential impacts to community and public amenity includes:

- Noise
- Dust
- Reduction in groundwater levels
- Groundwater contamination
- Lighting from fixed or mobile plants.

The potential impacts from each of the above issues have been addressed elsewhere within this EMP. In each of these areas, specific control strategies have been identified to minimise and mitigate potential impacts, should they arise and to monitor conditions to ensure that any potential adverse impacts are identified.

Positive Impacts
The positive direct and indirect effects of CSG operations on the economy of local and regional communities is generally significant as a result of provision of services to CSG operations and employee expenditure within the area.

All areas of government gain revenue from the petroleum industry through direct and indirect taxation, royalties, stamp duty and other government charges.

The resource industry, through membership of the Queensland Resources Council (QRC) and Australian Petroleum Products and Exploration Association Ltd (APPEA), in partnership with Local Government and the Queensland Government are seeking to address social and economic impacts through community consultation and continued research through the Gas Industry Social & Environmental Research Alliance and the U of Q Center for Natural Gas.

6.8.5 Management Plan

Environmental Protection Objectives	▪ To manage operations in a manner that minimises negative impacts on the local and broader community, both during and post CSG Operations ▪ To ensure Westside's activities assists in provision of community services and infrastructure to meet the increased demand created by Westside's activities ▪ To manage the operation in a manner that contributes positively to the economy and services of local and broader communities.
Performance Standards	▪ High level of public consultation conducted by Westside in relation to the Meridian Seam Gas Fields development and operation ▪ Development and implementation of procedures to manage risks to the public from operations ▪ Low number of complaints received by the public in relation to operations at the Project sites.
Control Strategies	
General	▪ Continue the ongoing development and implementation of the Community Consultation Program ▪ Develop and maintain a complaints management system during construction and operation ▪ Utilise accommodation options in the township of Moura to accommodate the workforce ▪ Ensure that lighting is oriented to minimise light spill beyond what is required for operations ▪ Commit to dust and noise monitoring as required to manage impacts and address complaints ▪ Commit to a groundwater monitoring program.
Corrective Actions	▪ Complaints will be managed according to Westsides Complaints and Incident Management Plan and regulator requirements.

6.9 Heritage Places and Archaeological Artefacts

6.9.1 Environmental Values

Indigenous Cultural Heritage

In accordance with the *Aboriginal Cultural Heritage Act 2003* (ACH Act) all appropriate measures to avoid or minimise impacts to Aboriginal cultural heritage will be undertaken by Westside. Aboriginal cultural heritage is defined by the ACH Act as being:

- A Significant Aboriginal area in Queensland; or
- A significant Aboriginal object; or
- Evidence, of archaeological or historic significance, of Aboriginal occupation of an area of Queensland.

Westside have demonstrated this duty of care under the ACH Act by developing several voluntary Cultural Heritage Investigation and Management Agreements (CHIMAs) in consultation with the Gangulu People which have been approved as Cultural Heritage Management Plans (CHMPs) under the ACH Act. The CHMPs apply to specific areas of PL94 relevant to the Cultural Heritage Party.

Under the CHIMAs, Westside has agreed not to undertake any activities involving ground disturbance unless a Work Program Notice is issued to the Party through the Coordinating Committee which has been appointed to administer the CHIMAs.

Surveys within PL94 and the wider Moura region have found many links with history such as stone artefact scatters, flakes, grinding stones, shell middens, scarred trees and places of significance, to name a few. It is understood an archaeological survey of PL94 was undertaken in 1995 by Anglo Coal in conjunction with the Traditional Owners. The survey found that there may have been previous losses of artefacts due to land disturbances arising from farming and grazing practices in the area.

The CHIMAs provide an efficient and workable means by which parties to the Agreements can protect and manage Aboriginal Cultural Heritage in a culturally appropriate manner while complying with all necessary legislative requirements.

Non Indigenous Cultural Heritage

The *Queensland Heritage Act 1992* (QH Act) requires that all State, archaeological and protected heritage places be preserved. This is achieved via the Queensland Heritage Register which ensures that the locations of these sites are recorded and subsequently protected by the QH Act.

The Queensland Heritage Register identifies six heritage places within the Banana Shire as summarised in **Table 16** below. A search of the Heritage Register has indicated that there are no registered significant heritage sites within the Meridian Seam Gas Fields area.

Table 16 Banana Shire Heritage Places

State Heritage Place	Town	Place Category/Type	Cultural Heritage Significance
Dawson Valley Collier (former)	Baralaba	Mine Site	Criterion A, B, C, D, H
Fraser family grave site and memorial, Hornet Bank	Taroom	Monuments and Memorials	Criterion A & C
Greycliffe Homestead	Biloela	Homestead	Criterion A, D, G, H
Kilbirnie Homestead	Jambin	Homestead	Criterion A, D, H
Leichhardt Tree	Taroom	Blazed Tree/Dig Tree	Criterion A, E, G, H
Glebe Homestead	Taroom	Homestead	Criterion A, B, C, D, E

The Heritage Places overlay of the *Banana Shire Planning Scheme*, (2005), indicate that the Biloela Butter Factory is also a place of cultural heritage significance. Other heritage places may be identified in heritage surveys once undertaken.

6.9.2 Potential Impacts

Indigenous Cultural Heritage
The gas fields are situated to the east of the Dawson River. Current and planned developments over the PL are not anticipated to have effects on known Aboriginal Cultural Heritage values in the area as cultural heritage assessments have already been undertaken to assess and mitigate this risk. However, potential impacts from the proposed activities may occur to previously unknown sites in the form of damage to, or loss of, culturally significant items and damage to, or loss of, significant places.

Non Indigenous Cultural Heritage
As the search of the Heritage Register has not indicated that there are any significant heritage sites within the area. It is not anticipated that any impacts to registered significant heritage sites will occur as a result of the activities within the gas fields. However, there is the potential for impacts to previously un-located heritage sites in the area, resulting from the proposed activities, which may occur to previously unknown sites, in the form of damage to or loss of culturally significant items and damage to, or loss of, significant places.

6.9.3 Management Plan

Environmental Protection Objectives	▪ Protect and preserve cultural heritage values within and surrounding the lease areas wherever possible; ▪ Be proactive in ensuring that as much value as is reasonably possible is maintained at significant cultural heritage sites in the unlikely event that disturbance is proposed to these areas for operational purposes; and Foster and maintain a positive and progressive relationship with relevant parties involved in cultural heritage within PL94.
Performance Standards	▪ No unauthorised damage to or loss of cultural heritage items or places.
Control Strategies	
General	▪ Site inductions will include information on the Cultural Heritage Management Plans and what actions are to be undertaken in the event that previously unidentified indigenous cultural heritage sites or artefacts are discovered ▪ Site inductions will also include information on the requirements of the QH Act and what actions are to be undertaken in the event that previously unidentified non-indigenous cultural heritage sites or artefacts of this nature are discovered
Indigenous Cultural Heritage	▪ To ensure that the known and unknown indigenous cultural heritage values of the area are preserved as effectively as possible, Westside will consult with representatives of the registered Traditional Owners the Gangulu People. Through this already established consultation process Westside has developed Cultural Heritage Investigation and Management Agreements (CHIMAs) to assist with the identification, management and protection of any significant cultural heritage sites which may be identified during development activities ▪ A GIS zoning scheme which classifies areas within the project as “not assessed”, “assessed and cleared for access”, “assessed and protected”, “assessed and conserved” for cultural heritage values has also been established and is maintained and continually updated by the Traditional Owners and made available to Westside for planning purposes.

Non-Indigenous Cultural Heritage	▪ Upon the event that any non-indigenous historical cultural heritage finds are made or sites are suspected, Westside will manage these in accordance with the QH Act and any relevant local by-laws.
Incident Notification	▪ Incidents involving cultural heritage will be managed according to Westside's incident management system, the CHIMA's and regulatory requirements.

6.10 Waste Minimisation and Management

Westside's key environmental protection objective for waste management is to manage all wastes in manner that avoids indirect impacts resulting from operations on the:

- Life, health and wellbeing of people
- Diversity of ecological processes and associated ecosystems
- Land use capability, having regard to economic considerations.

6.10.1 Environmental Values

The following EVs are related to waste production:

- Landscape and diversity of the ecological processes in and surrounding the area
- Health and wellbeing of the local community.

Waste products resulting from the activities have the potential to affect the landscape and diversity of the ecological processes in and surrounding the area. In addition to this, the waste products also have the potential to impact upon the health and wellbeing of the local community. More specifically the EVs that could be potentially impacted as a result of the CSG operations are as follows:

- Land quality
- Water quality
- Visual amenity
- Native wildlife.

These EVs could be potentially effected should improper waste management practices be in place. Land and water quality could potentially be impacted through oil or waste material spills. The potential for improper storage of waste materials at the site could lead to impacts to the visual amenity in the vicinity. Finally, native wildlife may be impacted through the potential for introduction or encouragement of pest fauna species via new food sources created by incorrect green waste disposal.

6.10.2 Potential Impacts

Impacts to environmental values as a result of waste have the potential to be beneficial or adverse. Potential beneficial uses of waste generated by petroleum activities and operations produced include:

- Opportunity for re-use of CSG Water from CSG operations by treatment for specific uses such as stream flow argumentation, crop irrigation, stock watering, dust suppression on roads, injection to recharge local shallow aquifers, process water or industrial cooling
- Opportunity for reuse or recycling of valuable materials, compounds, and constituents that may otherwise become wastes and thereby be disposed of without obtaining maximum benefit from re-use or recycling. Examples include scrap metal, use of waste oil as fuel, and recycle of plastics, glass, paper, and related materials.

Potential adverse impacts to the EVs can arise due to improper waste management practices. These potential impacts may include:

- Littering caused by lack of suitable containment measures for general rubbish
- Land contamination as a result of spills or ineffective disposal of solid and liquid wastes generated by the operations
- Water pollution caused by release or spills of solid or liquid waste either directly to receiving waters, or indirectly via storm water runoff to receiving waters from waste contaminated sites
- Contamination of ephemeral streams, irrigation areas or springs as a result of transport of water with a potentially elevated salinity (relative to that of the local water quality)
- Water logging and salinity build up as a result of localised creation of perched water table
- Groundwater contamination as a result of releases or spills of solid or liquid waste to land
- Localised tree or plant death as a water logging or excess salinity
- Loss of vegetation and increasing soil salinity caused by improper release or spills of CSG Water with high salinity concentrations
- Ambient air quality impacts to human health or the ecological environment as a result of emission of volatile wastes that improperly managed
- Odours caused by incorrect storage or treatment of putrescibles waste
- Reduction to the visual amenity of the local area as a result of poor management of green and other wastes
- Adverse effects on municipal infrastructure, such as sewage treatment plants, through increased peak demand.

A range of wastes, including regulated wastes, will be generated during the field development and the operation. These wastes and the resulting potential adverse or beneficial impacts are listed below in Table 17.

Table 17 Estimates of Waste Quantities and Potential Adverse and Beneficial Impacts

Waste Type	Quantity (2021)	Potential Adverse Impact	Potential Beneficial Impact
General Waste	462m^3	Contamination of land and water Introduction of pest fauna species	Recycling of portions of the general waste
Recyclable Waste	12m^3	Contamination of land and water	Recycling and reuse of portions of the waste
Regulated Waste	1.5m^3	Contamination of land and water Health Impact	Recycling and reuse of portions of the waste
Scrap Steel	5.68T	Contamination of land and water	Recycling and reuse of portions of the waste

Glycol Drums	1230L	Contamination of land and water	Recycling and reuse of portions of the waste
Oily Water	16,500L	Contamination of land and water	Recycling and reuse of portions of the waste

6.10.3 Management Plan

Environmental Protection Objectives	Manage all wastes in manner that avoids indirect impacts resulting from operations on the: ▪ Life, health and wellbeing of people ▪ Diversity of ecological processes and associated ecosystems ▪ Land use capability, having regard to economic considerations.
Performance Standards	▪ No uncontrolled releases of wastes to the receiving environment.
Control Strategies	
General	▪ Waste avoidance and reduction practices will be introduced into all aspects of the operation which will aim at reducing the amount of wastes produced ▪ Waste reuse practices will be implemented and monitoring of industry developments will identify any opportunities for external reuse programs ▪ A recycling program will be implemented which will aim at recycling all waste materials which have some value. Goods such as drums, metals, oils and solvents, glass, paper and plastic materials will be included in the recycling program ▪ Non-recyclable wastes generated will be disposed of in a Council Landfill.
General Waste	▪ A register of all chemicals stored on site will be developed and maintained ▪ Only licensed waste contractors will be employed to collect, transport and dispose of waste from the site. The waste management contractor will be required to dispose of the waste to a licensed waste management facility, with reporting requirements on the final destination of the waste ▪ Sewage generated from site will be treated and grey water disposed of via irrigation system in accordance with the EA conditions ▪ Wastes will not be burned or allowed to burn on site.
Regulated Wastes	▪ No oil or synthetic based drilling muds will be used in operations ▪ All petroleum products and other hazardous goods will be stored in bunded areas sized in accordance with AS1940 Storage and Handling of Flammable and Combustible Liquids ▪ Regulated wastes will be tracked in accordance with the Queensland waste tracking system (either a paper based waste tracking certificate or online through Connect) ▪ Regulated wastes will be stored in designated locations to ensure that there is a minimal risk of accidental release of regulated wastes to land. Regulated wastes will only be removed from site by a licensed regulated waste contractor and will be taken to an appropriate licensed waste disposal facility

	▪ Register of hazardous materials and their corresponding locations will be kept on site ▪ Residual drilling material may be disposed of onsite using the mix-bury cover method and is certified as being of acceptable quality for disposal to land as per the EA.
Hydrostatic Testing (Pipelines)	▪ Hydrostatic testing water will only be released to land if it meets the requirements of the EA.
Corrective Actions	▪ Waste related incidents will be managed as per Westside's incident management system and regulatory requirements.

6.11 Rehabilitation

6.11.1 Rehabilitation Activities

Rehabilitation will be undertaken progressively and include the following activities:

- Consultation with landholders to ensure appropriate rehabilitation objectives are developed
- Decommissioning of infrastructure including well sites, pipelines, dams, booster compressor stations and power generation units
- Rehabilitation of access tracks and infrastructure areas
- Monitoring of rehabilitation areas.

Where infrastructure is to be left for the landholder, a written agreement will be submitted alongside the Final Rehabilitation Report.

6.11.2 Decommissioning of Infrastructure

Decommissioning of infrastructure used in the production of CSG will be undertaken in accordance with the relevant provisions of the EA, the *Petroleum and Gas (Production and Safety) Act 2004* and the Act's regulations.

Well Sites

Well sites will plugged and abandoned in accordance with the *Petroleum and Gas (Production and Safety) Regulation 2004*. Any conversion of CSG wells or bores to water bores will be undertaken by a water bore driller licensed under the *Water Act 2000*.

Pipelines

Decommissioning of pipelines will occur in accordance with the requirements of Australian Standard *AS2885.3 – Gas and liquid petroleum operation and maintenance*. The Australian Pipeline Industry Association's *Code of Environmental Practice for Onshore Pipelines* will also be used as a guide for the decommissioning process.

Above ground pipelines will be removed or cut at ground level.

Where pipelines are buried, decommissioning will be via abandonment in place. Prior to abandonment, all pipelines will be disconnected and purged. Water used in purging will disposed of via one of the following options:

- directly reused where appropriate for petroleum activities;
- treated so that it meets water quality criteria for the intended reuse; or
- disposed of via evaporation.

Dams
Dams used for the containment of process water will be either decommissioned or handed over to landholders under a beneficial use agreement.

Decommissioning may involve the treatment of remaining water, sediment analysis and depending on the outcomes, managed in-situ or remove the salt or other contaminated sediment. Any salt or other contaminated sediments removed from dams will be transported by a licensed contractor to a licensed waste treatment or disposal facility. Dams will then be converted to a stable landform and revegetated according to the final land use objectives.

Where dams are to be handed over to a landholder for beneficial use, a written agreement will be submitted alongside the Final Rehabilitation Report.

Compressor Stations and Other Infrastructure
Upon decommissioning, compressor stations and other infrastructure will be dismantled and removed from site. Where possible, infrastructure components will be recycled.

6.11.3 Rehabilitation Strategies

Access Tracks
Where access tracks are to be left for the landholder, a written agreement will be submitted alongside the Final Rehabilitation Report.

Should access tracks require rehabilitation, this will include the following activities:
- Removal of gravel
- Ripping to correct soil compaction where necessary
- Revegetation consistent with the final land use objectives.

Well Sites and Infrastructure Areas
Well sites and infrastructure areas will be decommissioned as outlined above. Once the decommissioning process is complete, general rehabilitation strategies will include:
- Remediation of any contaminated land;
- Backfilling of any excavations resulting from decommissioning;
- Grading of sites to original contours;
- Erosion and sediment control works; and
- Revegetation consistent with the final land use objectives.

A detailed Rehabilitation Management Plan further outlines decommissioning and rehabilitation strategies for each of the infrastructure areas listed in the above sections.

6.11.4 Management Plan

Environmental Protection Objectives	The final land use objectives for the affected areas will include returning land to its previous use where possible. At a minimum, rehabilitated areas must meet the following goals: ▪ The site must be made safe for humans and animals

	▪ The site must be non-polluting, with appropriate erosion and sediment control measures ▪ The site must be stable ▪ The site must be self-sustaining. Further details regarding land use objectives will be contained in the site Rehabilitation Plan.
Performance Standards	Specific rehabilitation indicators and success criteria will be detailed in the Rehabilitation Plan in accordance with the conditions of the EA. However general indicators and success criteria will include: ▪ Wells abandoned according to the *Petroleum and Gas (Production and Safety) Act 2004* and the Act's regulations ▪ Stability of rehabilitated areas ▪ Indicators for erosion ▪ Vegetation cover ▪ Vegetation diversity ▪ Absence of pest species ▪ Downstream water quality ▪ Land returned to the pre-disturbance land use.
Control Strategies	
General	▪ Detailed planning prior to disturbance, such as local soil conditions, vegetation, erosion potential etc.. ▪ Implementation of practical landform designs, to prevent erosion and establish final landform stability ▪ Identification of appropriate post-petroleum activity land use consistent with location based environmental constraints and values ▪ Progressive rehabilitation of disturbed areas to the operational footprint ▪ Implementation of best practice erosion control measures ▪ Regular monitoring and visual inspection of rehabilitated areas undertaken to ensure the site meets minimum rehabilitation goals ▪ A Rehabilitation Monitoring Program is maintained in line with EA conditions, to ensure regular inspections are undertaken of rehabilitation areas against the rehabilitation indicators and success criteria outlined above. Should monitoring identify areas of erosion or pest species, appropriate management strategies will be implemented. ▪ Prepare a Final Rehabilitation Report within two years prior to the surrender of the PL.
Corrective Actions	▪ A corrective action program to address fail areas of rehabilitation will be developed ▪ Incidents involving rehabilitation will be managed according to Westside's incident management system and as per regulatory requirements.

7. Monitoring

Activities undertaken for this EMP will be routinely monitored by site personnel, external service providers and Westside management. Monitoring is supported by HSE personnel to ensure the management controls described in this EMP are implemented and that the performance measures are achieved.

Table 18 provides an outline of the main monitoring activities that will be undertaken.

All equipment used for monitoring will be calibrated in accordance with manufacturer's specifications.

Table 18 Activities to monitor control effectiveness

Control	Monitoring	
	Action	Frequency
All		
Site inductions	Records of site inductions show 100% participation by all personnel, contractors and visitors	For all new staff members and visitors before access to the site Annual review of training records
Job hazard analysis	Perform a job hazard analysis of any new task or new use of equipment	Prior to commencing new task or using new equipment
Asset Integrity – Workover		
Well commissioning following workover	Monitoring of wellhead pressure	During commissioning and into operations phase
Asset Integrity – Wellhead Equipment, Safety Systems and Gathering Line		
Gas processing	Routine testing, inspection and preventative maintenance program for each well	Per inspection regime within Westside's maintenance management system
Chemical and Hazardous Materials Management		
Storage of chemicals, fuel and oils	Routine visual inspection of storage areas to ensure adequate bunding and containment strategies implemented, no leaks or spill. Records of inspections and routine maintenance to be maintained. Records show repairs carried out following detection.	Weekly inspections when in use and after a rainfall event
Spills and leaks of chemicals, fuel and oils	Routine emergency response drills	Annual
	Records kept of location, clean-up procedure in DoneSafe and any communication with DETSI regarding any leaks or spills	As required when applicable
Waste Management		
Regulated Waste tracking – to and from site	Records kept of quantities of waste in and out from site	During works as required
Waste tracking - NORMs	Records of NORMs disposal	During works as required
Waste tracking - transport	Records waste transporter licences show they are licenced transport the waste	Each waste transport event
Waste tracking – disposal	Records of waste disposal facilities licences showing that they are licenced to accept the waste	Each waste disposal event
Waste receptacles	Visual inspection of waste receptacles to ensure no fauna access to waste storage locations, lids are secure, waste are appropriately stored and there are no leaks	Weekly

Control	Monitoring	
	Action	Frequency
Water Usage		
Water usage tracking - groundwater extraction	Records of volume of groundwater extracted for the petroleum activities	Following extraction and use
Water usage tracking – commercial freshwater	Record volume of commercial freshwater used	Following purchase and use
Water usage tracking – produced water	Records of volume of produced water used during the petroleum activities	Following use
Water usage tracking– tank transfer	Records of volume of water transferred to each tank	Following transfer
Water usage tracking – spills	Records of volumes of water spilled in DoneSafe	Following spill
Erosion and Sediment Control		
Erosion and sedimentation on site	Records of location and size Recorded in DoneSafe	Site inspection at beginning of the works and then following any significant rainfall events (>15mm in 24 hours)
Erosion control	Visual inspection ensuring adequate control devices in place in accordance with IECA best practice guidelines No erosion occurring	Site inspection at beginning of operation Then following any significant rainfall events (>15mm in 24 hours)
Decommissioning and Rehabilitation Management		
Decommission and rehabilitation activities	Visual inspection of rehabilitation areas	Yearly
	Photographic point monitoring before during and after rehabilitation	As required before, during and after the rehabilitation works
Biosecurity Management		
Weed free certification	Weed free certificates to be obtained when equipment and materials are mobilised to site from known weed infested areas with records kept	When equipment / materials are brought to site from known weed infested areas
Weed management	Inspection to identify weed prior to mobilisation. Mange any weeds prior to earthworks If weeds occur during progressive rehabilitation manage any outbreaks	Prior to mobilisation to site and following demobilisation.
Biodiversity Management		
Fauna management	Inspect well leases, gathering trenches, pipe strings for fauna	During activities
Wildlife/ stock/ human interactions – trends	Review of recorded wildlife/stock interactions to ensure controls are effective and guide additional management if review shows unacceptable results	Annually
Bushfire Prevention		
Bushfire prevention	Check local weather condition and fire danger warnings	Daily check
Fire control	Inspect fire breaks	Annually

Control	Monitoring	
	Action	Frequency
Fire fuel load reduction	Assess fire fuel load and local site conditions (e.g. seasonal rainfall, fuel load, grazing, high fuel exotic grasses (e.g. buffel)) and action as necessary.	Once prior to commencement of activities, and annually if required
Air Quality Protection Measures		
Emissions minimisation	Maintenance records of vehicles and equipment	Per manufacture's specifications
Flaring records	Record of all flaring events	During activities as required
Emissions monitoring	Undertake ground level air monitoring as per the AREMP.	Annually
Traffic and Transport Management		
No unauthorised off-road driving, all drivers inducted into the potential impacts of driving on soil	Records kept of any incident Records stored in DoneSafe	During activities as required
Fauna strike records	Records kept in DoneSafe of any near misses or strikes of fauna	During activities as required
Zone designated speed limits	Records of any failures to comply and corrective action taken. Records stored in DoneSafe	During activities as required
Dust management (offsite)	Records kept of any visual monitoring of dust on Westside controlled roads and action to reduce vehicle speeds Records stored in DoneSafe	During activities as required
Appropriate licences for handling and transporting hazardous loads	Routine checks of licences	During activities as required
Community Impact Minimisation		
Complaints management	Records of complaints from community in regards to activities including response to complaint and any actions taken	During activities as required
Noise and Vibration		
Vehicle servicing	Compliance with vehicle manufactures specifications	Before mobilisation of vehicle to site as required
Petroleum activities	Assess the potential noise and vibration impacts on sensitive receptors. If there is an impact arrange an Alternative Arrangement. Complete in the Permit to Disturb System	Before mobilisation of equipment to site or prior to construction and operations of equipment
Cultural Heritage and Sacred Sites Preservation		
Manage incident of interference with Aboriginal Sacred Sites, places or objects of archaeological significance	Implement protocol to prevent further disturbance and notify as per the Cultural Heritage Management Plan requirements.	Records kept of any incident including notifications and remedial actions when applicable
Soil Contamination Management		

Control	Monitoring	
	Action	Frequency
Management of soil contamination	Soil sampling directly after clean up at any location where spill/ contamination has occurred. Soil testing of any area of remediation following spill/contamination if applicable. Sampling conducting in accordance with AS 4482.1-2005 or other industry standard.	As required, following incident, until soil is classified as remediated in accordance with NEPM 2013 guidelines for contaminated sites
Surface Water Contamination Management		
Management of surface water contamination	Water/soil sampling directly after incident to determine extent of contamination and following removal of contamination source. Samples will be taken in accordance with the protocols detailed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality field sampling program (or as otherwise required by the Code) and samples analysed at a NATA-accredited laboratory.	As required, following incident, until soil is classified as remediated in accordance with NEPM 2013 guidelines for contaminated sites and / or appropriate surface water guidelines Then one year later
Groundwater Contamination Management		
Groundwater monitoring	Monitor groundwater levels and quality as per the UWIR requirements. Samples will be taken in accordance with the protocols detailed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality field sampling program (or as otherwise required by the Code) and samples analysed at a NATA-accredited laboratory	Gas wells monthly Shallow overlying ground wells quarterly. A review of frequency undertaken after a year of sampling.
Wet Season Monitoring		
Weather forecast	Review http://www.bom.gov.au/places/qld/moura/	Daily for next day and coming week
Road conditions	Review http://emd.banana.qitplus.com/	After a rain event
Chemical and waste storage areas	Visual inspection with records of inspection and any action taken to improve/repair rainfall containment	After a rain event
Produced Water Management		
Produced water tracking	Records kept of produced water use: • Quantity • Location of the supply and location of use • Date	Every time produced water is used
Dust suppression using produced water – EOWC for dust suppression and PL94 EA conditions	Visual inspection for: • on-site ponding; or • runoff from the site where the resource is applied; or • vegetation die-off; or • visible salting; or • serious or material environmental harm	When dust suppressing - daily

Control	Monitoring	
	Action	Frequency
Produced water tracking/monitoring – Stock water supply	For stock and stock intensive drinking water the water quality of the resource must comply with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000) Volume 1: Chapter 4.3 Table 4.3.1, 4.3.2, & 4.3.3.	1. Fortnightly sampling for pH and TDS 2. Monthly for ANZECC sampling for Stock water
Produced water tracking/monitoring – Irrigation	As per the Resource Monitoring and Management Plan Section 9.11.3	As per the Resource Monitoring and Management Plan Section 9.11.3
Treated Produced water	Records of volume of: • produced water treated • brine produced • permeate produced.	Daily
Above ground tanks integrity	Records kept of visual inspections to assess tank integrity including assessment of freeboard	Weekly inspections when in use

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Westside Corporation Pty Ltd

DOCUMENT TYPE **MANAGEMENT PLAN**

DOCUMENT TITLE

Meridian Seam Gas Significant Species Management Plan Petroleum Lease 94

DOCUMENT DETAILS

Dept. Origin	Environmental
Document #	WCL-0000-HS-PLN-012-01
Intranet Folder	Health, Safety, Environment & Risk
Used by	All Relevant Westside Personnel

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1. Introduction

Westside Corporation Pty Limited (Westside) operates Petroleum Lease (PL) 94, referred to as the Meridian Seam Gas Fields (the Project). PL94 is held 51% by Westside entities (Westside CSG A Pty Ltd and Westside CSG D Pty Ltd) in joint venture with Mitsui E&P Australia Pty Ltd (MEPAU) who holds 49%.

The current Environmental Authority (EA) for the Project is a site specific Environmental Authority, Chapter 5A petroleum activity Permit Number: EPPG00783713.

1.1 Purpose

This Significant Species Management Plan (SSMP) describes the management of potential impacts to significant species listed as Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), within the Project. The significant species relevant to this SSMP are threatened ecological communities (TECs), threatened species and migratory species.

This SSMP describes:

- Significant species that are known or potentially present within the Meridian Seam Gas Fields;
- Species-specific requirements for managing potential impacts to significant species during pre-construction, construction and operation phases of the Project; and
- Monitoring and reporting requirements.

The information contained in this SSMP has been summarised from the *Petroleum Lease (PL) 94 Ecological Assessment: Report for Impacts to Matters of National Environmental Significance* (Umwelt, 2024), documenting the outcomes of a detailed ecological assessment for the Project Stage 2.

The SSMP has been prepared focusing on the final 350 well heads for PL94 which is being assessed by the Department of Climate Change, Energy, the Environment and Water

1.2 Legislative Requirements

The EPBC Act provides the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined as MNES.

There is potential for MNES to occur within the Project area including the following prescribed matters relevant to the Project:

- Listed threatened species and communities (section 18 & 18A of the EPBC Act).
- Listed migratory species (section 20 & 20A of the EPBC Act).

2. Location

The Project is located in the Moura-Theodore district of the Banana Shire, Queensland. The area consists of the fields Dawson River, Nipan, Moura, Moura Central and Mungi. The field development occurs as 'pods' within an area extending approximately 36km north to south and up to 8km east to west. Moura is located within the PL94 tenure on the Western boundary and located 3.5km South of the PL94 boundary and 33km North of the Southern boundary. The development lies between the western boundary of various Anglo Coal Mining Leases (MLs) and the Dawson River. Access to the well fields utilises public roads and associated secondary roads which provide access to local properties. Figure 1 shows the Project location and identifies the existing Project area (stage 1) and the proposed stage 2 Project area boundary.

149°50'
150°
-24°30'
-24°40'
-24°50'
N

GLNG
Interconnect

PPL 166

PPL26 - PPL61
Interconnect Compound

Moura Office/Warehouse

Moura

PPL26

Mungi Laydown Yard

MR81 Moura M99
Booster Station

Moura Central
Compressor Station

Moura C
Booster

Nipan Booster

MERIDIAN SEAMGAS
PL94 AREA

Dawson River
Compressor Stati

Dawson River Water
Treatment Plant

Legend

Existing Facility and Infrastructure:

- Faclities
- Well pads
- PPL26 gas pipeline
- PPL166 gas pipeline
- Gas gathering pipeline

EPBC 2021/9217:

- PL94 Project Area

0 2 4 6 8 10 km

Data must not be used for direct marketing or be used in breach of the privacy laws.
(i) Westside Corporation Pty Ltd (WCL) accepts no responsibility for any loss or damage suffered however so arising to any person or corporation who may use or rely on this plan in contravention of the terms of this clause or clauses (ii) & (iii).
(ii) The dimensions, areas, numbers of lots, size & location of corridor information are approximate only and may vary.
(iii) This plan may not be copied unless this note is included.
Source: WCL; DNRME (QLD); Geoscience Australia; Bing Maps

Compiled:	M.Rodiger
Checked:	M.Rodiger
Drawn:	J.Payne
Date:	27/02/25
Datum:	GDA2020
Approved:	M.Rodiger

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FIGURE 1 - PROJECT AREA AND EXISTING PL94 INFRASTRUCTURE MAP

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Path: M:\02_Products\02_Meridian\Workspaces\ME_308\ME_308d\ME_308d.aprx\ME_308d

3. Significant Species

Species of significant flora, fauna and TECs are known to occur, or could occur within the Project area. The likelihood of occurrence within the Project was determined by Umwelt (2025) through a review of Commonwealth databases, GIS data, peer-reviewed literature, ecological surveys, current (known) distribution range, and the presence and condition of suitable habitat. For the purposes of this management plan, only significant species and communities known to occur or have a high or moderate likelihood of occurrence have been included. Figures showing the significant species habitat locations within the Project area are in Appendix A

3.1 Threatened Ecological Communities

A search of the Protected Matters Search Tool (PMST) indicate five TECs that are known, are likely to, or may occur in the search extent. Two endangered TECs were confirmed during site surveys as being present and one endangered TEC with a high likelihood of being present within PL94 through ground-truthing of analogous Regional Ecosystems (REs):

- Brigalow (*Acacia harpophylla* dominant and co-dominant) - **Known** (Table 1)
- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions – **Known** (Table 2)
- Poplar Box Grassy Woodland on Alluvial Plains – **Highly likely to occur** (Table 3).

Table 1 Brigalow TEC within PL94

Analogous RE	Short Description
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains
11.4.7	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
11.4.9a	*Acacia harpophylla, Lysiphyllum carronii +/- Casuarina cristata open forest to woodland*
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks

Table 2 Coolibah TEC within PL94

Analogous RE	Short Description
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains

Table 3 Poplar Box TEC within PL94

Analogous RE	Short Description
11.3.2	*Eucalyptus populnea* woodland on alluvial plains

Analogous RE	Short Description
11.3.17	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains
11.4.7	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains
11.4.12	*Eucalyptus populnea* woodland on Cainozoic clay plains

3.2 Threatened Species

3.2.1 Threatened flora

Three threatened flora species are known to PL94, confirmed during site survey (Umwelt, 2020) (Table 4).

Table 4 Threatened Flora

Scientific Name	Common Name	EPBC Act Status
Known		
Solanum dissectum	-	Endangered
Xerothamnella herbacea	-	Endangered
Solanum johnsonianum	-	Endangered

The known significant species were all recorded from within *Acacia harpophylla* woodlands. Notable habitat features from these locations included the presence of ground timber (presumably affords protection from cattle trampling), abundant leaf litter and sparse grass cover. *Xerothamnella herbacea* was only recorded from *Acacia harpophylla* woodlands along drainage lines and waterways.

Solanum johnsonianum was observed from remnant vegetation associated with the Gibihi Road reserve. The species is known to PL94 from both remnant and regrowth vegetation, at three locations within road reserve north of Dawson Highway, and at one location in the central portion of the Project area, west of Theodore Moura Road and north of Kianga River Road (Atlas of Living Australia, 2020).

Solanum dissectum was observed from one location within *Acacia harpophylla* woodlands in the northern portion of the Project area. The species has been recently recorded elsewhere within the PL, within road reserve north of Dawson Highway. Recent records also exist approximately 2 km outside of the northern PL boundary, along Moura-Baralaba Road.

Xerothamnella herbacea was identified from two locations within *Acacia harpophylla* woodlands in the northern portion of the PL. The species has been recently recorded within the PL, from road reserve in one location north and one location south of Dawson Highway (Atlas of Living Australia, 2020).

3.2.2 Threatened fauna

The likelihood of occurrence was evaluated for threatened fauna species identified in the PMST. One threatened fauna species is known to PL94 (ornamental snake), confirmed during site survey. The occurrence assessment determined that a further four threatened species have a high likelihood of occurring, whilst seven have a moderate likelihood of occurring (Table 5).

Table 5 Threatened Fauna

Scientific Name	Common Name	EPBC Act Status
Known		
Denisonia maculata	Ornamental snake	Vulnerable
High		
Petauroides volans	Greater glider	Endangered
Phascolarctos cinereus	Koala	Endangered
Elseya albagula	White-throated snapping turtle	Critically Endangered
Rheodytes leukops	Fitzroy River turtle	Endangered
Moderate		
Geophaps scripta scripta	Squatter pigeon	Vulnerable
Grantiella picta	Painted honeyeater	Vulnerable
Hirundapus caudacutus	White-throated needletail	Vulnerable/ Migratory
Rostratula australis	Australian painted snipe	Endangered
Egernia rugosa	Yakka skink	Vulnerable
Petaurus australis australis	Yellow-bellied glider (south-eastern)	Vulnerable
Adclarkia dawsonensis	Boggomoss snail	Critically Endangered

3.2.3 Migratory fauna

Eight migratory species are either known to PL94 or have been identified as having a high to moderate likelihood of occurring based on the presence of suitable habitat and recent or nearby records (**Table 6**).

Table 6 Migratory Fauna Known to PL94

Scientific Name	Common Name	EPBC Act Status
Known		
Plegadis falcinellus	Glossy ibis	Migratory
Hydroprogne caspia	Caspian tern	Migratory
High		
Rhipidura rufifrons	Rufous fantail	Migratory

Scientific Name	Common Name	EPBC Act Status
Gallinago hardwickii	Latham's snipe	Migratory
Actitis hypoleucos	Common sandpiper	Migratory
Apus pacificus	Fork-tailed swift	Migratory
Moderate		
Myiagra cyanoleuca	Satin flycatcher	Migratory
Calidris acuminata	Sharp-tailed sandpiper	Migratory

3.3 Species specific management measures

The Environmental Constraints Planning and Field Development Protocol (the Protocol) for the Meridian Seam Gas Fields will be implemented to finalise infrastructure layout. The Protocol documents the process for validating MNES, and implementing a hierarchy of avoiding, minimising, mitigating, rehabilitating and then offsetting impacts to MNES.

Threats and species-specific mitigation and management measures are summarised in Table 7 and Table 8 below. The mitigation and management measures includes TECs, threatened species and migratory species that were confirmed during sites surveys and that were not identified during site surveys, but could occur in the PL94 area based on their known habitat requirements.

MNES confirmed within the PL94 are:

Two TECs - Brigalow and Coolibah

- Three flora species - *Solanum dissectum*, *Xerothamnella herbacea* and *Solanum johnsonianum*
- One fauna species - ornamental snake (*Denisonia maculata*)
- Two migratory species – glossy ibis (*Plegadis falcinellus*) and Caspian tern (*Hydroprogne caspia*).

Potential direct and indirect impacts to TECs, threatened species, and migratory species known to the Project area are summarised in Table 7.

Other listed TECs, threatened species and migratory species were not identified during site surveys, but have a high or moderate likelihood of occurrence in the Project area based on their known habitat requirements. Management measures for these TECs and species are summarised in Table 8.

Table 7 Management Measures for Confirmed MNES

MNES	Threats	Mitigation and Management Measures
TECs identified in the Meridian Seam Gas Fields		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	All TECs are threatened by any activities that further reduce their extent, cause a decline in the condition of the vegetation, or impede their recovery. This includes: • Vegetation clearing • Inappropriate fire regimes • Grazing by herbivorous species • Introduction and/or spread of Invasive species • Changes to groundwater hydrology leading to changed aquifer and river levels, and salinity.	**Avoidance of Direct Impacts** • Site scout surveys will be undertaken to confirm the absence of these TECs from the PL94 Development Area. • Direct disturbance to Brigalow TECs for the project is limited to the maximum disturbance limits in the Westside Environmental Constraints Planning and Field Protocol (MSG-G000-HS-PLN-003). • No direct impacts to Coolibah TEC will be permissible at any time throughout the life of the Project. • Coolibah TECs are identified as 'no-go' areas. **Minimise Indirect Impacts** • Development will avoid disturbance to areas directly adjacent to TECs as standard practice. • Minimising disturbance within fringe areas of TECs • Locations of prior significant disturbance will be utilised • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • TECs within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. The presence and extent of TECs within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential TEC mapped). • Direct impacts to Brigalow TEC will occur on the edges of patches only, and/or utilise existing gaps and breaks. No patches will be dissected, however where existing gaps are already present these may be widened, provided cumulative maximum disturbance limits for the TEC are adhered to. • No stockpiling of construction materials including excavated soil will occur in areas identified as TEC. • Clearing works will maintain a vegetation 'exclusion zone' of 5 m or more around areas of TEC to ensure suitable micro-climatic conditions are maintained and weed incursion risks are reduced. • The extent of Project-related construction work (including equipment laydown and other non-clearing activities) proposed to occur within 5 m of a confirmed or potential TEC will be demarcated using flagging tape, barricade webbing or similar, to avoid accidental clearing outside the approved disturbance area. • Confirmed and potential TEC areas adjacent to Project construction activities will be inspected by a suitably qualified ecologist prior to commencement and at completion of works, in accordance with the methods outlined in the Project SSMP (MSG-GN00-HS-PLN-005). • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species. • If landholder seed mix is not requested, rehabilitation works in areas adjacent to a TEC will prioritise the use of native species, to reduce further incursion of weed species and/or exotic grass species (i.e. buffel grass) within the area. Rehabilitation will be undertaken in accordance with the Westside Rehabilitation Management Plan (WCL-0000-HS-PLN-011).

MNES	Threats	Mitigation and Management Measures
Threatened flora species identified in the Meridian Seam Gas Fields		
Solanum dissectum *Xerothamnella herbacea* *Solanum johnsonianum*	These flora are threatened by any activities that further reduce their extent, cause a decline in the condition of the vegetation, or impede their recovery. This includes: • Vegetation clearing • Inappropriate fire regimes • Grazing by herbivorous species • Introduction and/or spread of invasive species.	**Avoidance of Direct Impacts** • Site scout surveys will be undertaken for populations of threatened flora species and Project infrastructure will avoid disturbance to identified populations. • No direct disturbance to confirmed threatened flora species is proposed for the project. • Direct disturbance to *Solanum dissectum*, *Solanum johnsonianum*, *Xerothamnella herbacea* habitat are as per limits in the Westside Environmental Constraints Planning and Field Protocol (MSG-G000-HS-PLN-003). The locations of the records within the site are shown in Figures 7 -9 of the Westside Environmental Constraints Planning and Field Protocol (MSG-G000-HS-PLN-003). **Mitigation & Management Measures for Indirect Impacts** • Threatened flora individuals/populations and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. The presence and extent of threatened flora populations and habitat within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped). • No direct impacts to any threatened flora plants listed under the EPBC Act will be permissible at any time throughout the life of the Project. Areas known to support threatened flora listed under the EPBC Act adjacent to Project construction activities will be monitored by a suitably qualified ecologist in accordance with the frequency and method provided in the Project SSMP (MSG-GN00-HS-PLN-005). • Where a plant is identified to potentially be a species' listed under the EPBC Act, but formal identification cannot be made at the time, the plants will be assumed to be the threatened species and managed accordingly until proper identification occur. • Direct impacts to potential habitat for the relevant threatened flora species (i.e. meets the habitat definition but did not contain any individuals or populations) are only permitted to a cumulative maximum disturbance limit of 1.0 ha. Direct impacts to potential threatened flora habitat will be avoided to the maximum extent possible. • The extent of Project-related construction work (including equipment laydown and other non-clearing activities) proposed to occur within 5 m of threatened flora habitat will be demarcated using flagging tape, barricade webbing or similar, to avoid accidental clearing outside the approved disturbance area. • The siting of Project infrastructure will aim to minimise fragmentation of potential habitat as much as possible (i.e. clear edges rather than dissect patches) to maintain core patch and population viability. • No stockpiling of construction materials including excavated soil will occur in areas identified as threatened flora habitat. • A vegetation 'exclusion zone' of 5 mwill be established around identified locations of threatened flora species to ensure suitable micro-climatic conditions are maintained and weed incursion risks are reduced. The known threatened flora location, inclusive of the exclusion zone, will be considered a 'no-go' zone to mitigate any occurrence of accidental damage or death as a result of trampling etc. Given the very small size of the plants (forbs) and root system characteristics (Xerothamnella herbacea able to root at the nodes that contact the soil while both Solanum spp. rhizomatous and may benefit from some disturbance), a 5 m exclusion zone is considered sufficient.

MNES	Threats	Mitigation and Management Measures
		• Patches confirmed to contain threatened flora individuals/populations and associated 'no-go' zones, adjacent to Project construction activities will be inspected by a suitably qualified ecologist prior to commencement and at completion of works, to ensure no unintentional indirect impacts have occurred in accordance with the methods outlined in the Project SSMP (MSG-GN00-HS-PLN-005). • In the unlikely event that threatened flora plant listed under the EPBC Act is damaged, removed or killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species within areas of habitat. • Wherever landholder seed mix is not requested, rehabilitation works in areas adjacent to threatened flora habitat will prioritise the use of native species, to reduce increased incursion of weed species and/or exotic grass species (i.e. buffel grass) within the area

Threatened fauna species identified in the Meridian Seam Gas Fields		
Ornamental snake	Threats to this threatened species include: • Land clearing leading to habitat loss and fragmentation • Habitat degradation from overgrazing by stock, or grazing in key gilgai habitat areas • Alteration of landscape hydrology • Alteration of water quality • Predation by feral species • Contact with cane toads.	**Avoidance of Direct Impacts** • Direct impacts to ornamental snake suitable habitat are permitted only to a cumulative maximum disturbance limit of 16.0 ha. Direct impacts to potential ornamental snake habitat will be avoided to the maximum extent possible. • Suitable habitat for ornamental snake has been identified as 'moderate constraint' areas. • Disturbance to suitable habitat for ornamental snake will not cause the fragmentation of important habitat. **Minimise Impacts** • Locations of prior significant disturbance will be utilised • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • Ornamental snake individuals and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the field site scouts completed as part of the Assess Project execution phase. The presence and extent of ornamental snake habitat within 30 m of the infrastructure location should also be assessed during the field site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped). • Where clearing is proposed for areas of ornamental snake suitable habitat (all utilisation categories), a fauna spotter-catcher must be present. The fauna spotter-catcher will attempt to relocate any ornamental snake individuals that may occur within areas of suitable potential habitat to be cleared to nearby areas of suitable habitat. breeding and foraging habitat to be retained that are at least 100m away from the clearing works. This will be done by: o Searching for individuals via spotlighting surveys at night. This could be completed the night before works are planned, or at any time within three months of clearing works if conditions are suitable i.e. following rain. o Searching for individuals immediately prior to clearing within surface microhabitat such as fallen timber and deep litter piles. o Any ornamental snakes captured will be relocated at least 100 m away. The chances of relocated ornamental snake/s returning to areas of habitat to be cleared are considered low as radio tracking studies completed by Veary (2011) indicate that the species moves only short distances during late summer and winter, and even shorter distances in summer. • Where clearing is proposed within or adjacent to ornamental snake suitable habitat (all utilisation categories), active erosion and sediment control measures will be implemented to mitigate potential habitat degradation. • Micro-siting of proposed infrastructure will preferentially avoid larger/deeper gilgai or areas with deep soil cracks and fallen timber. • The period of time that trenches and other excavations are open will be minimised, particularly in areas where the species has been recorded and in mapped breeding and foragingsuitable habitat. • Surface water pipeline design will consider the dispersal requirements of the ornamental snake and be s will be preferentially collocated with access tracks (new or existing) to minimise creating barriers to movement. Where the pipeline is not raised off the ground, egress points that allow ornamental snakes to safely move over or under the pipelines, will be installed (minimum frequency of 1 egress point per 100 m of pipeline). • Since this species does not use a defined breeding place, all areas occupied by ornamental snakes are considered to be breeding and foraging habitat. If an individual is found during field-validation, all connecting habitat will be classified as breeding and foraging habitat, and the area will be preferentially avoided as per the conTo reduce the potential for direct mortality, all vehicles and pedestrians will remain within designated access tracks in areas of

		ornamental snake habitat. • To minimise the chances of collision, in known ornamental snake occurrence areas within the Project Area, speed limits will be reduced to 40 km/hr or less and signage will be installed that indicates species presence. • Larger, discrete surface microhabitat features such as fallen timber and surface rocks will be relocated to adjacent areas of undisturbed habitat prior to clearing, where safe and practical. As described in Section 8.2.1 of the MNES Assessment Report, the fauna spotter-catcher will identify these items prior to clearing and relocation will be supported by machinery as required. • If an ornamental snake is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species within areas of habitat.
Migratory species identified in the Meridian Seam Gas Fields		
Glossy ibis Caspian tern	The main threats to these migratory species are: • Direct mortality • Habitat loss and destruction • Predation by feral animals • Reduction of quality and quantity of water • Disturbance from human activities.	**Avoidance of Direct Impacts** • Avoidance of disturbance to waterbody habitat (e.g. wetlands) for this species. **Minimise impacts** • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • Implementation of pest, weed, and disease/hygiene management measures to minimise the potential for introduction or spread of invasive species or diseases, including compliance with obligations under the QLD Biosecurity Act 2014. • Fuel and chemical storage in accordance with Australian Standards. • Erosion and sediment controls. • Rehabilitation of all significantly disturbed land in accordance with the PL94 EA and Rehabilitation Plan. Rehabilitation includes the use of native groundcover species wherever possible. • Beneficial use of produced water in accordance with the water quality limits under the PL 94 EA and beneficial use approvals under the Waste Reduction and Recycling Act 2011 (e.g. ANZECC water quality limits for irrigation). • Implementation of pest, weed, and disease/hygiene management measures to minimise the potential for introduction or spread of invasive species or diseases, including compliance with obligations under the QLD Biosecurity Act 2014. • Prohibition of keeping domestic animals (e.g. dogs or cats) within the PL94 Development Area and surrounds by personnel employed for the Project.

Table 8 Management Measures for Potential MNES

MNES	Threats	Mitigation and Management Measures
Potential TECs (not identified by surveys)		
Poplar Box Grassy Woodland on Alluvial Plains	All TECs are threatened by any activities that further reduce their extent, cause a decline in the condition of the vegetation, or impede their recovery. This includes: • Vegetation clearing • Inappropriate fire regimes • Grazing by herbivorous species • Introduction and/or spread of Invasive species • Changes to groundwater hydrology leading to changed aquifer and river levels, and salinity.	**Avoidance of Direct Impacts** • Site scout surveys will be undertaken to confirm the absence of these TECs from the PL94 Development Area. • No direct impacts to Poplar Box Woodland will be permissible at any time throughout the life of the Project. • Poplar Box Woodland TECs are identified as 'no-go' areas. **Minimise Indirect Impacts** • Site scout surveys will be undertaken to confirm the absence of these TECs from the PL94 Development Area. • No direct impacts to Poplar Box Woodland TEC will be permissible at any time throughout the life of the Project. • Poplar Box Woodland TECs are identified as 'no-go' areas. **Mitigation & Management Measures for Indirect Impacts** • TECs within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. The presence and extent of TECs within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential TEC mapped). • No stockpiling of construction materials including excavated soil will occur in areas identified as TEC. • Where practical, clearing works should maintain a vegetation 'exclusion zone' of 5 m or more around areas of TEC to ensure suitable micro-climatic conditions are maintained and weed incursion risks are reduced. • The extent of Project-related construction work (including equipment laydown and other non-clearing activities) proposed to occur within 5 m of a confirmed or potential TEC will be demarcated using flagging tape, barricade webbing or similar, to avoid accidental clearing outside the approved disturbance area. • Confirmed and potential TEC areas adjacent to Project construction activities will be inspected by a suitably qualified ecologist prior to commencement and at completion of works, in accordance with the methods outlined in the Project SSMP (MSG-GN00-HS-PLN-005). • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species. • Wherever landholder seed mix is not requested, rehabilitation works in areas adjacent to a TEC will prioritise the use of native species, to reduce further incursion of weed species and/or exotic grass species (i.e. buffel grass) within the area. Rehabilitation will be undertaken in accordance with the Westside Rehabilitation Management Plan (WCL-0000-HS-PLN-011).
Potential threatened fauna species (not identified by surveys)		
Greater glider	Threats to greater gliders include: • Habitat loss and fragmentation • Inappropriate fire regimes • Barbed wire fencing entanglement • Selective logging of old	**Avoidance of Direct Impacts** • No direct impacts to greater glider denning habitat or foraging and dispersal habitat (maximum disturbance limit of 0.0 ha). • Direct impacts to greater glider foraging and dispersal only habitat are permitted to a cumulative maximum disturbance limit of 2.0 ha. **Minimise Impacts** • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • When clearing greater glider (southern and central) foraging and dispersal habitat, micro-siting will aim to retain the tallest trees

	growth, hollow bearing trees • Competition for breeding hollows from sulphur crested cockatoos (*Cacatua galerita*).	present within the assessed area, to ensure availability of gliding launch points is retained. • During the site scouts, ecologists will assess tree height and size relative to known glide angle to determine if an area meets the habitat definition and how habitat exists functionally in the landscape (i.e. as an isolated patch or as a habitat corridor). This data will also be used to determine if proposed infrastructure siting is in accordance with the below measure that specifies that clearing must not create gaps within a habitat corridor that are impassable. • Where clearing is proposed within a greater glider (southern and central) habitat corridor, as defined in the MNES habitat criteria, site scout data collected by a qualified ecologist will be used to understand how much wider existing gaps can be made. Clearing required for construction of the Project will not create gaps in the habitat corridor that are too great for the species to glide across based on known glide ratios (i.e. turn the corridor into two isolated patches or corridors, thereby reducing habitat connectivity within the Project Area)**.** Refer Appendix A Habitat Descriptions, for full definition, as well as the following clarification: • Foraging and dispersal habitat (individual patch or corridor) must occur within gliding distance (calculated based on known glide angle (40°) and tree height, or 100 m if not able to calculate accurately) of denning habitat or foraging and dispersal habitat, given the species' reliance on hollow-bearing trees to shelter during the day.
Koala	Threats to koalas include: • Land clearing leading to habitat loss and fragmentation • Mortality arising from dog attacks and car strikes • Disease, particularly from Chlamydia infection • Inappropriate fire regimes.	**Avoidance of Direct Impacts** • No direct impacts to koala habitat categorised as climate refugia will be permissible at any time throughout the life of the Project. • Direct impacts to koala breeding and foraging habitat are permitted only to a cumulative maximum disturbance limit of 2.0 ha. Direct impacts to koala shelter habitat and dispersal habitat are permitted only to a cumulative maximum disturbance limit of 6.9 ha and 400.0 ha respectively. Of the 400 ha limit for dispersal habitat, 1% (or 4 ha) may comprise koala dispersal trees - Recognised as a plant of any genera that has a tree diameter that is equal to or greater than 10 cm when measured at 1.3 m above the ground (referred as >10 cm DBH) within areas of koala dispersal habitat. **Minimise Impacts** • Minimising disturbance within other habitat for these species • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • Koala individuals and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. The presence and extent of koala habitat (breeding and foraging) within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped). • During the site scouts, the presence and extent (measured by canopy cover) of koala dispersal trees (recognised as a plant of any genera that has a tree diameter that is equal to or greater than 10 cm when measured at 1.3 m above the ground (referred as >10 cm DBH) within areas of koala dispersal habitat) will be assessed as part of habitat verification and mapping. This data will be used to provide guidance on micro-siting and inform the site-specific determination of impacts to dispersal habitat (including area of dispersal tree cover loss predicted). The subsequent site scout ecology report will detail the findings and include an assessment of predicted residual changes to koala dispersal capacity as a result of the Project, relative to the baseline. No functional loss of koala dispersal habitat will be permitted. • As the majority of the Project Area is mapped as koala dispersal habitat, impacts on the species are largely unavoidable. Siting of infrastructure will preferentially retain breeding and foraging habitat over shelter and dispersal habitat. • The micro-siting of Project infrastructure within areas of koala dispersal habitat proposed for clearing will prioritise the retention of koala dispersal trees (highest priority) followed by any native woody vegetation. • Within areas of koala breeding and foraging habitat to be cleared, micro-siting will aim to maximise the retention of Brigalow Belt Locally important koala trees, as defined in A review of koala habitat assessment criteria and methods (Youngentob, Marsh and

		Skewes, 2021). • Within areas of koala shelter habitat to be cleared, micro-siting will aim to maximise the retention of Brigalow Belt ancillary koala trees, as defined in A review of koala habitat assessment criteria and methods (Youngentob, Marsh and Skewes, 2021). • Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention. • Where clearing is proposed for areas of koala habitat (breeding and foraging and shelter habitat categories), a fauna spotter-catcher must be present. Prior to vegetation clearing commencing, the fauna spotter-catcher will include canopy searches for koalas. If a koala is located during clearing activities: o The individual must not be forcibly relocated. o Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition. o Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher. o Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer. • Requirements for koalas subject to handling to be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. • To reduce the potential for direct mortality, all vehicles and pedestrians will remain within designated access tracks in areas of koala habitat. • To minimise the chances of collision, in known koala occurrence areas, speed limits (in private areas) will be reduced to 40 km/hr or less and signage will be installed that indicates species presence. It is noted that the species is currently considered a potential occurrence and is not known to the Project Area. • If a koala is sighted within the Project Area, the details of this observation will be communicated via the daily toolbox and on notices in the common areas of the site office in order to increase vigilance in the area and compliance with enforced speed limits. • In the unlikely event that a koala is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species within areas of habitat.
Squatter pigeon Australian Painted snipe	Threats to squatter pigeons include: • Habitat loss and fragmentation • Degradation of habitat by overgrazing by domesticated herbivores • Introduction and/or spread of invasive species • Predation by numerous avian and terrestrial predators.	**Avoidance of Direct Impacts** • Direct impacts to squatter pigeon (southern) breeding habitat and foraging habitat are permitted only to a cumulative maximum disturbance limit of 1.0 ha. Direct impacts to squatter pigeon (southern) dispersal habitat are permitted only to a cumulative maximum disturbance limit of 40.0 ha. Direct impacts to potential squatter pigeon (southern) habitat will be avoided to the maximum extent possible. • Direct impacts to Australian painted snipe seasonal breeding, foraging and dispersal habitat are permitted only to a cumulative maximum disturbance limit of 6.0 ha. Direct impacts to potential Australian painted snipe habitat will be avoided to the maximum extent possible. • Where clearing is proposed within squatter pigeon (southern) dispersal habitat, micro-siting efforts will aim to retain mature trees that may provide shelter from aerial predators. • Avoidance of disturbance to breeding and foraging habitat for the Australian painted snipe. **Minimise Impacts**

		• Minimising disturbance within other habitat for these species
		• Rehabilitate disturbances
		Mitigation & Management Measures for Indirect Impacts
		• Squatter pigeon (southern) and Australian painted snipe individuals, nests and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. Nest locations should be recorded and mapped. The presence and extent of squatter pigeon (southern) and Australian painted snipe habitat within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped).
		• Where clearing is proposed for areas of squatter pigeon (southern) or Australian painted snipe habitat (all utilisation categories), a fauna spotter-catcher must be present.
		• Immediately prior to clearing any squatter pigeon (southern) or Australian painted snipe habitat, the fauna spotter-catcher will complete flushing transects to encourage the movement of individuals out of the impact area.
		• As both the squatter pigeon (southern) and Australian painted snipe nests on the ground and is at high risk of direct mortality, potential nests should also be searched for by the fauna spotter-catcher immediately prior to clearing potential habitat, with any located demarcated.
		  • If a squatter pigeon (southern) nest is located and the area is not already identified as breeding habitat, work will temporarily cease. The Protocol will identify the next steps, including but not limited to, re-categorised the area as breeding habitat and determining if predicted impact areas are within the cumulative disturbance limits for squatter pigeon (southern) breeding habitat.
		  • If direct disturbance to a squatter pigeon (southern) or Australian painted snipe nest is required, this will be managed under an approved DESI SMP (high-risk). An appropriate exclusion zone as determined by the fauna spotter catcher will be required around active nests. A minimum 100 m radius exclusion zone (or larger if determined necessary by the fauna spotter-catcher) will be required around active nest
		• To reduce the potential for crushing of nests or direct mortality, all vehicles and pedestrians will remain within designated access tracks in areas of squatter pigeon (southern) and Australian painted snipe habitat.
		• To minimise the chances of collision, in known squatter pigeon (southern) and Australian painted snipe occurrence areas on private property, speed limits will be reduced to 40 km/hr or less and signage will be installed that indicates subspecies presence. It is noted that both species are currently considered a potential occurrence and are not known to the Project Area.
		• In the unlikely event that a squatter pigeon (southern) or Australian painted snipe is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.
		• Clearing in and around potential squatter pigeon (southern) and Australian painted snipe water sources (i.e. farm dams and wetlands) will be preferentially avoided. Where clearing is proposed within or adjacent to Australian painted snipe habitat or a squatter pigeon (southern) water source, active erosion and sediment control measures will be implemented to mitigate potential habitat degradation.
		• Water extraction activities at any potentially suitable water source for squatter pigeon (southern) or Australian painted snipe will be strictly controlled and monitored to ensure the continuation of the resource. Per waterbody, a single access point will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring individuals to avoid the same area during construction.
		• All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species within areas of habitat

Painted honeyeater	Threats to painted honeyeaters include:
	• Habitat loss and fragmentation
	• Degradation of habitat by overgrazing by domesticated herbivores
	• Predation by invasive species such as black rat (*Rattus rattus*).
		Avoidance of Direct Impacts
		• Direct impacts to painted honeyeater habitat are permitted only to a cumulative maximum disturbance limit of 6.9 ha. Direct impacts to potential painted honeyeater habitat will be avoided to the maximum extent possible.
		Minimise Impacts
		• Minimising disturbance within other habitat for these species
		• Rehabilitate disturbances
		Mitigation & Management Measures for Indirect Impacts
		• Painted honeyeater individuals and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. Trees or shrubs supporting abundant mistletoe or nest locations should be recorded (including mistletoe genus) and mapped. The presence and extent of painted honeyeater habitat within 200 m1 of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped).
		• During the field site scouts, the diversity and abundance of mistletoe within areas of suitable habitat must be assessed and mapped. This data will inform the assessment by field site scouts, regarding the impacts to foraging and dispersal habitat, and specifically any potential changes in habitat functionality. No loss of habitat functionality per patch will be permitted, as determined by a suitably qualified ecologist. This can be measured by:
		  • Reduction in relative abundance: A loss of habitat functionality may occur in areas assessed using relative abundance, where there is a change in mistletoe abundance from rare to absent. Depending on the context, a reduction from abundant mistletoe to occasional mistletoe may not impact functionality.
		  • Reduction in individual plants with mistletoe: In areas assessed where individual plants have been mapped, any reduction >10% may impact functionality.
		• Within areas of painted honeyeater foraging and breeding habitat that are proposed for clearing, micro-siting will preferentially retain trees containing the species preferred mistletoe which are from the genus *Amyema*.
		• Where clearing is proposed for areas of painted honeyeater habitat, a fauna spotter-catcher must be present.
		• Immediately prior to clearing any painted honeyeater habitat, the fauna spotter-catcher will complete canopy searches to identify any foraging individuals. The movements of any identified individuals should be monitored during the completion of clearing works to ensure they relocate of their own volition.
		• In the unlikely event that a painted honeyeater is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.
		• All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pests.

Yakka skink Yellow-bellied Glider (South-eastern) Boggomos snail Fitzroy River turtle White-throated snapping turtle	The main threats to these species include: • Loss and degradation of habitat for agriculture and industry developments • Removal of habitat features such as rocks, course woody debris and ground litter • Use of agricultural chemicals • Predation by feral cats and foxes • Overabundance of invasive weeds.	**Avoidance of Direct Impacts** • No direct disturbance to habitat is proposed for the Project **Minimise Impacts** • Minimising disturbance within areas adjacent to habitat • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • Threatened fauna individuals and habitat within the proposed infrastructure location will be identified and mapped by a suitably qualified ecologist during the site scouts completed as part of the Assess Project execution phase. The presence and extent of threatened fauna habitat within 30 m of the infrastructure location should also be assessed during the site scouts. Where this cannot be completed (i.e. land access restrictions), presence will be assumed if such findings are supported by the MNES mapping (i.e. potential habitat mapped). • All areas of potential habitat (excluding Boggomoss snail) will be designated a high constraint area (i.e. only incidental surveys with no ground disturbance permitted) and no direct impacts as a result of the Project will occur (i.e. disturbance limit of 0.0 ha). • Boggomoss snail habitat that is confirmed via a fieldsite scout will become a no-go constraint area, to minimise mortality risks including accidental trampling. • In the unlikely event that a fauna species listed threatened under the EPBC Act is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • All requirements within the Westside Weed Management Procedure (WCL-0000-HS-PRC-034) and Biosecurity Management Plan (WCL-0000-HS-PLN-010-010) will be implemented to minimise the introduction and spread of pest and weed species within areas of habitat. • Measures outlined in the Westside Noise Management Plan (WCL-0000-HS-PLN-009), Erosion and Sediment Control Procedure (WCL-0000-HS-PRC-029) and Weed Management Procedure (WCL-0000-HS-PRC-034) will be implemented to minimise indirect impacts to the species. • project activities in areas adjacent that utilise chemicals, fuels and other pollutants will be carefully planned for and follow strict industry-standard protocols. Specific consideration will be given to the potential for contamination. Contingencies will be in place to ensure any accidental release or spill is immediately detected and managed, with corrective actions taken immediately. Measures relating to chemicals, fuels and other pollutants outlined in the EMP will be implemented to ensure potential indirect impacts on the species and its habitat are managed effectively
Potential migratory fauna species (not identified by surveys)		
Migratory species Fork-tailed swift Satin Flycatcher Rufous fantail Common sandpiper Sharp-tailed sandpiper Lathams snipe	The main threats to migratory species include: • Direct mortality • Habitat loss and destruction • Predation by feral animals • Reduction of quality and quantity of water • Disturbance from human activities.	**Avoidance of Direct Impacts** • Additional ecological assessments to identify the presence of these species. • Minimise impacts • Rehabilitate disturbances **Mitigation & Management Measures for Indirect Impacts** • Implementation of pest, weed, and disease/hygiene management measures to minimise the potential for introduction or spread of invasive species or diseases, including compliance with obligations under the QLD Biosecurity Act 2014. • Fuel and chemical storage in accordance with Australian Standards. • Erosion and sediment controls. • Rehabilitation of all significantly disturbed land in accordance with the PL94 EA and Rehabilitation Plan. Rehabilitation includes the use of native groundcover species wherever possible. • Beneficial use of produced water in accordance with the water quality limits under the PL 94 EA and beneficial use approvals

		under the Waste Reduction and Recycling Act 2011 (e.g. ANZECC water quality limits for irrigation). • Implementation of pest, weed, and disease/hygiene management measures to minimise the potential for introduction or spread of invasive species or diseases, including compliance with obligations under the QLD Biosecurity Act 2014. • Prohibition of keeping domestic animals (e.g. dogs or cats) within the PL94 Development Area and surrounds by personnel employed for the Project.

4. Additional Ecological Assessments and Monitoring

Although not identified by existing ecological assessments, any additional ecological assessments undertaken as part of Westsides site scouts will be utilised to identify the presence of the potential TECs and listed species identified in this plan, and refine the potential extent of TECs and habitat shown in Appendix A.

Monitoring for the Project will be undertaken in accordance with the EA and regulatory requirements as well as the Meridian Gas Field Rehabilitation Management Plan detailing rehabilitation monitoring requirements.

5. Abbreviations

Abbreviation	
CSG	Coal Seam Gas
DoR	Department of Resources
DESI	Department of Environment, Science and Innovation
EA	Environmental Authority
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Ha	Hectares
ML	Mining Lease
MNES	Matters of National Environmental Significance
PL	Petroleum Lease
RE	Regional Ecosystem
SSMP	Significant Species Management Plan
TEC	Threatened Ecological Communities
The Project	Meridian Seam Gas Fields

APPENDIX A – SPECIES HABITAT MAPS

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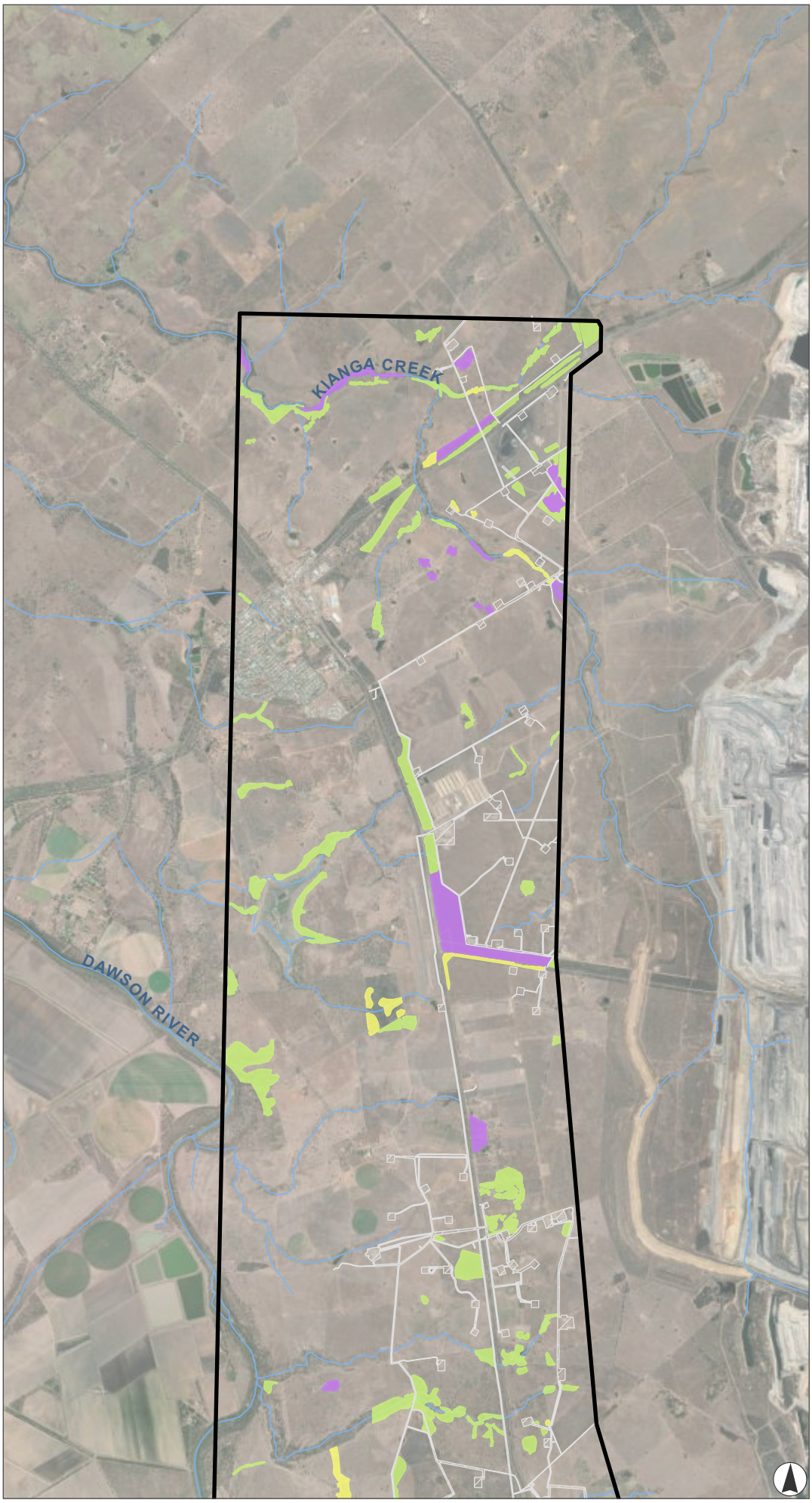
FIGURE 9.1A

Brigalow TEC Habitat Map

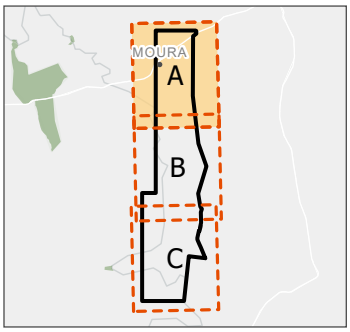


Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Brigalow TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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Kilometres

Scale 1:80,000 at A4
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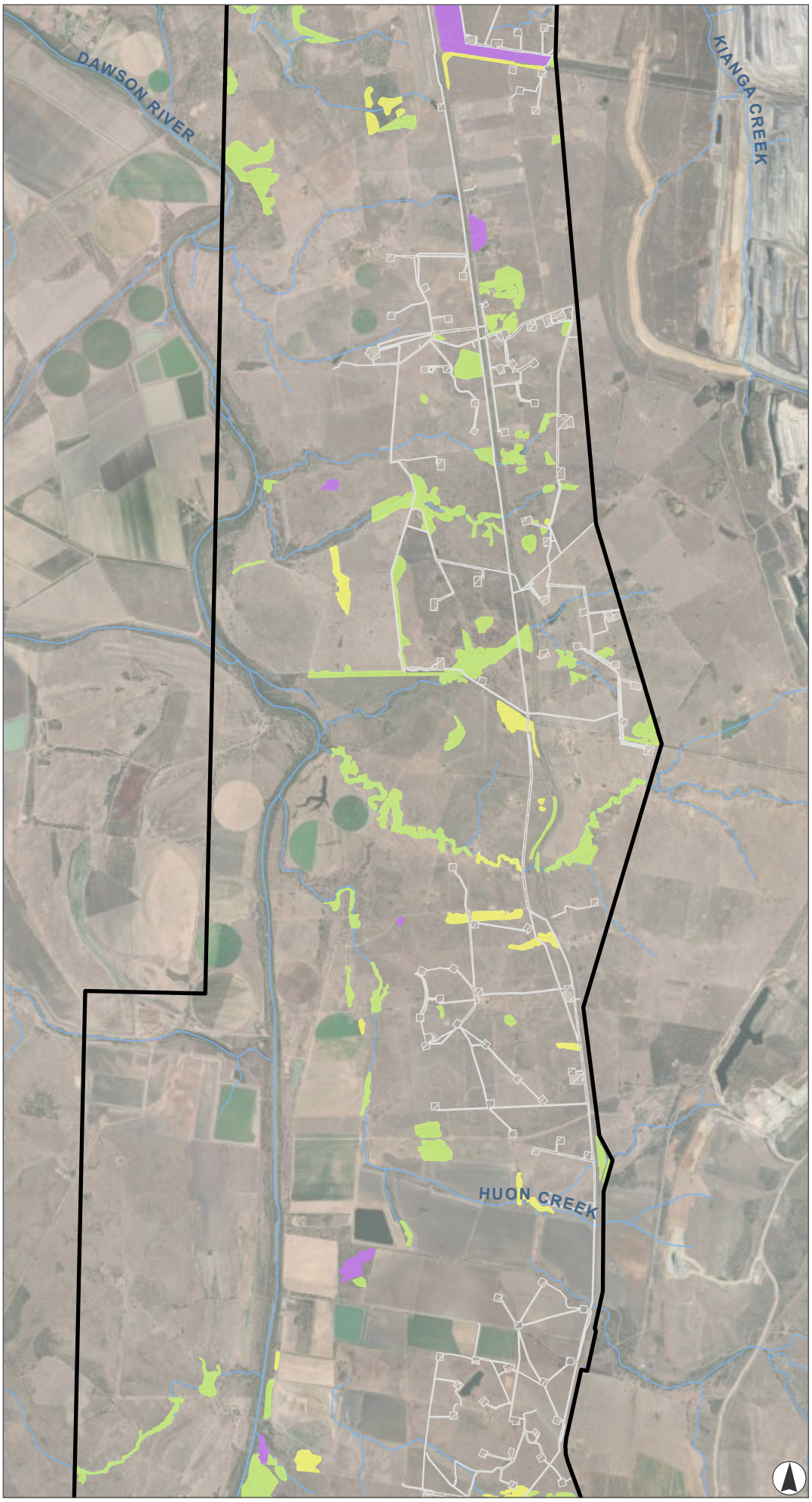


FIGURE 9.1B

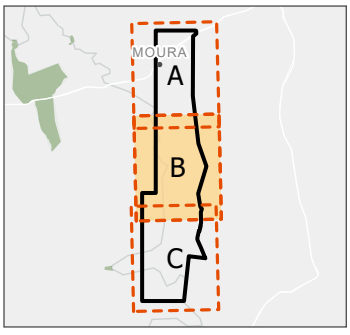
Brigalow TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Brigalow TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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Kilometres

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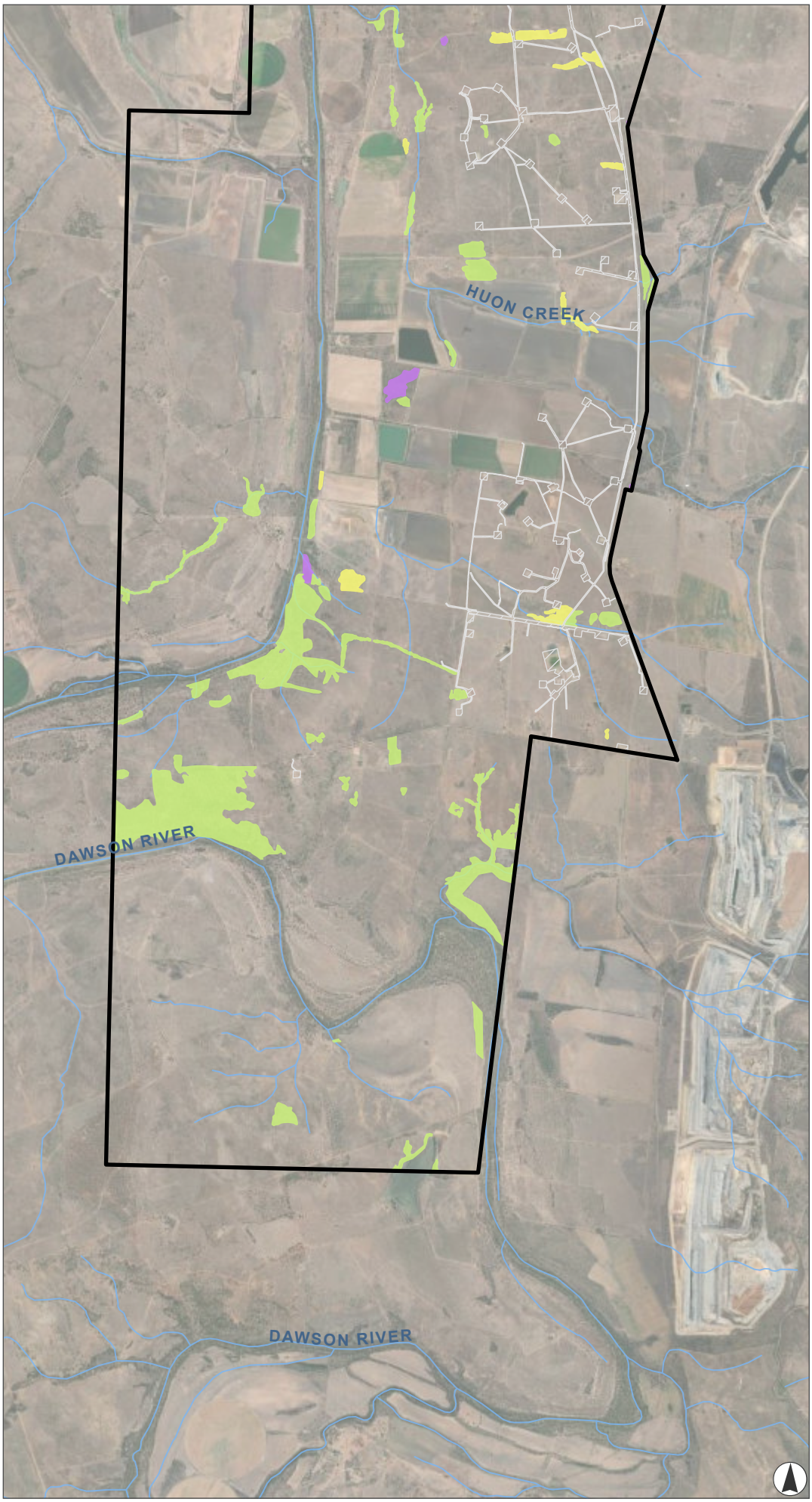


FIGURE 9.1C

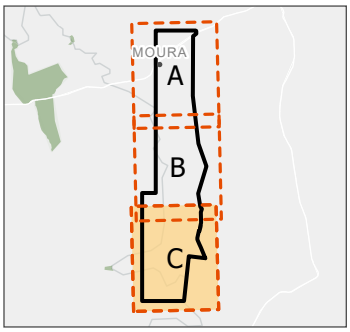
Brigalow TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Brigalow TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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Kilometres

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FIGURE 9.2A

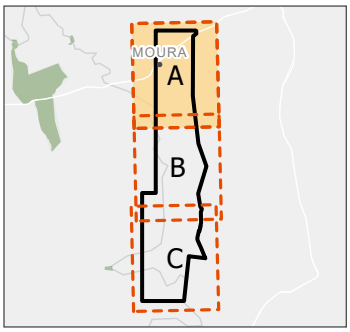
Coolibah TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Coolibah TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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Kilometres

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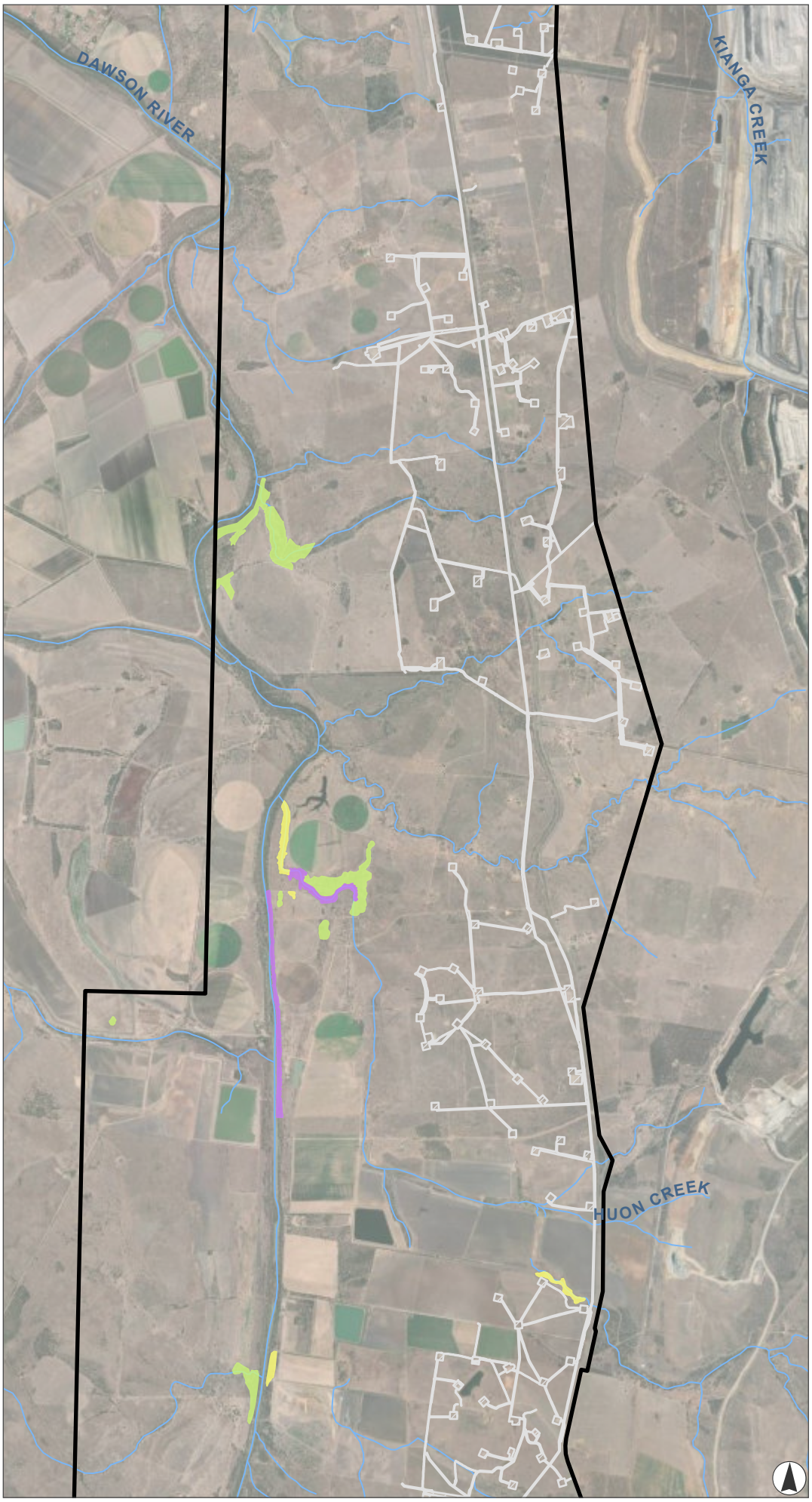


FIGURE 9.2B

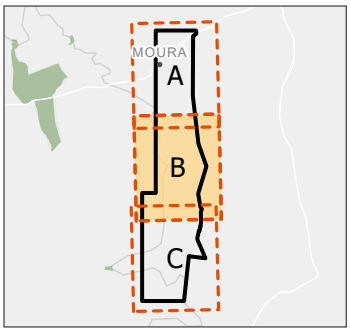
Coolibah TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Coolibah TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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Kilometres

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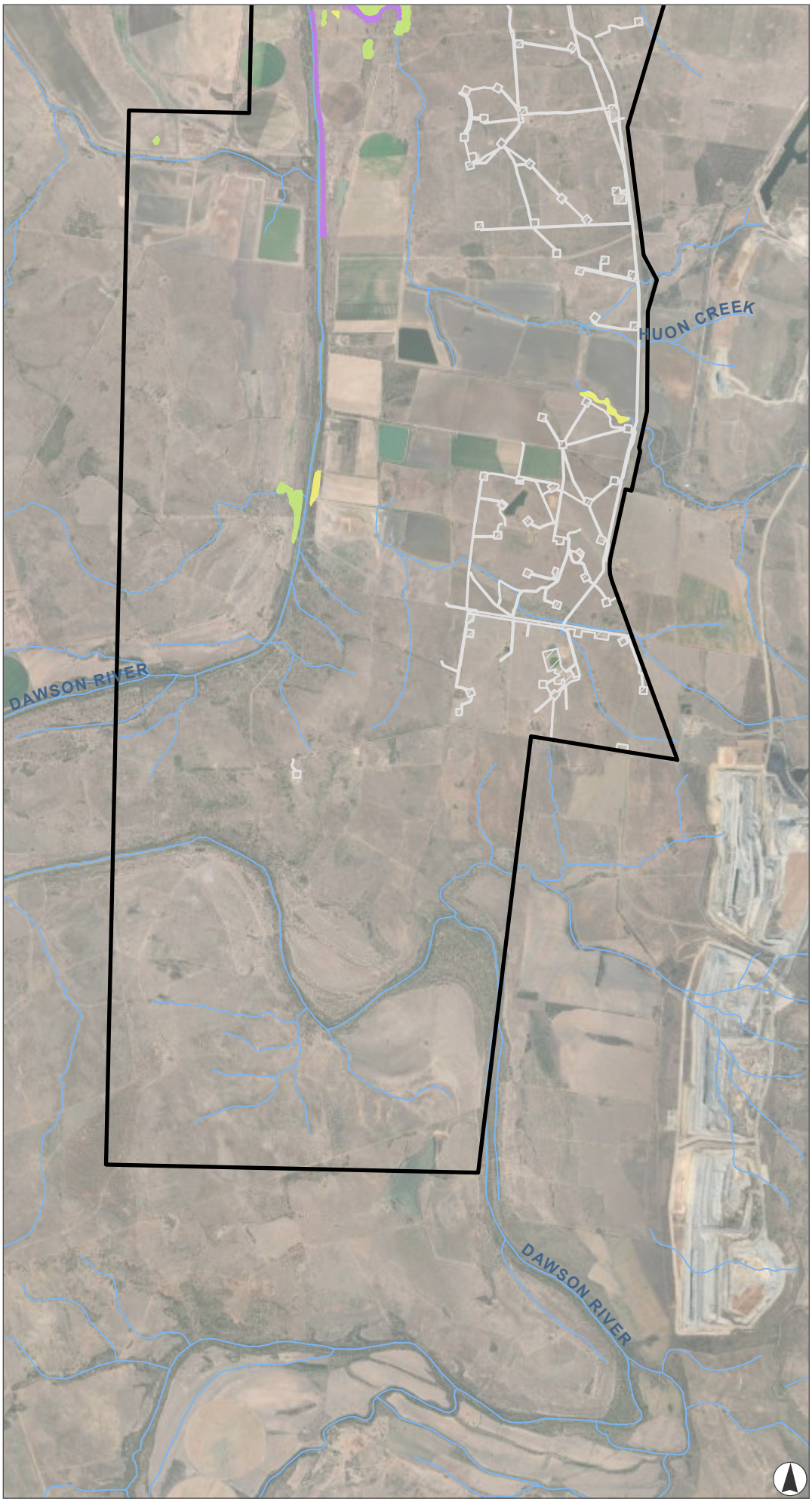


FIGURE 9.2C

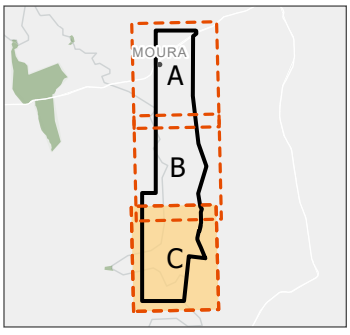
Coolibah TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Coolibah TEC Habitat

- Analogous RE but not TEC
- Confirmed
- Potential



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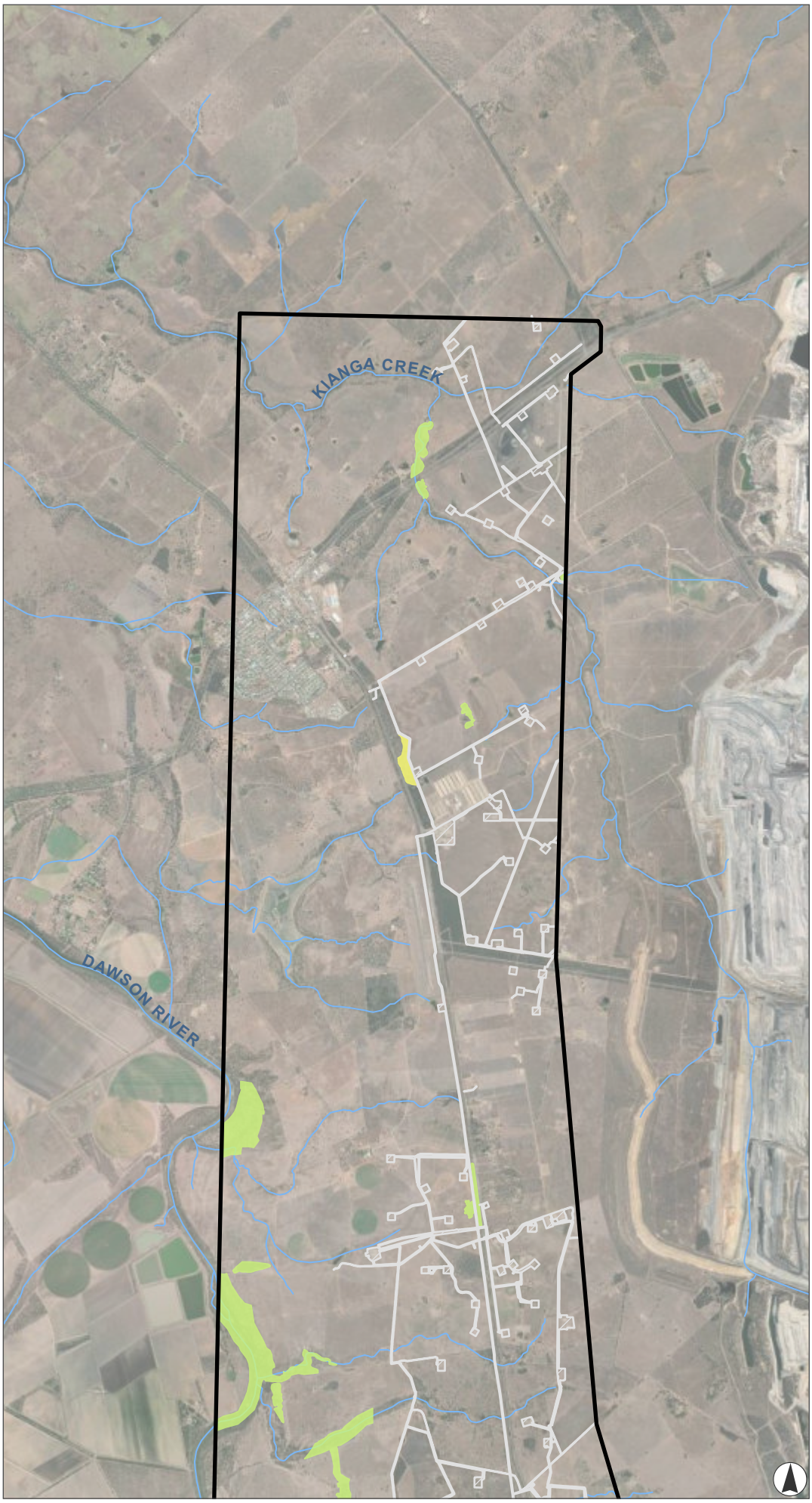


FIGURE 9.3A

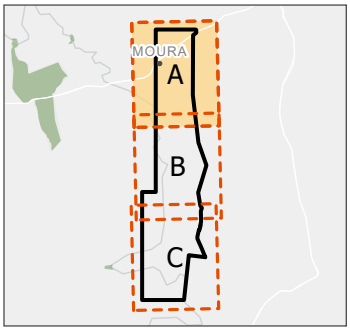
Poplar Box Woodland TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Poplar Box Woodland TEC Habitat

- Analogous RE but not TEC
- Potential



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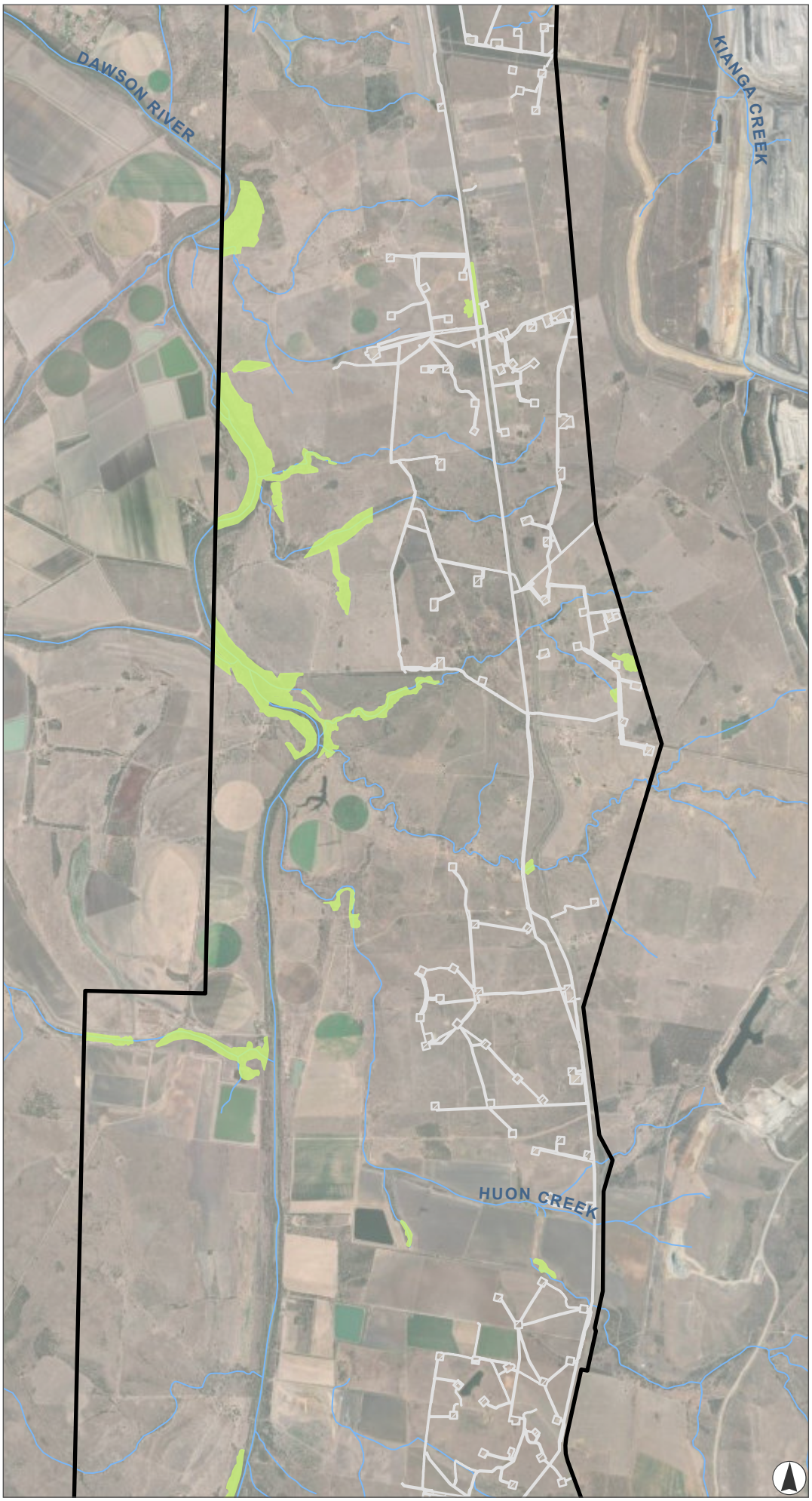


FIGURE 9.3B

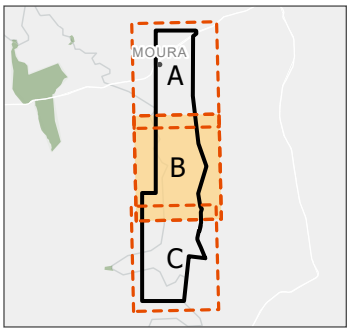
Poplar Box Woodland TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Poplar Box Woodland TEC Habitat

- Analogous RE but not TEC
- Potential



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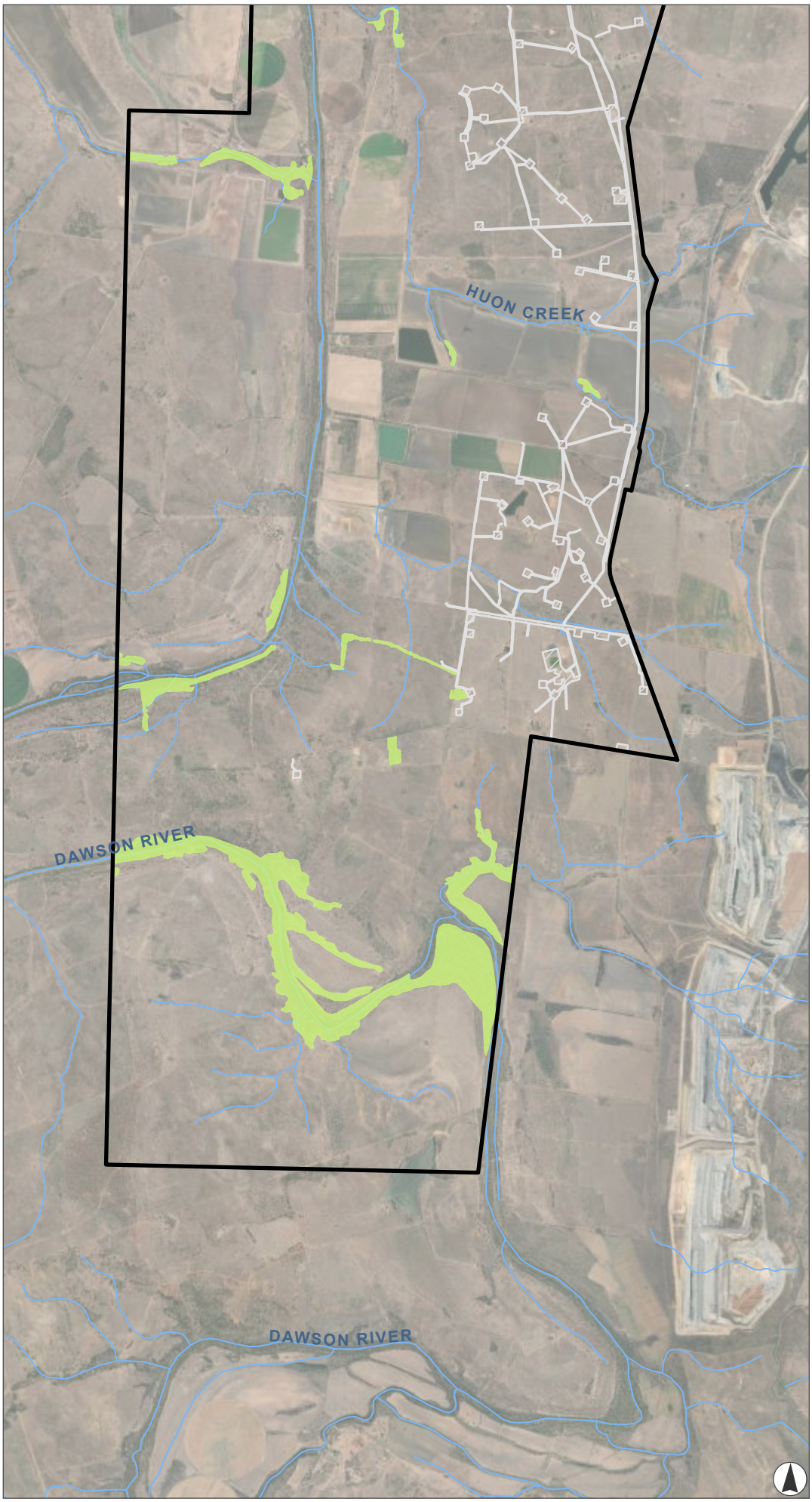

FIGURE 9.3C

Poplar Box Woodland TEC Habitat Map

Legend

- Watercourse
- Project Area
- Existing Westside infrastructure

Poplar Box Woodland TEC Habitat

- Analogous RE but not TEC
- Potential

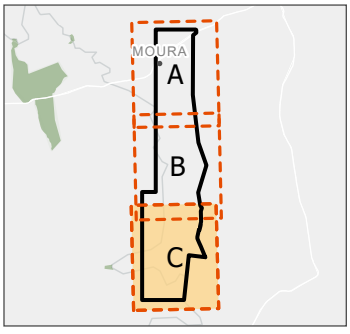

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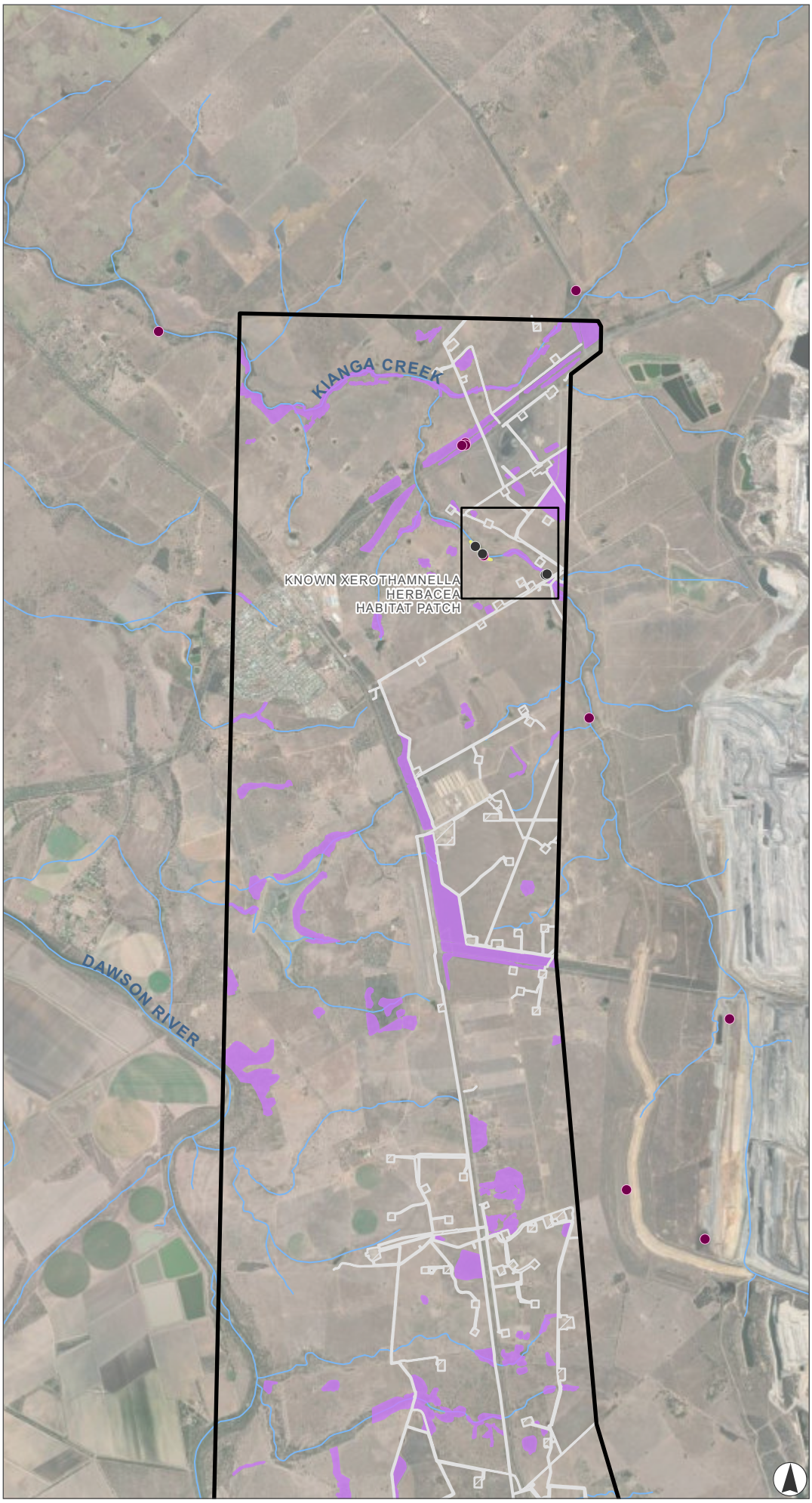
FIGURE 9.4A

Xerothamnella herbacea Habitat and Records



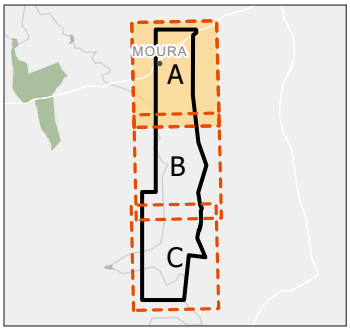
Legend

- Umwelt Records of *Xerothamnella herbacea*
- ALA Records of *Xerothamnella herbacea*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Xerothemnella herbacea* habitat mapping**

- Known
- Potential





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Kilometres

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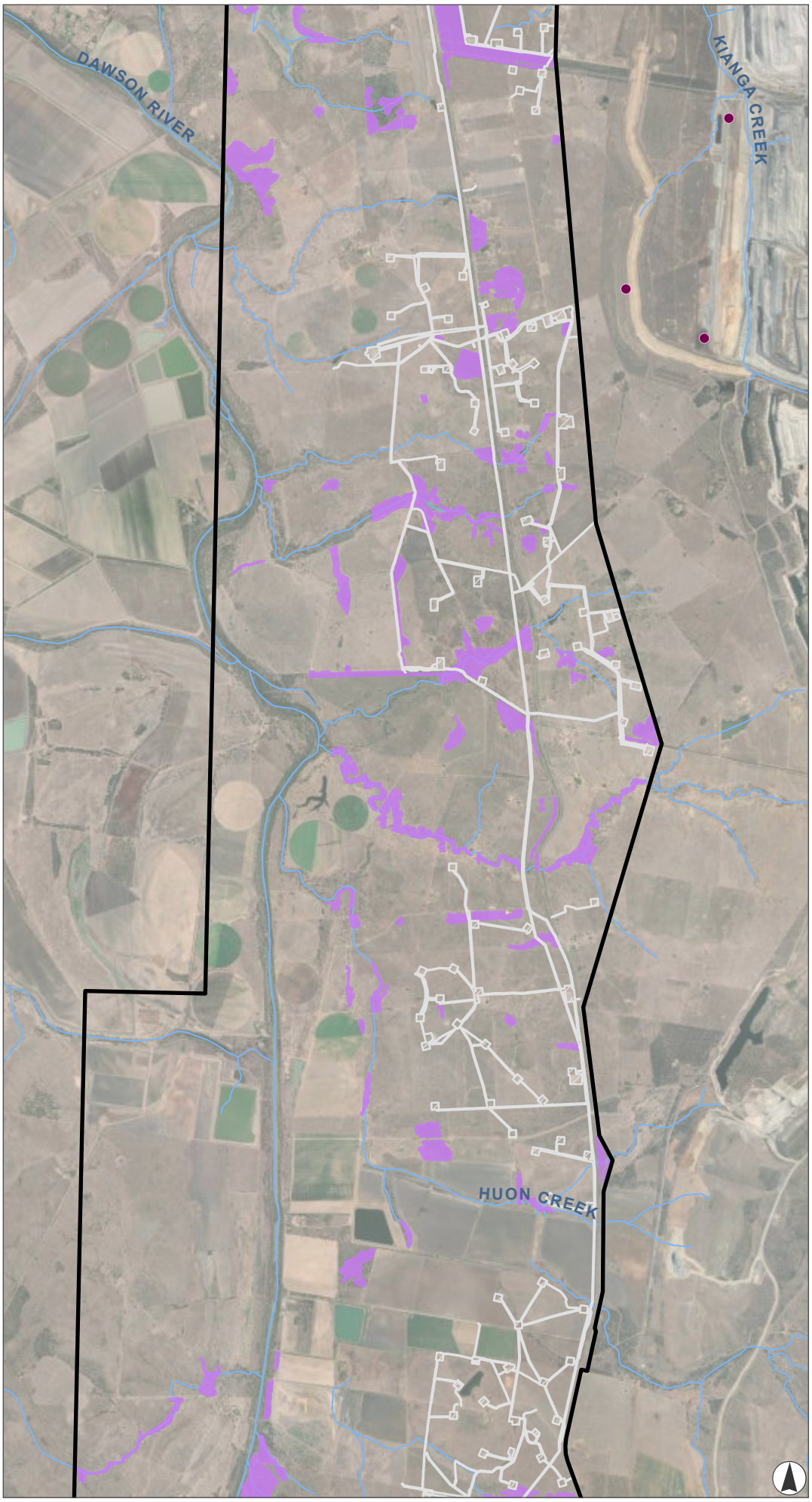
FIGURE 9.4B

Xerothamnella herbacea Habitat and Records



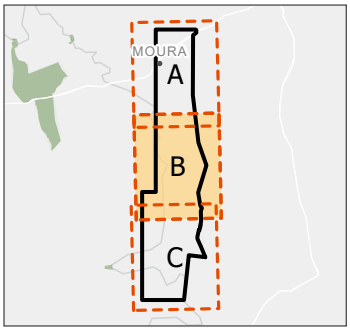
Legend

- Umwelt Records of *Xerothamnella herbacea*
- ALA Records of *Xerothamnella herbacea*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Xerothemnella herbacea* habitat mapping**

- Potential





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Kilometres

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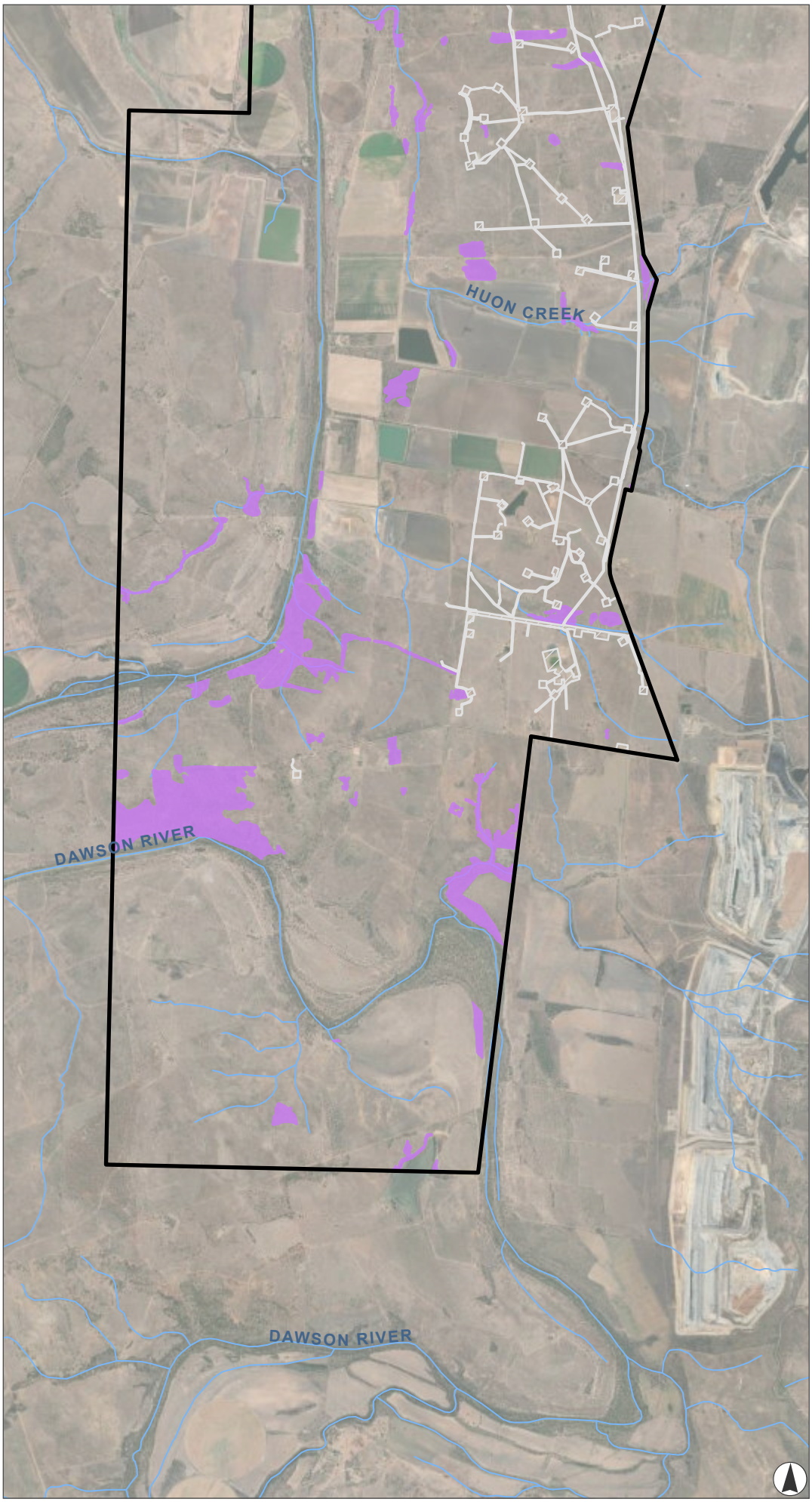


FIGURE 9.4C

Xerothamnella herbacea Habitat and Records

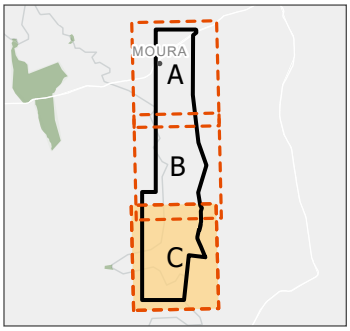
Legend

- Umwelt Records of *Xerothamnella herbacea*
- ALA Records of *Xerothamnella herbacea*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Xerothemnella herbacea* habitat mapping**

- Potential





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Kilometres

Scale 1:80,000 at A4
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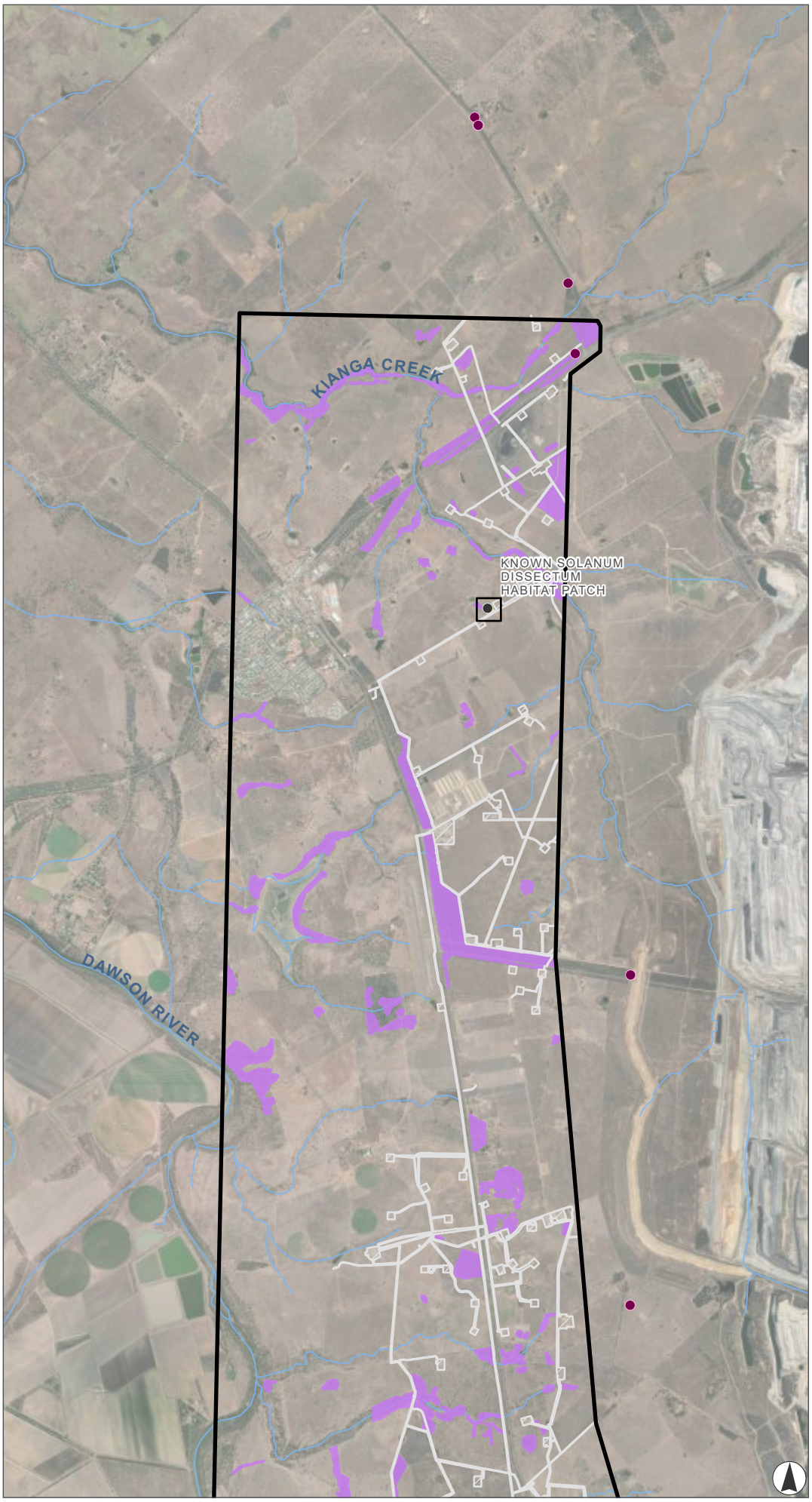
FIGURE 9.5A

Solanum dissectum Habitat and Records

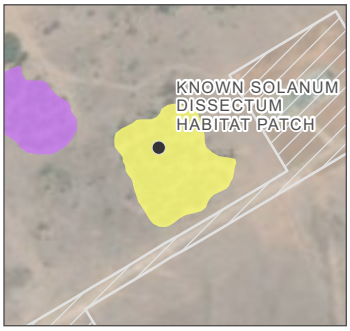


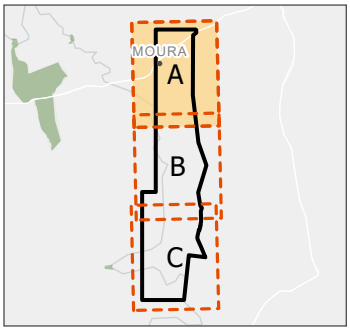
Legend

- Umwelt Records of *Solanum dissectum*
- ALA Records of *Solanum dissectum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum dissectum* habitat mapping and records**

- Known
- Potential





0 1 2 3

Kilometres

Scale 1:80,000 at A4
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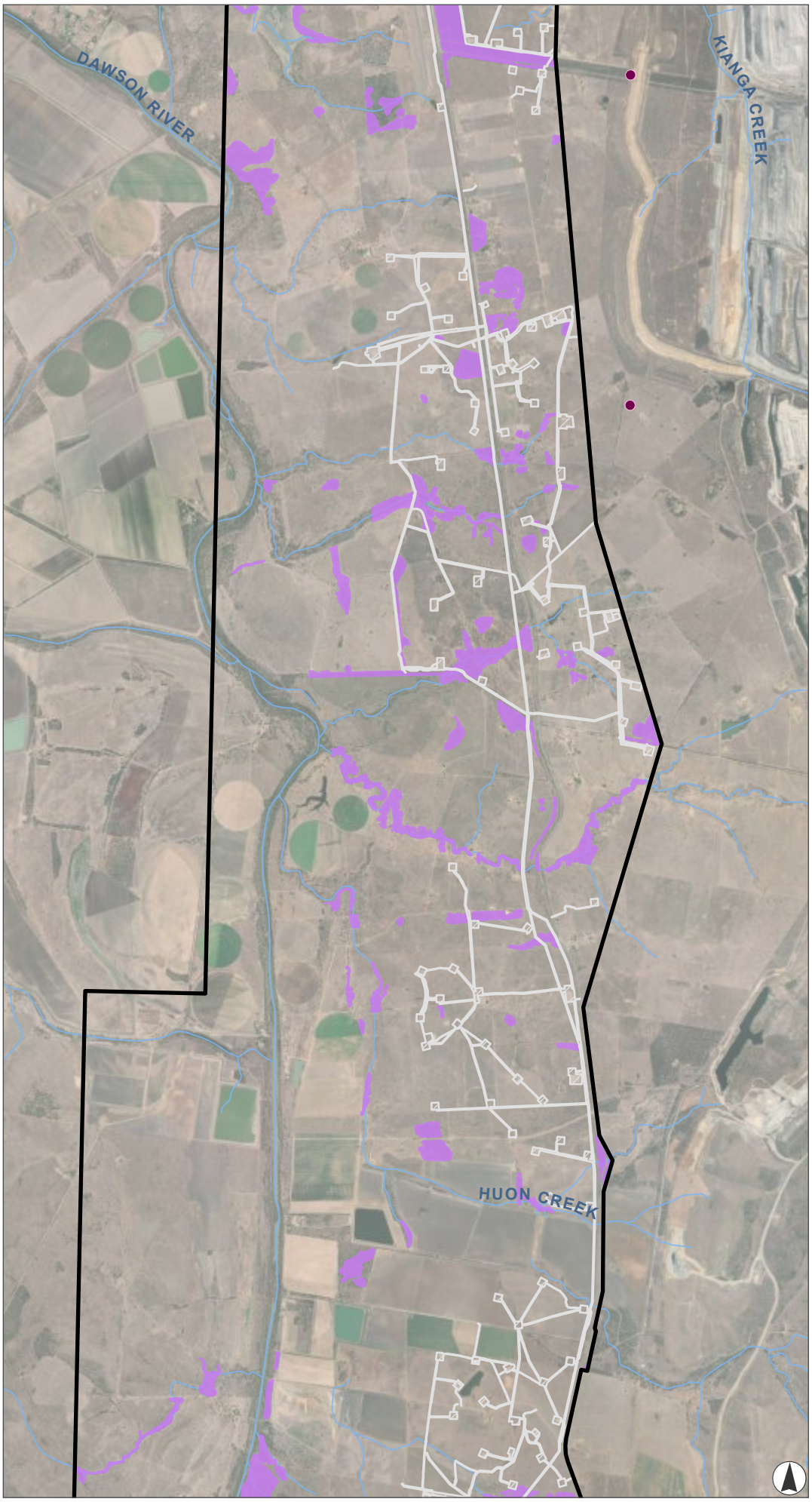


FIGURE 9.5B

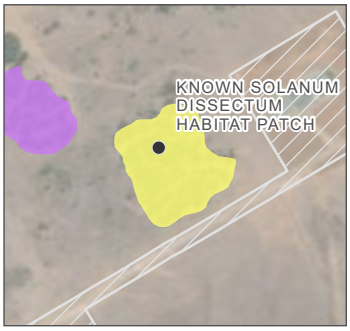
Solanum dissectum Habitat and Records

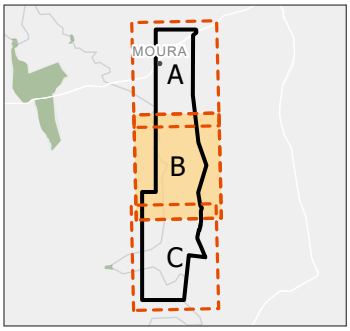
Legend

- Umwelt Records of *Solanum dissectum*
- ALA Records of *Solanum dissectum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum dissectum* habitat mapping and records**

- Potential





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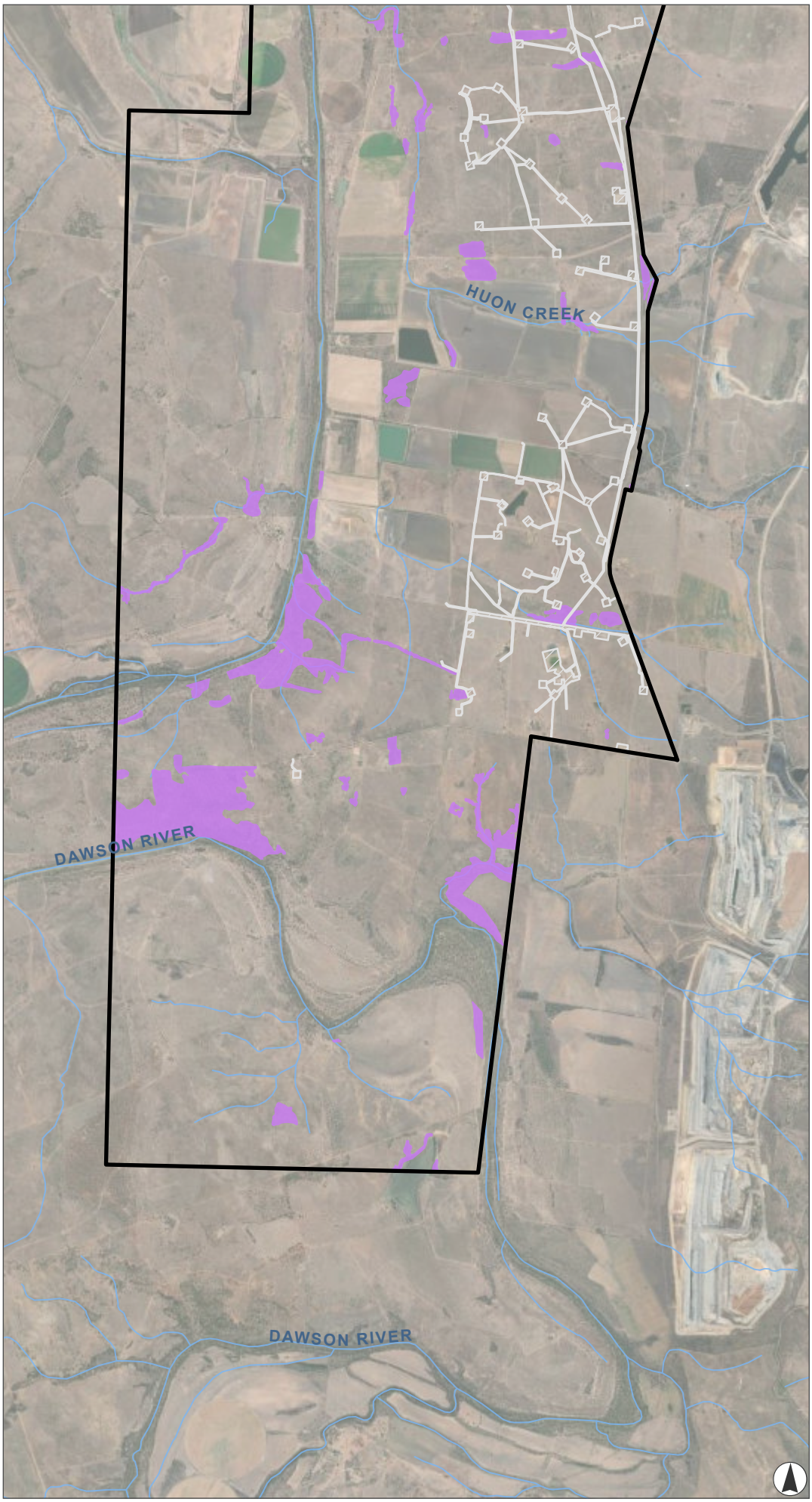


FIGURE 9.5C

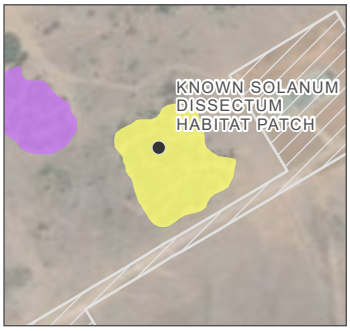
Solanum dissectum Habitat and Records

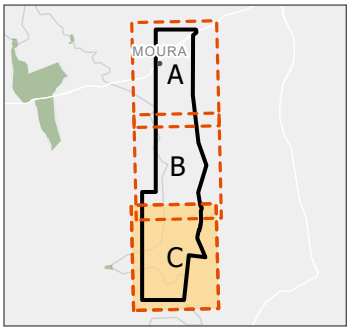
Legend

- Umwelt Records of *Solanum dissectum*
- ALA Records of *Solanum dissectum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum dissectum* habitat mapping and records**

- Potential





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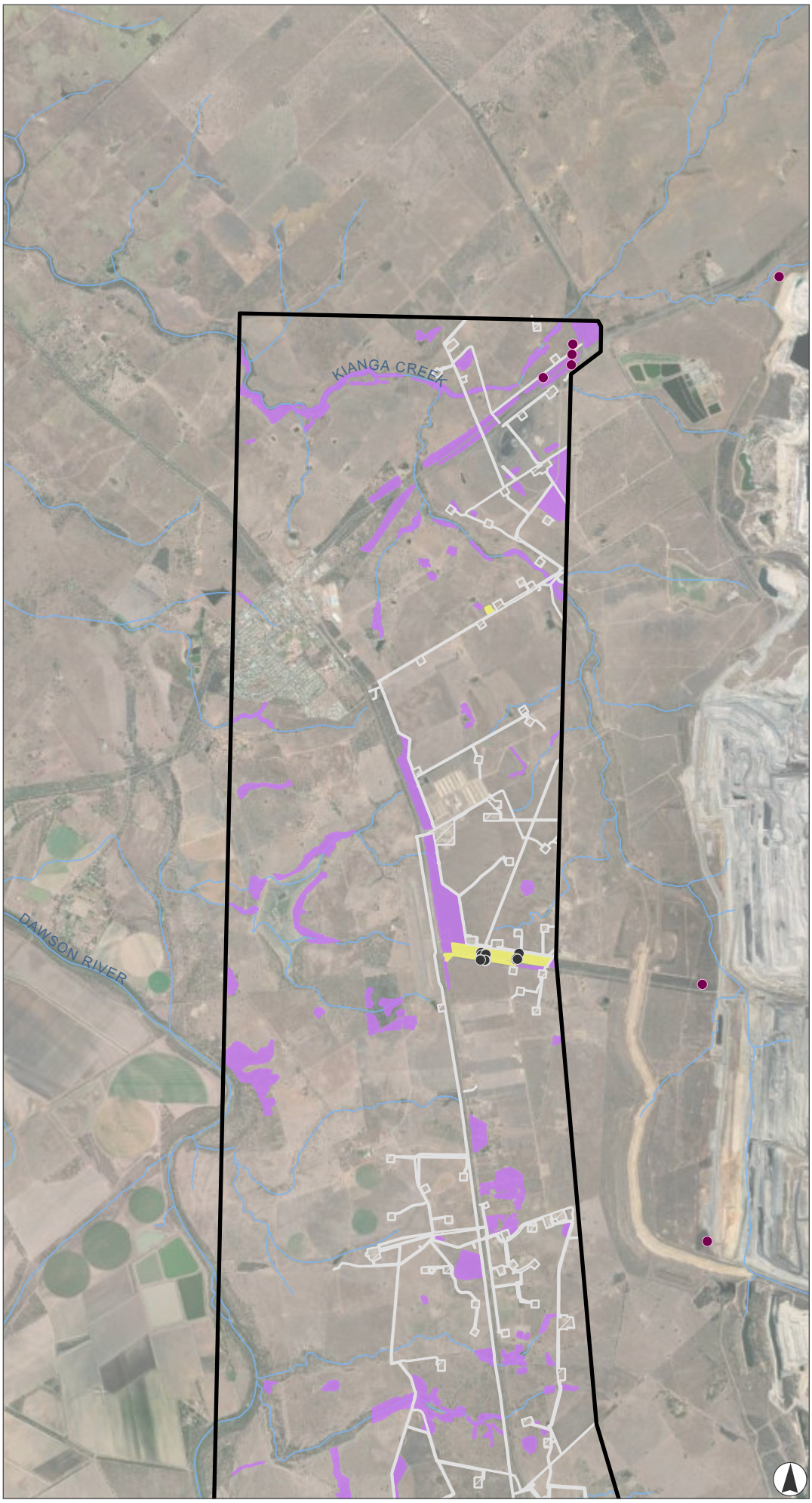


FIGURE 9.6A

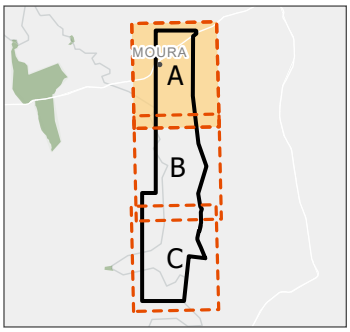
Solanum johnsonianum Habitat and Records

Legend

- Umwelt Records of *Solanum johnsonianum*
- ALA Records of *Solanum johnsonianum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum johnsonianum* habitat mapping and records**

- Known
- Potential



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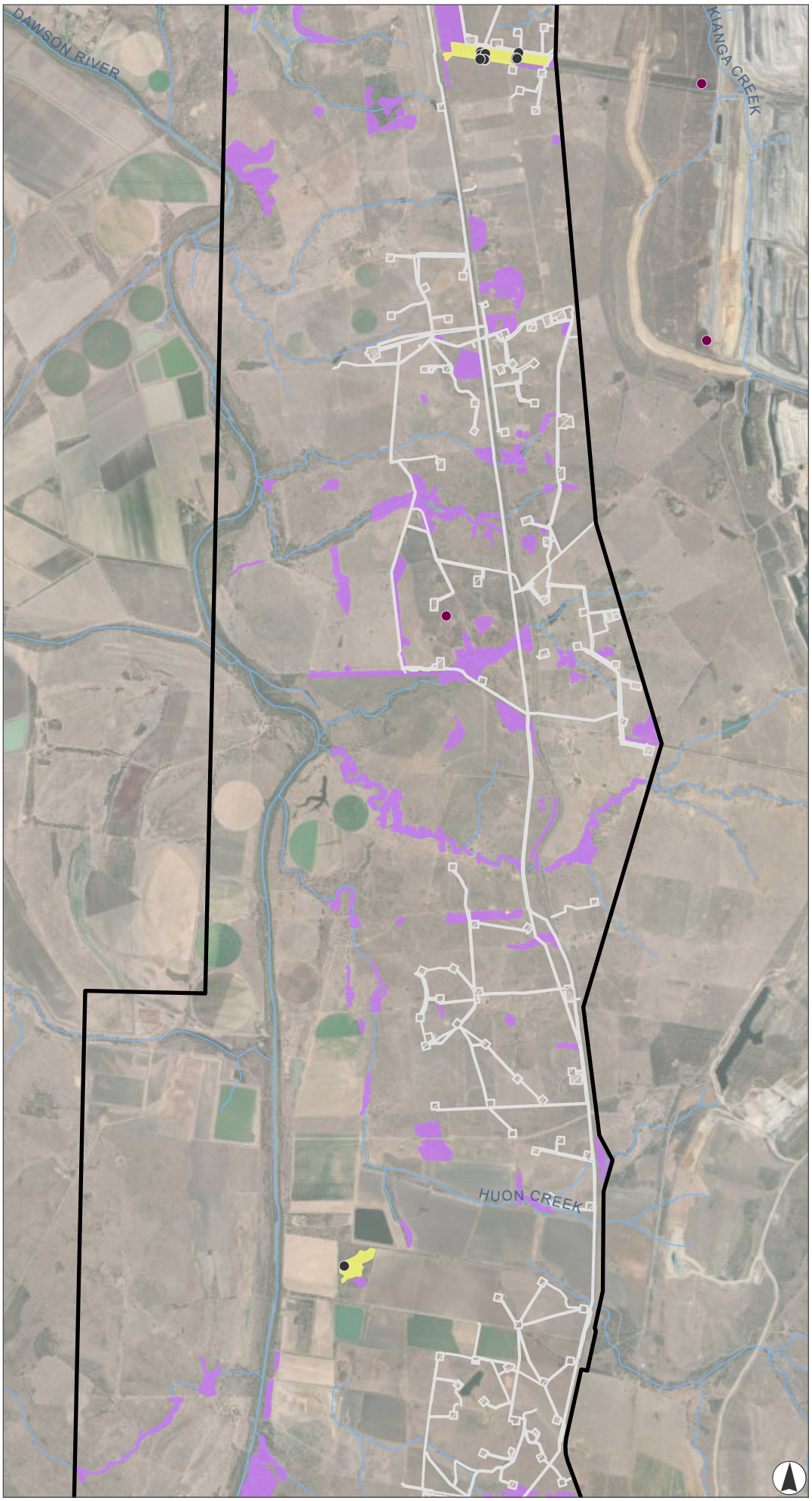


FIGURE 9.6B

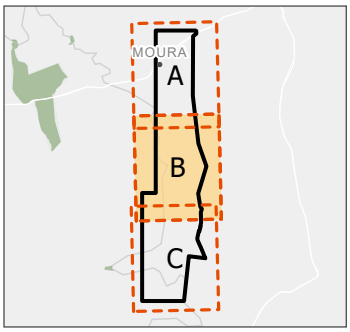
Solanum johnsonianum Habitat and Records

Legend

- Umwelt Records of *Solanum johnsonianum*
- ALA Records of *Solanum johnsonianum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum johnsonianum* habitat mapping and records**

- Known
- Potential



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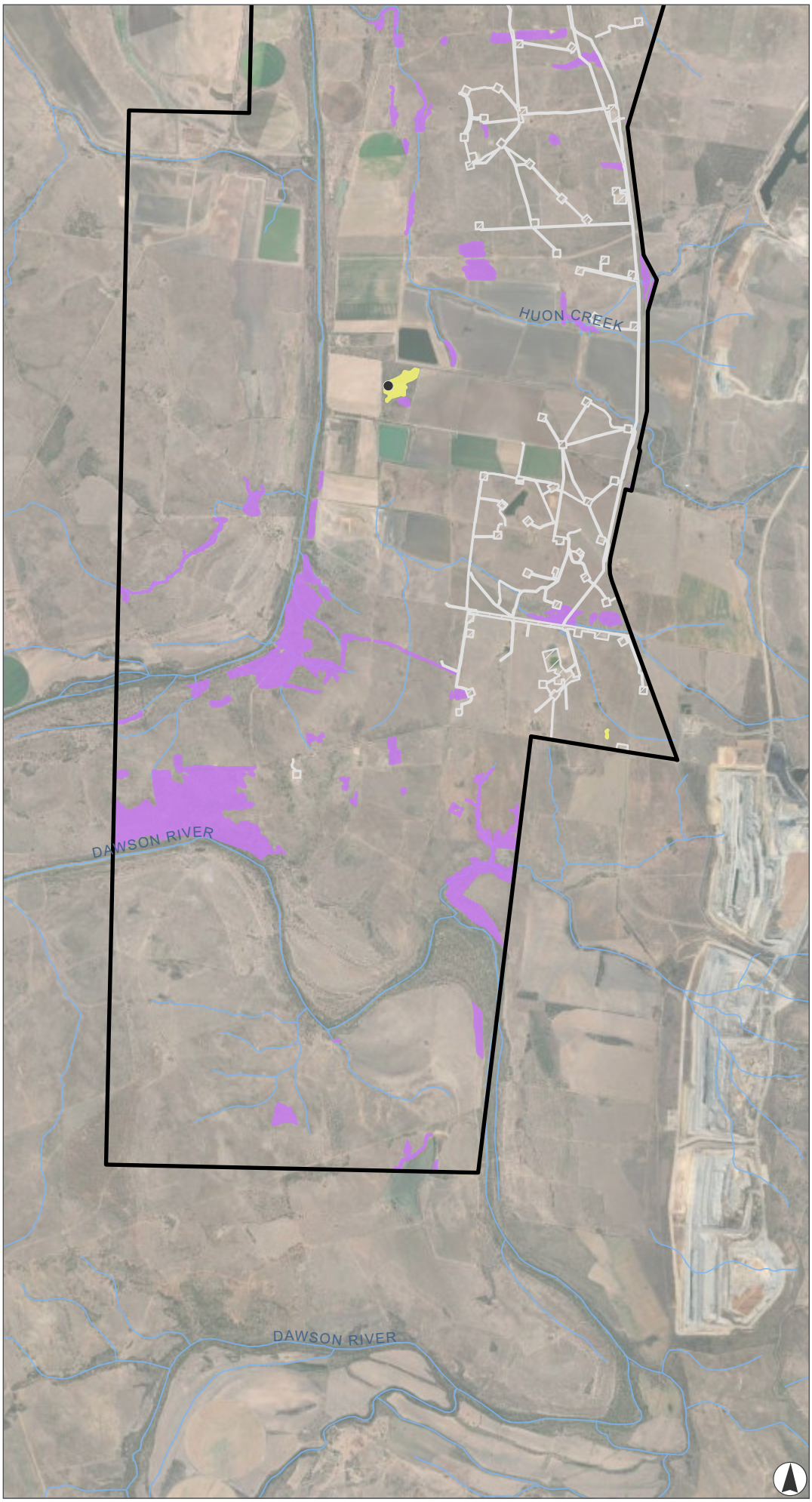


FIGURE 9.6C

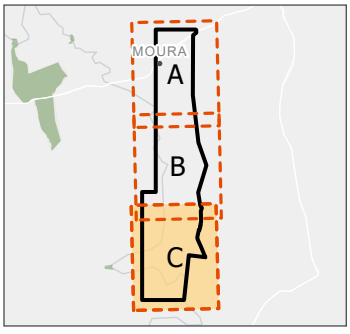
Solanum johnsonianum Habitat and Records

Legend

- Umwelt Records of *Solanum johnsonianum*
- Watercourse
- Project Area
- Existing Westside infrastructure

***Solanum johnsonianum* habitat mapping and records**

- Known
- Potential



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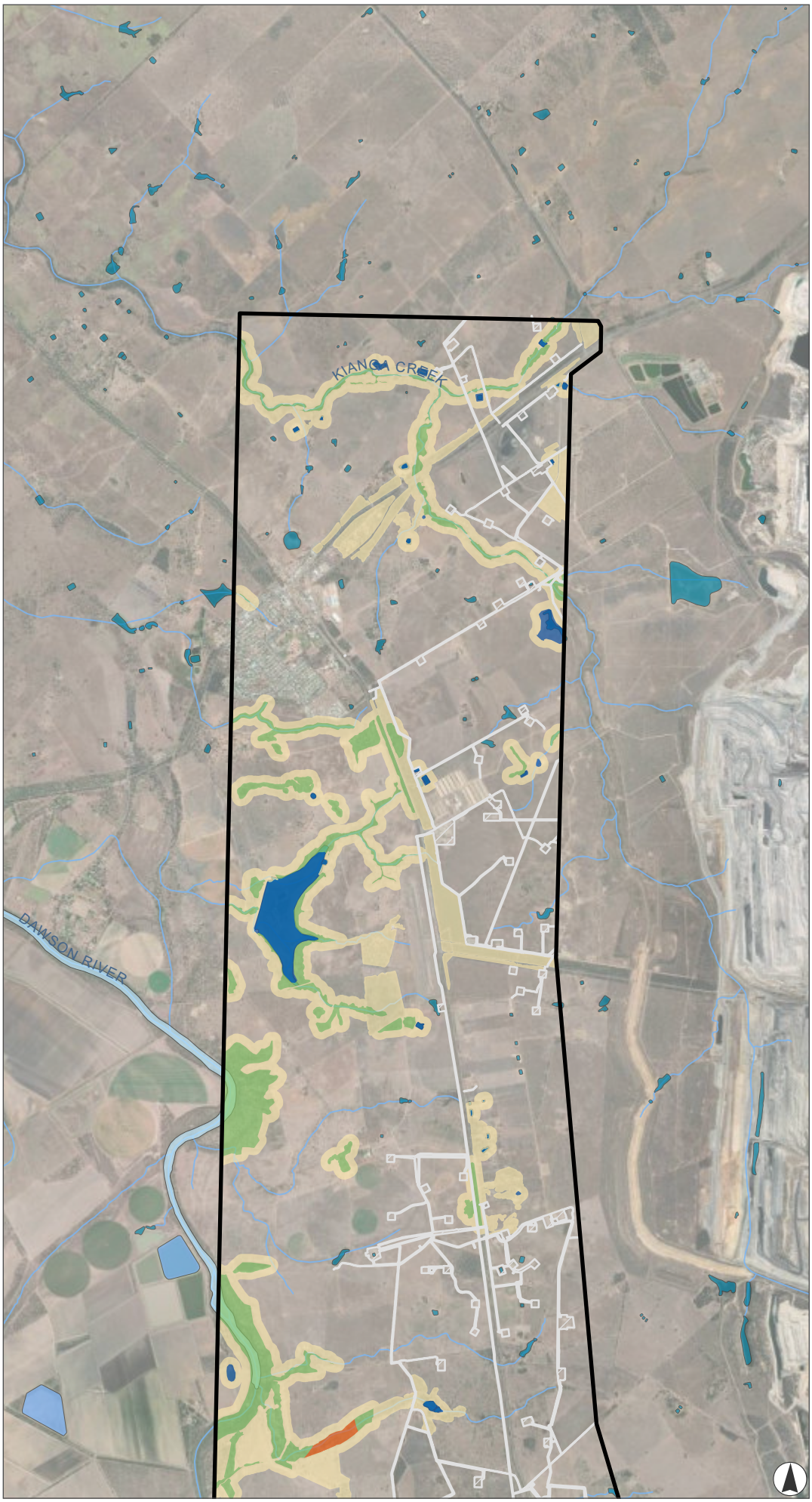


FIGURE 9.7A

Squatter pigeon (southern) *(Geophaps scripta scripta)* Habitat and Records

Legend

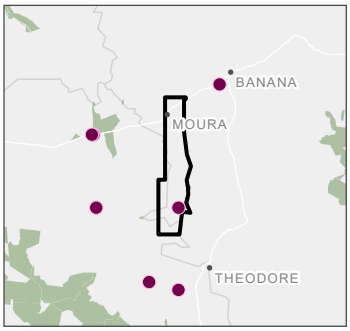
- ALA Records of Squatter Pigeon (southern)
- Watercourse
- Project Area
- Existing Westside infrastructure

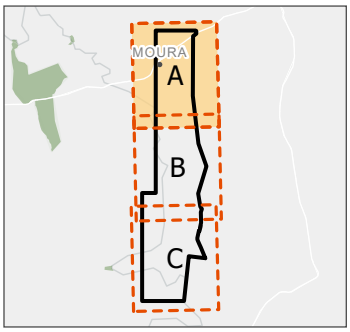
Squatter Pigeon (southern) habitat mapping

- Breeding
- Dispersal
- Foraging
- Potential water source

DoR Reservoirs

- Flood Irrigation Storage
- Rural Water Storage
- Town Water Storage





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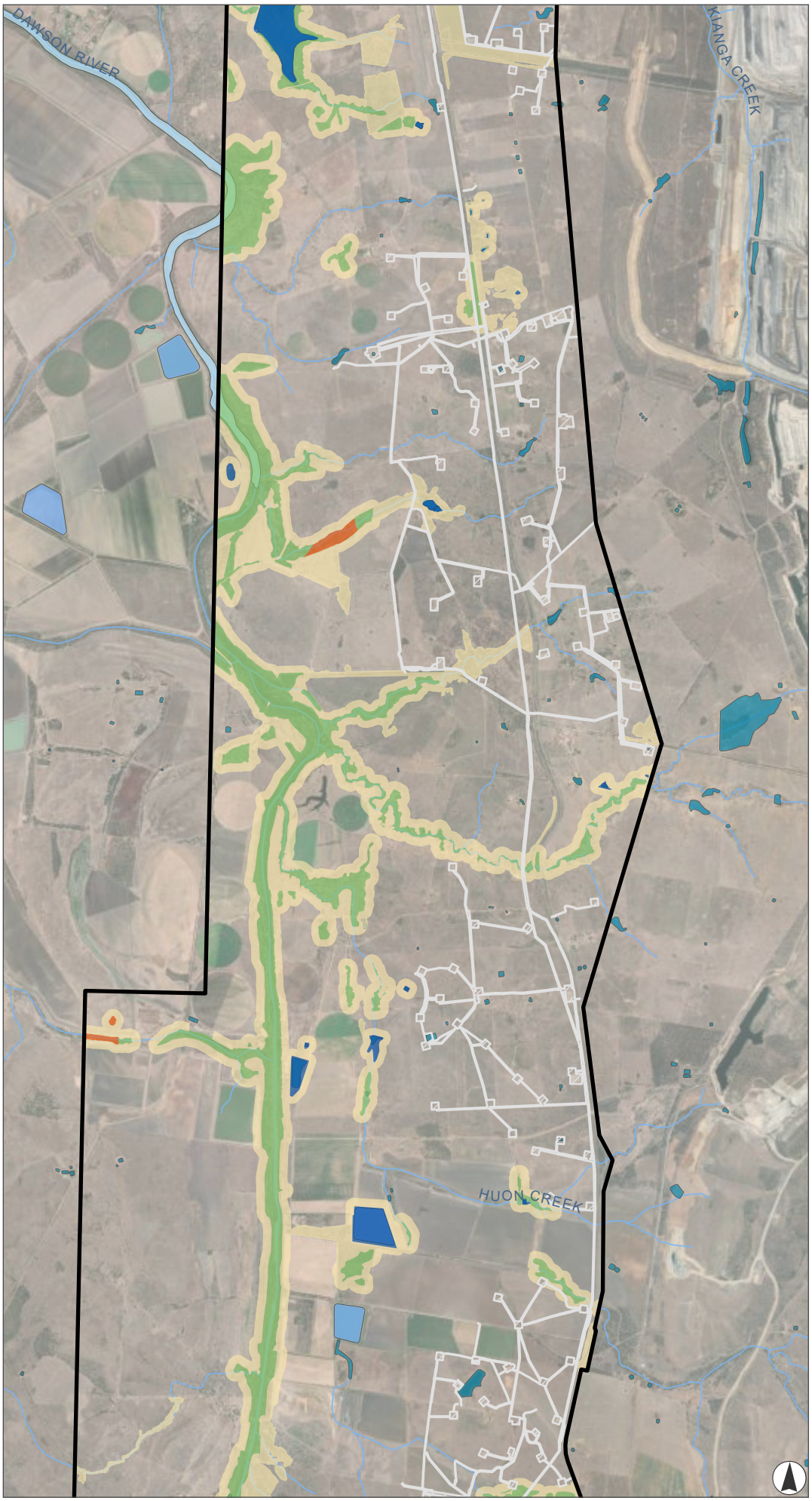


FIGURE 9.7B

Squatter pigeon (southern) *(Geophaps scripta scripta)* Habitat and Records

Legend

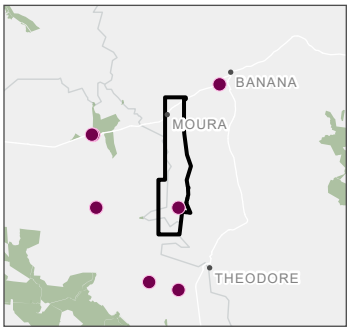
- ALA Records of Squatter Pigeon (southern)
- Watercourse
- Project Area
- Existing Westside infrastructure

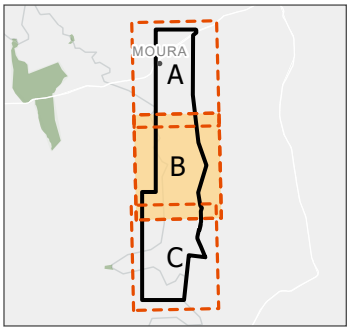
Squatter Pigeon (southern) habitat mapping

- Breeding
- Dispersal
- Foraging
- Potential water source

DoR Reservoirs

- Flood Irrigation Storage
- Rural Water Storage
- Town Water Storage





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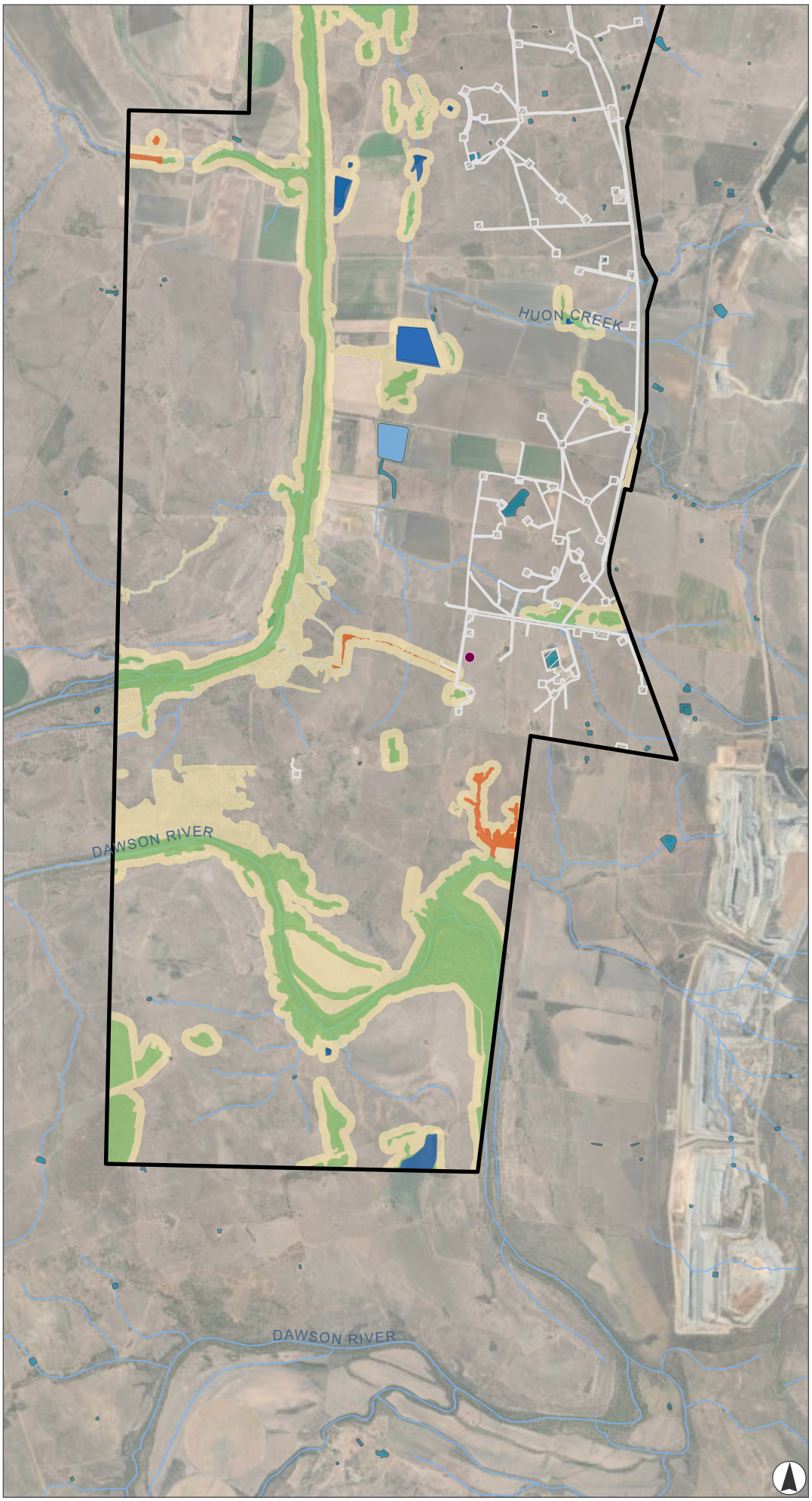


FIGURE 9.7C

Squatter pigeon (southern) *(Geophaps scripta scripta)* Habitat and Records

Legend

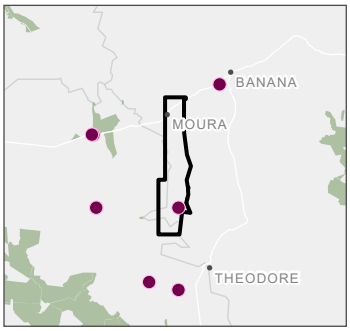
- ALA Records of Squatter Pigeon (southern)
- Watercourse
- Project Area
- Existing Westside infrastructure

Squatter Pigeon (southern) habitat mapping

- Breeding
- Dispersal
- Foraging
- Potential water source

DoR Reservoirs

- Flood Irrigation Storage
- Rural Water Storage
- Town Water Storage



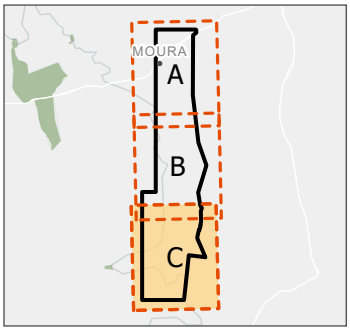


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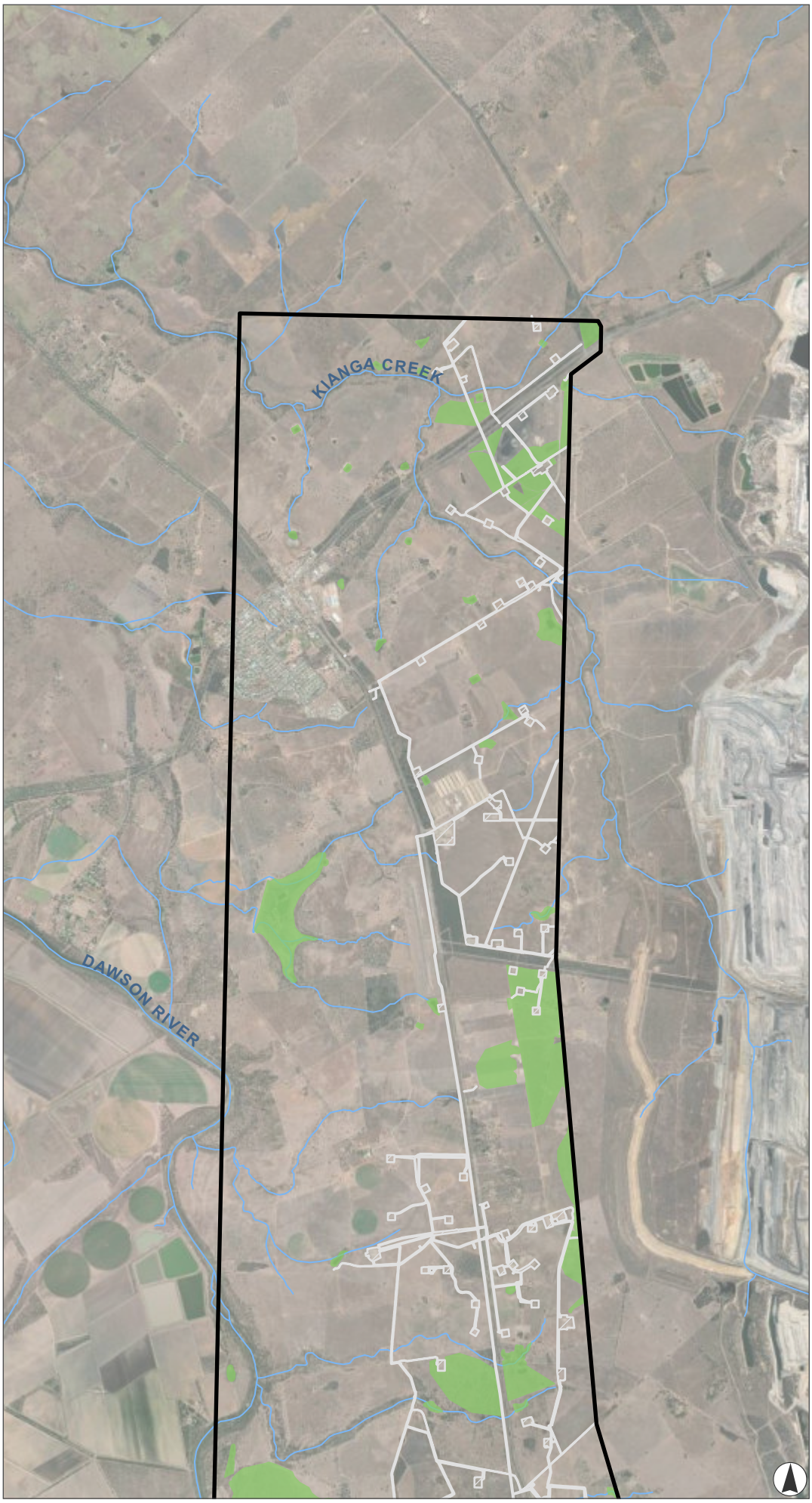
FIGURE 9.8A

Australian painted snipe *(Rostratula australis)* Habitat and Records

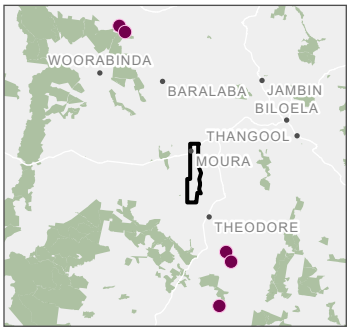


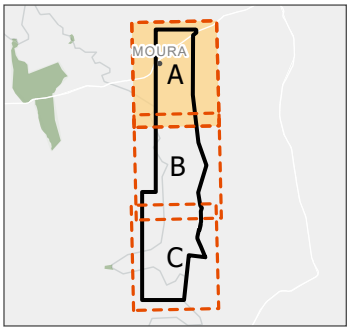
Legend

- ALA Records of Australian Painted Snipe
- Watercourse
- Project Area
- Existing Westside infrastructure

Australian Painted Snipe Habitat

- Seasonal breeding, foraging and dispersal





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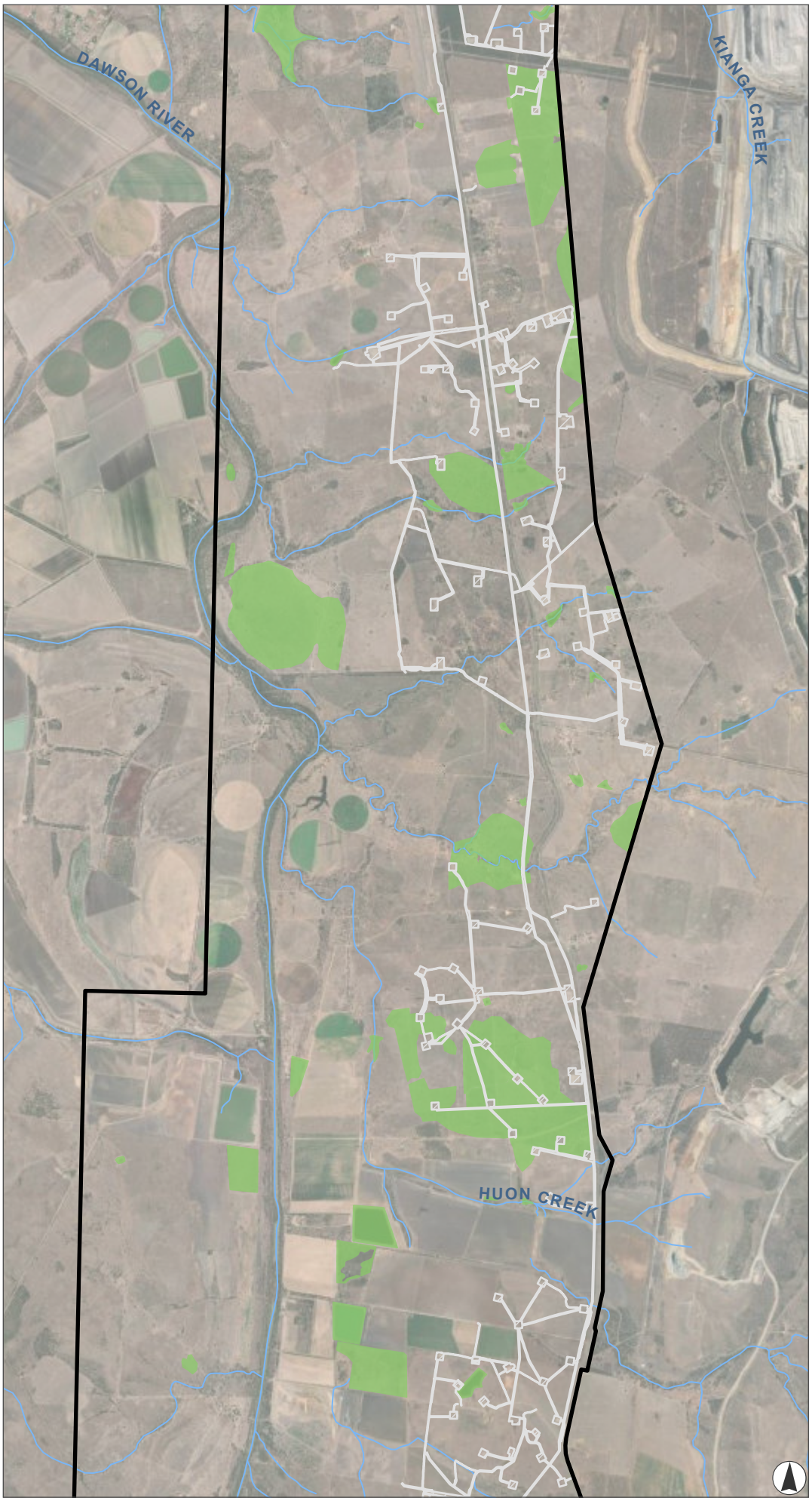


FIGURE 9.8B

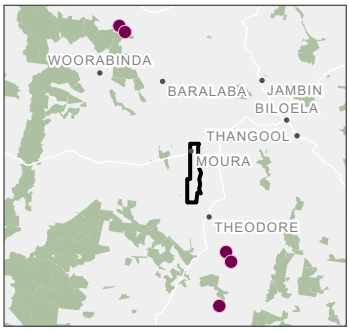
Australian painted snipe *(Rostratula australis)* Habitat and Records

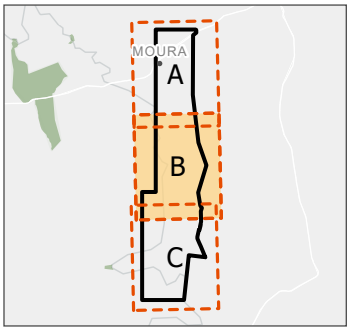
Legend

- ALA Records of Australian Painted Snipe
- Watercourse
- Project Area
- Existing Westside infrastructure

Australian Painted Snipe Habitat

- Seasonal breeding, foraging and dispersal





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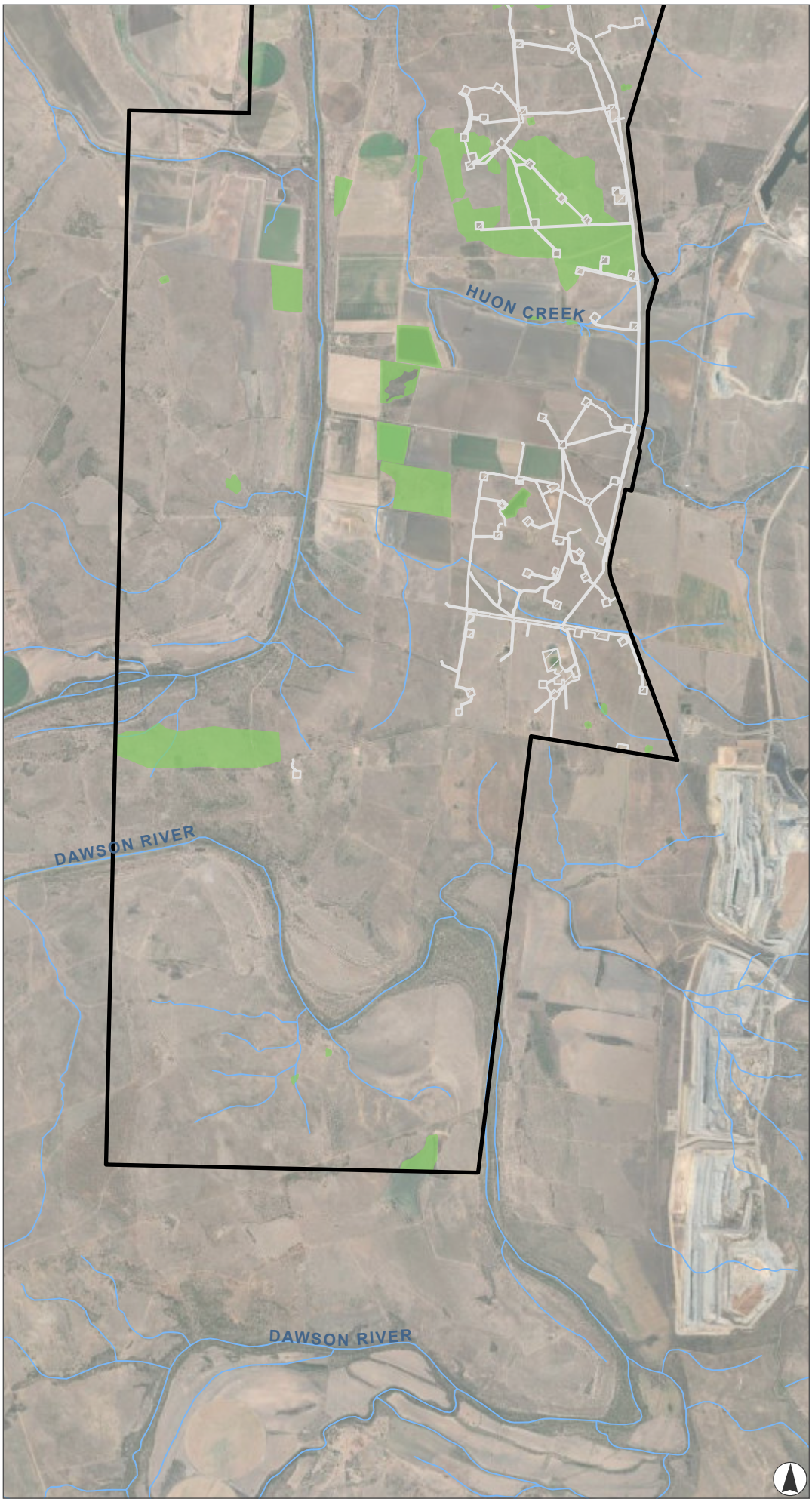


FIGURE 9.8C

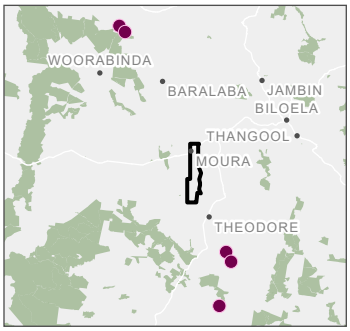
Australian painted snipe *(Rostratula australis)* Habitat and Records

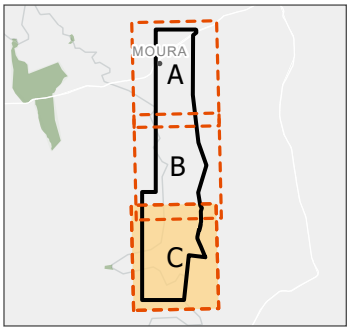
Legend

- ALA Records of Australian Painted Snipe
- Watercourse
- Project Area
- Existing Westside infrastructure

Australian Painted Snipe Habitat

- Seasonal breeding, foraging and dispersal





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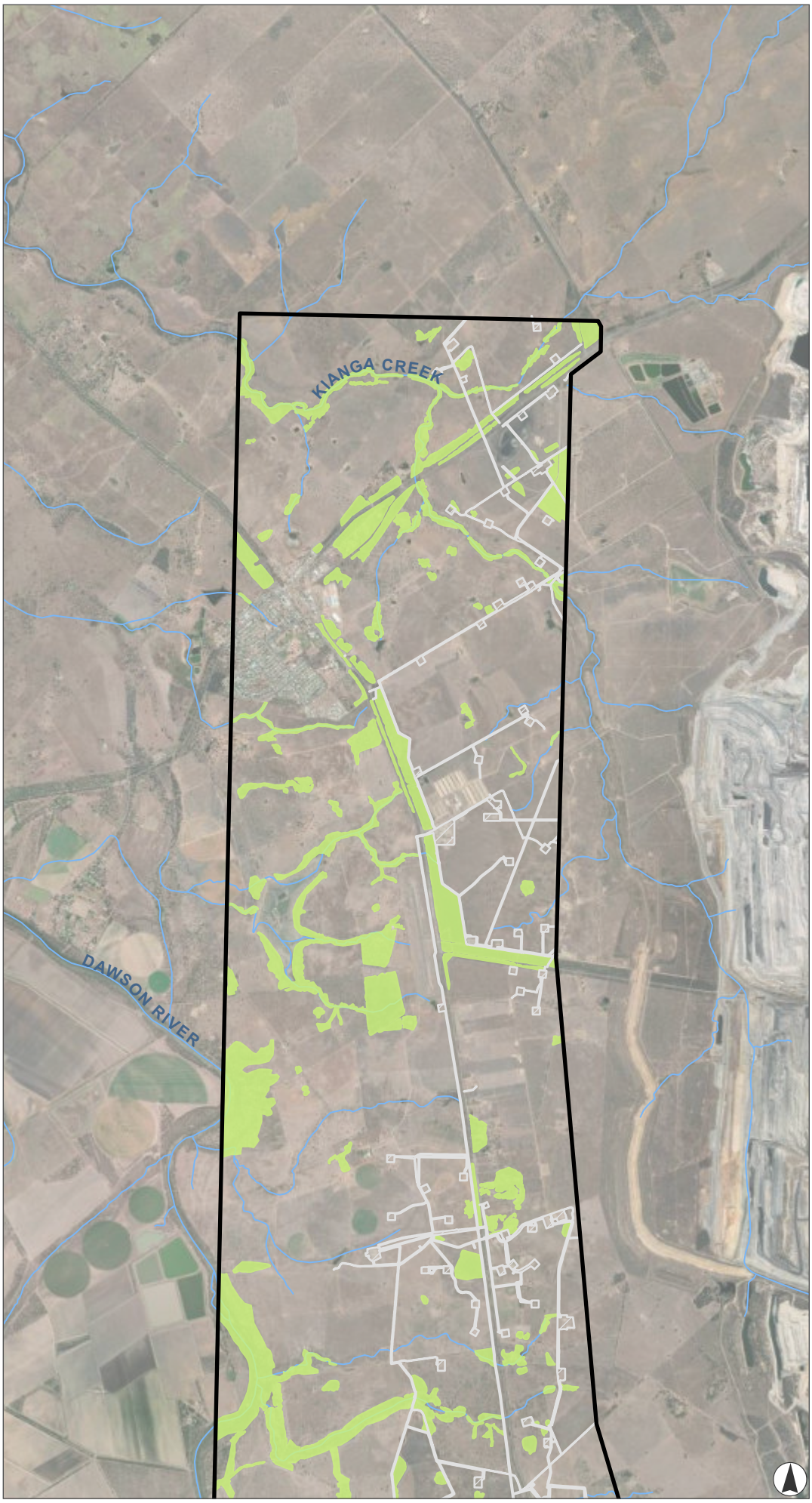


FIGURE 9.9A

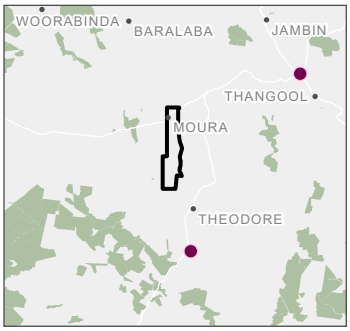
Painted honeyeater *(Grantiella picta)* Habitat and Records

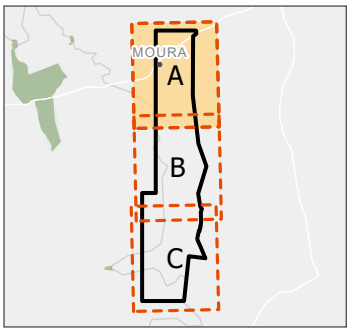
Legend

- ALA Records of Painted Honeyeater
- Watercourse
- Project Area
- Existing Westside infrastructure

Painted Honeyeaeter Habitat

- Foraging and dispersal





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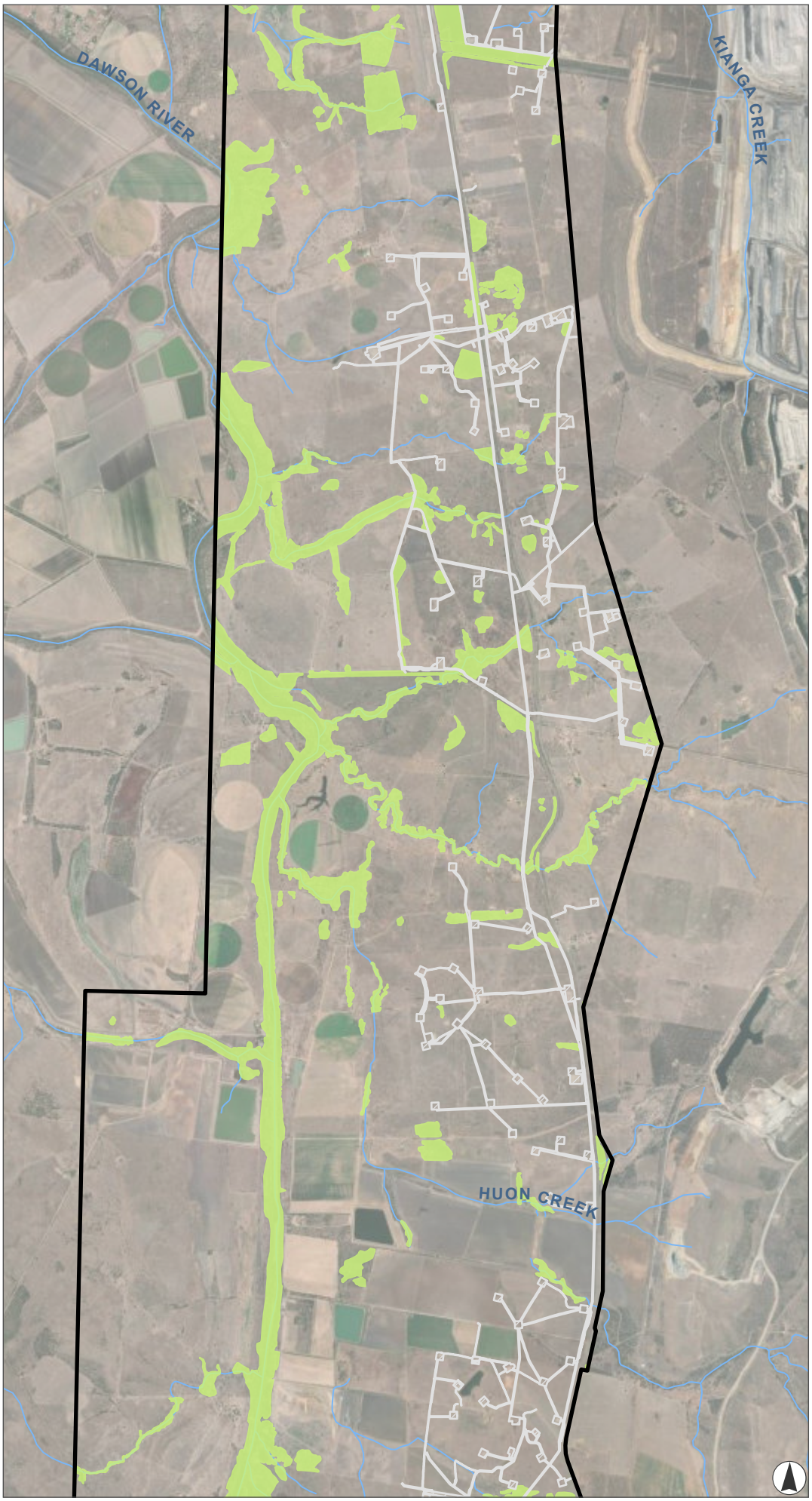


FIGURE 9.9B

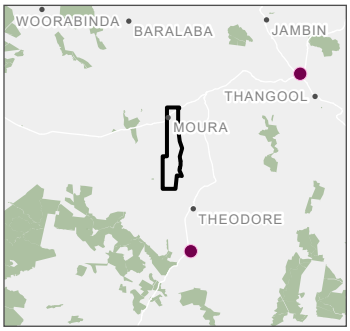
Painted honeyeater *(Grantiella picta)* Habitat and Records

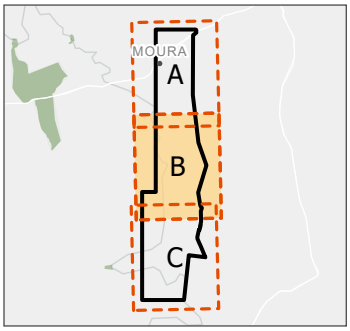
Legend

- ALA Records of Painted Honeyeater
- Watercourse
- Project Area
- Existing Westside infrastructure

Painted Honeyeaeter Habitat

- Foraging and dispersal





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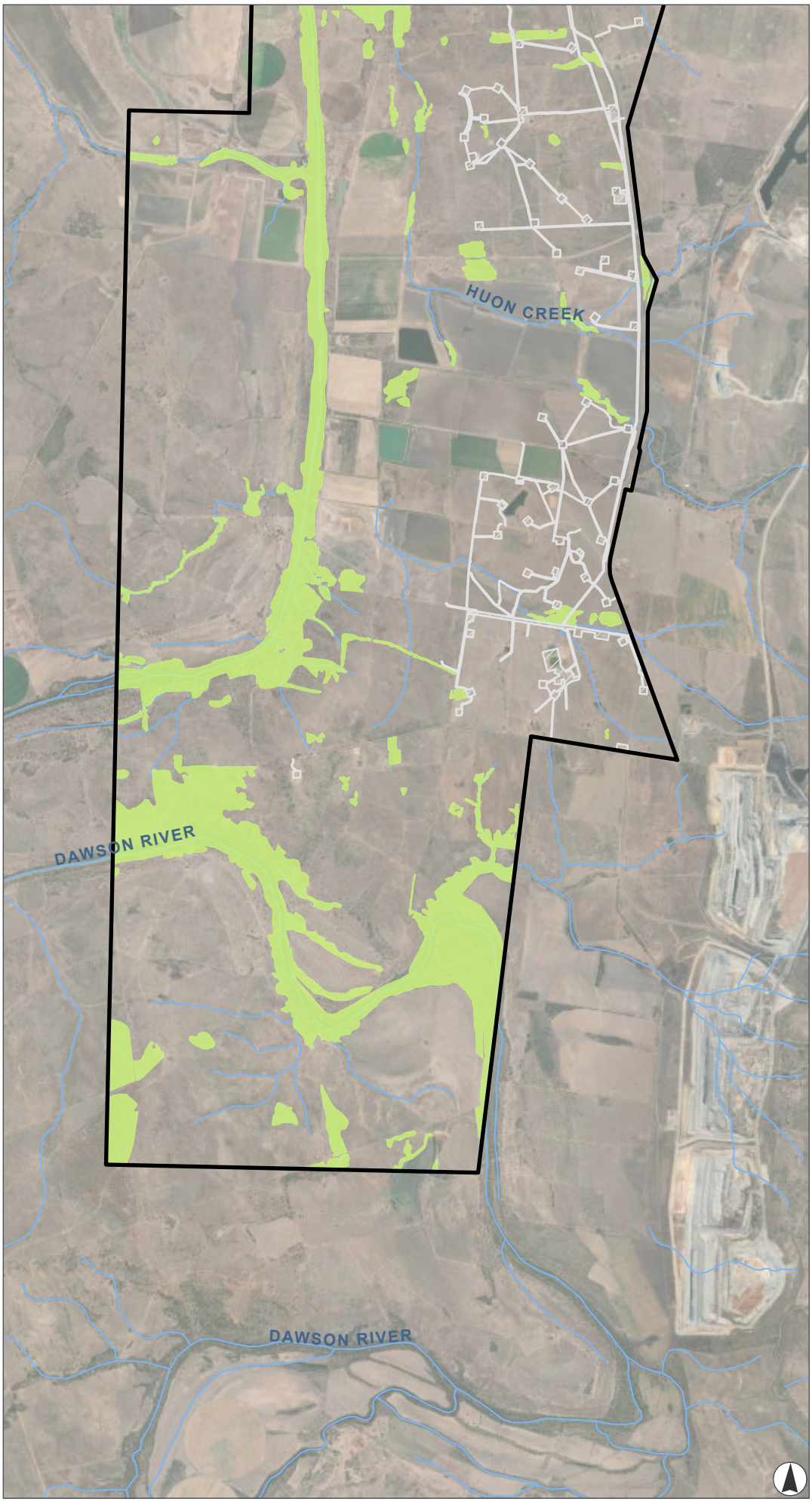


FIGURE 9.9C

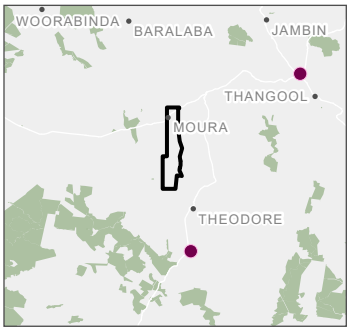
Painted honeyeater *(Grantiella picta)* Habitat and Records

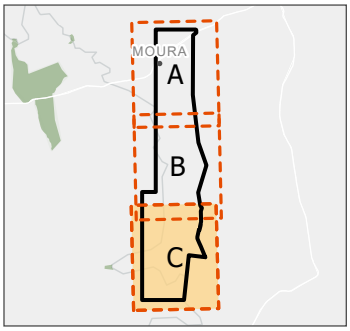
Legend

- ALA Records of Painted Honeyeater
- Watercourse
- Project Area
- Existing Westside infrastructure

Painted Honeyeaeter Habitat

- Foraging and dispersal





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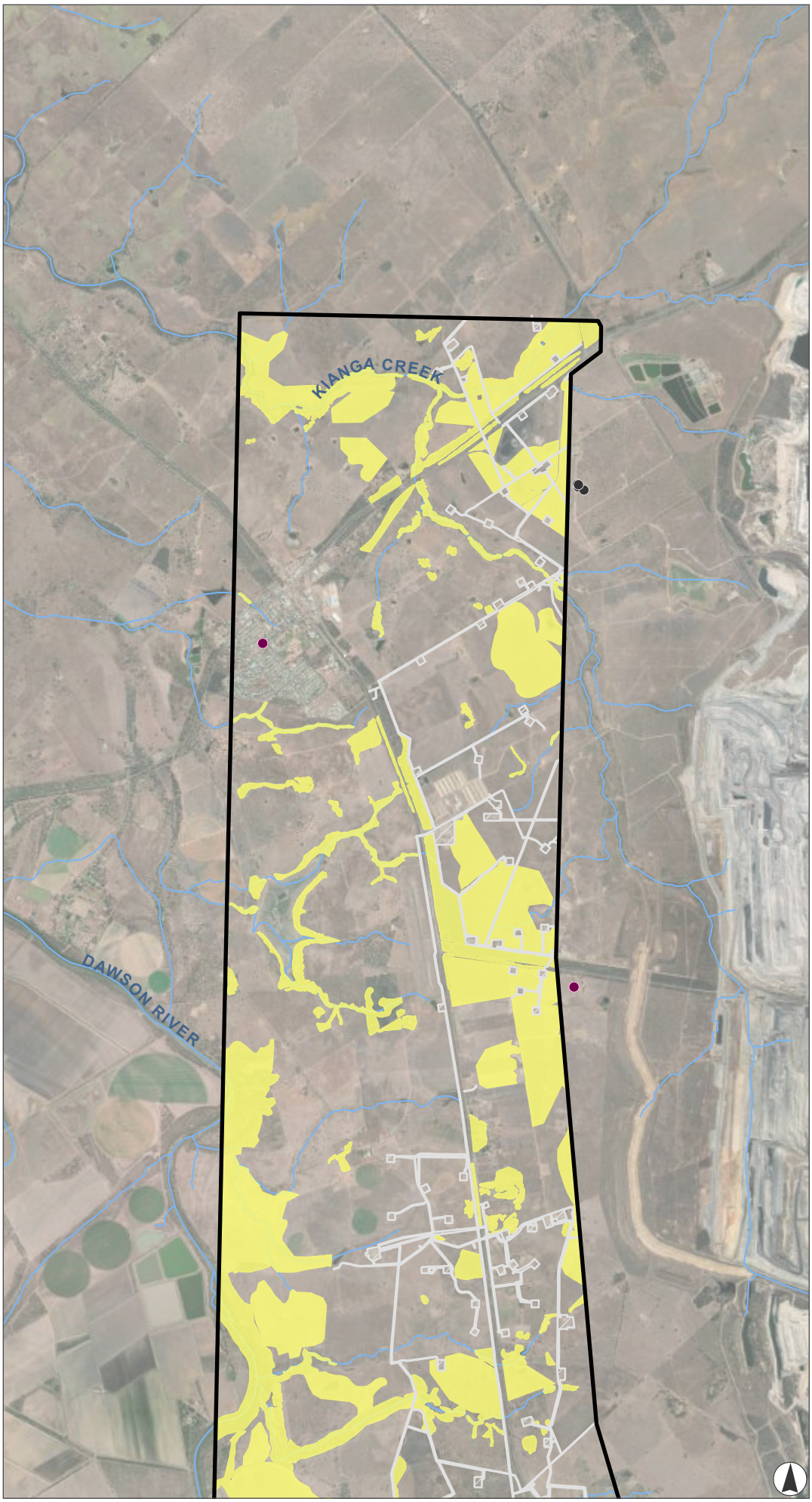


FIGURE 9.10A

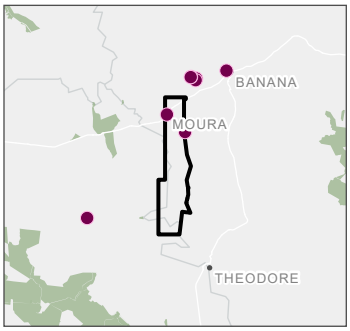
Ornamental snake *(Denisonia maculata)* Habitat and Records

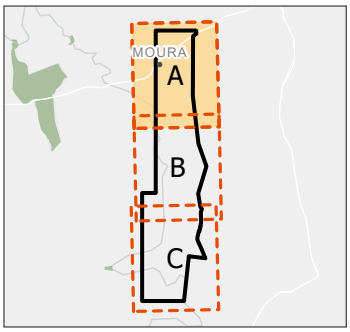
Legend

- Umwelt Records of Ornamental snake
- ALA Records of Ornamental snake
- Watercourse
- Project Area
- Existing Westside infrastructure

Ornamental snake habitat mapping

- Suitable habitat





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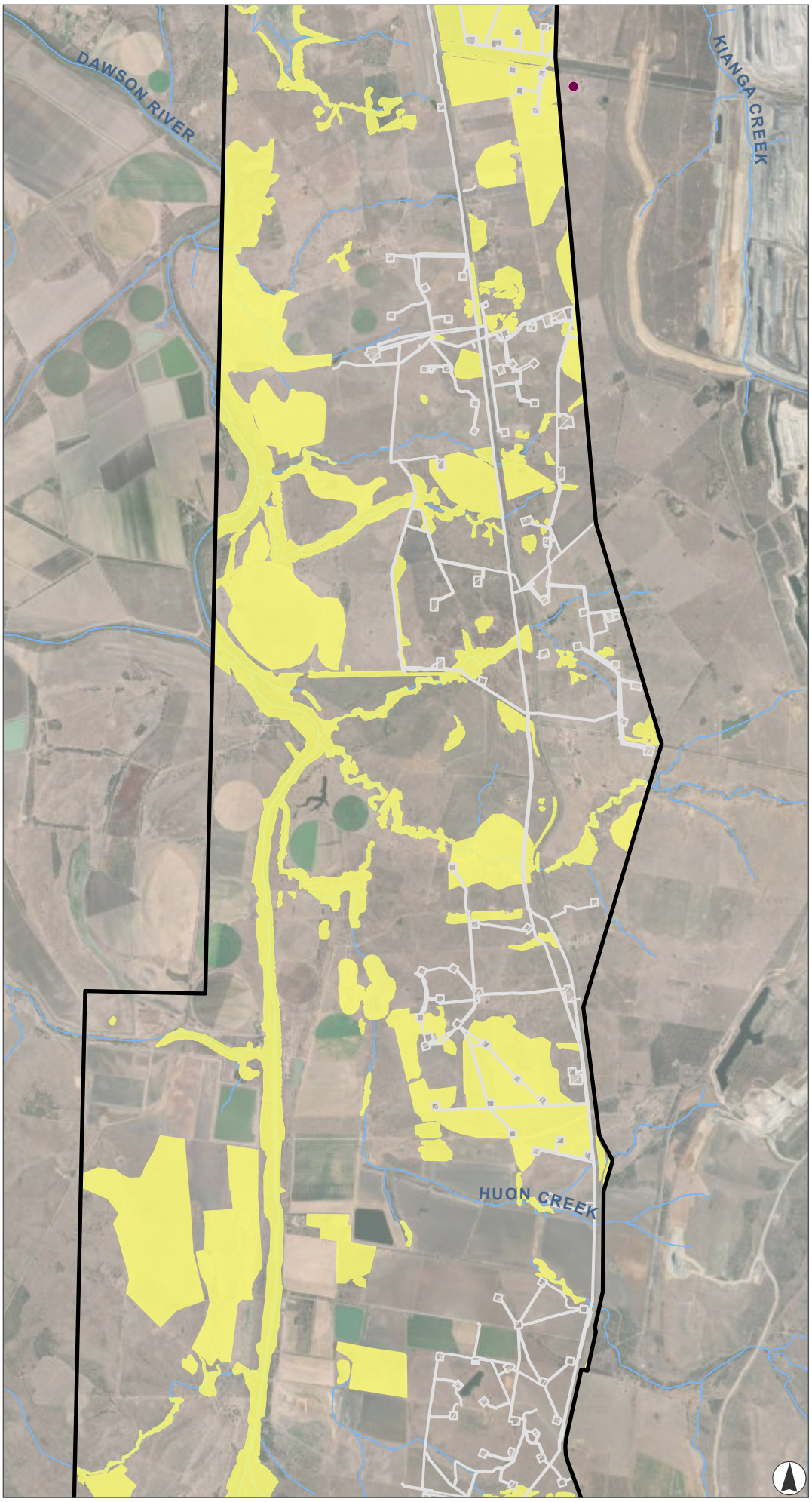


FIGURE 9.10B

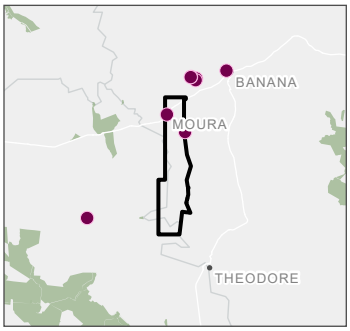
Ornamental snake *(Denisonia maculata)* Habitat and Records

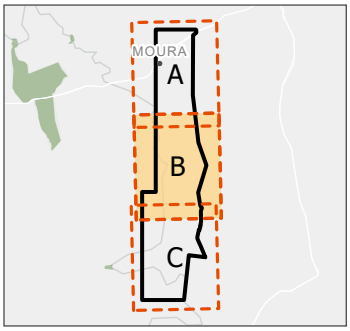
Legend

- Umwelt Records of Ornamental snake
- ALA Records of Ornamental snake
- Watercourse
- Project Area
- Existing Westside infrastructure

Ornamental snake habitat mapping

- Suitable habitat





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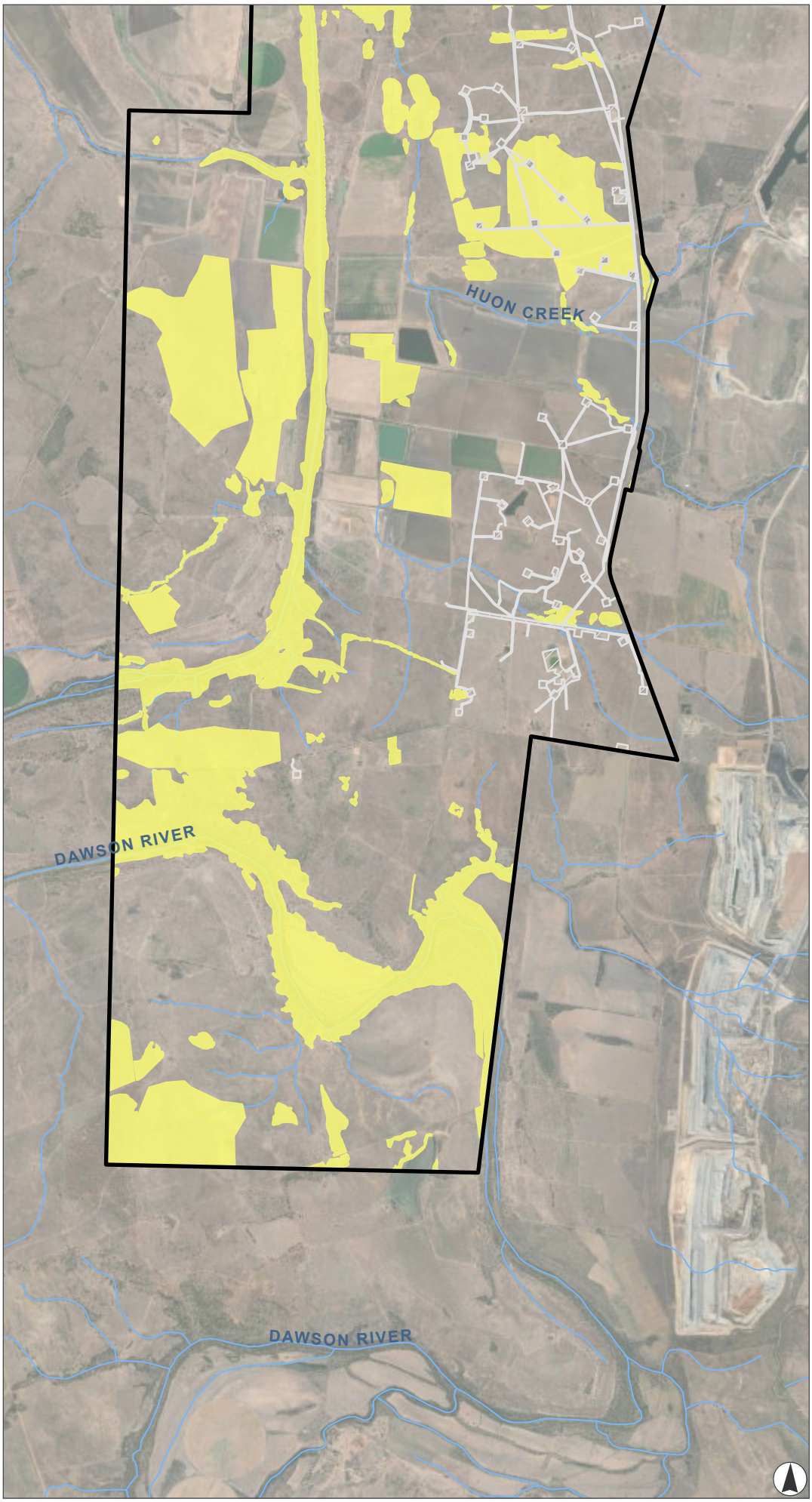


FIGURE 9.10C

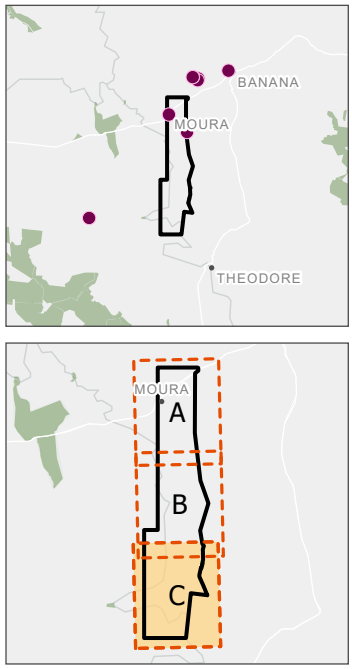
Ornamental snake *(Denisonia maculata)* Habitat and Records

Legend

- Umwelt Records of Ornamental snake
- Watercourse
- Project Area
- Existing Westside infrastructure

Ornamental snake habitat mapping

- Suitable habitat



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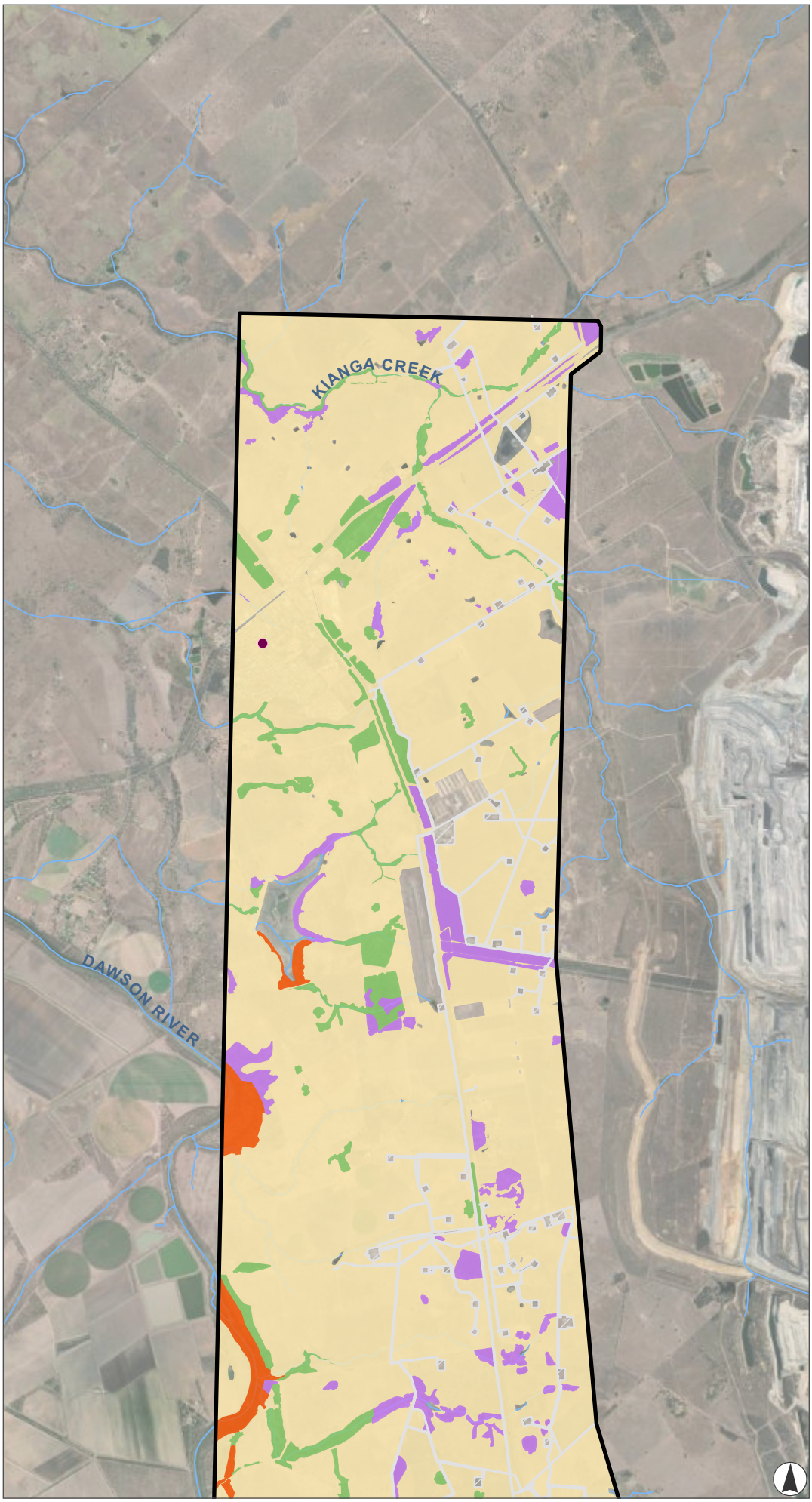


FIGURE 9.12A

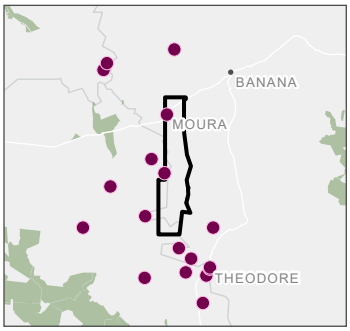
Koala *(Phascolarctos cinereus)* Habitat and Records

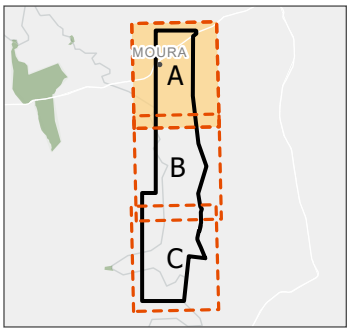
Legend

- ALA Records of Koala
- Watercourse
- Project Area
- Existing Westside infrastructure

Koala Habitat

- Breeding and foraging
- Climate refugia
- Dispersal
- Shelter vegetation





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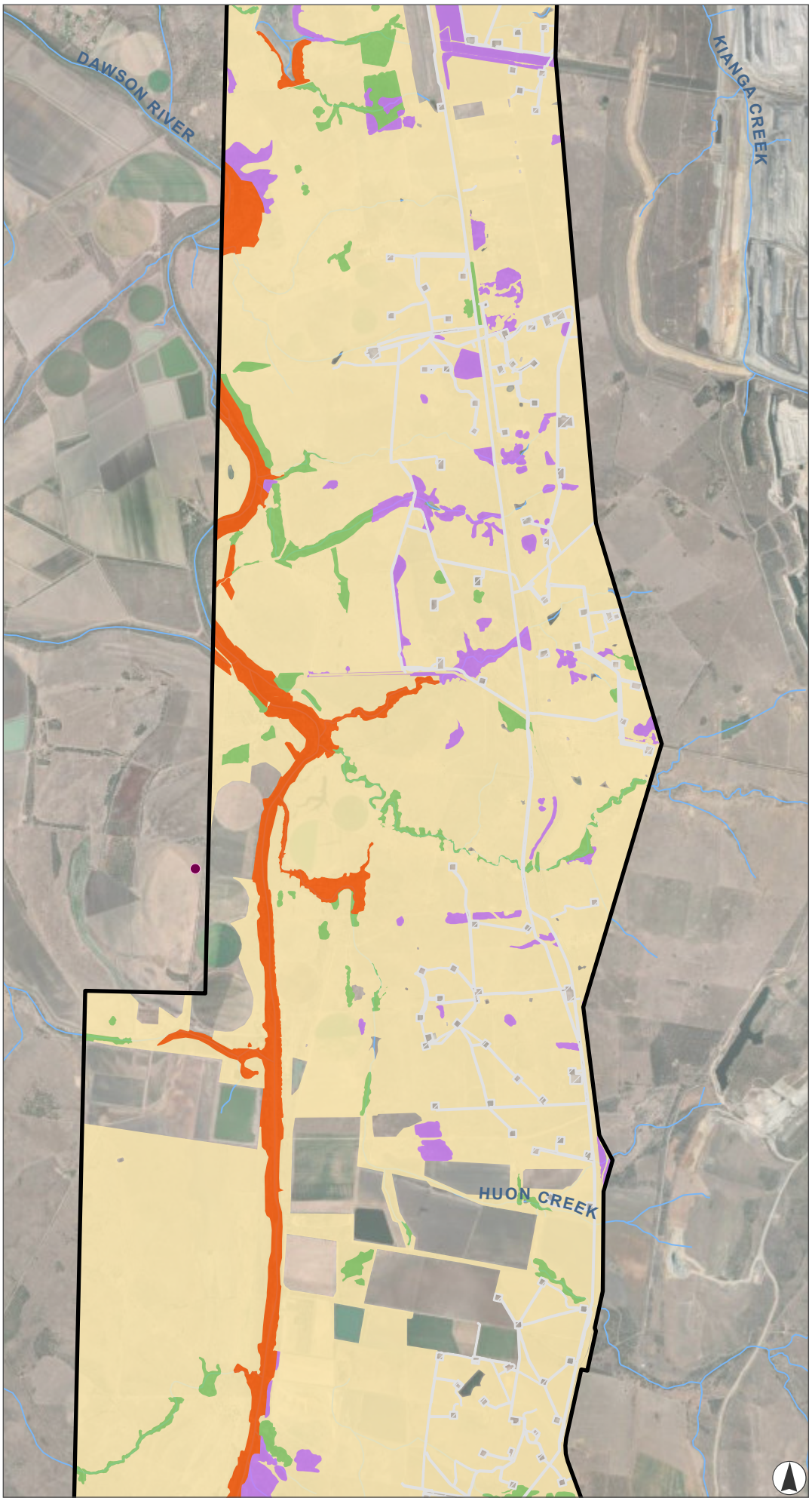


FIGURE 9.12B

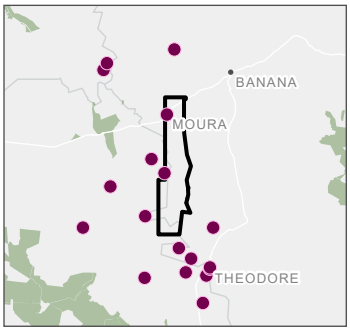
Koala *(Phascolarctos cinereus)* Habitat and Records

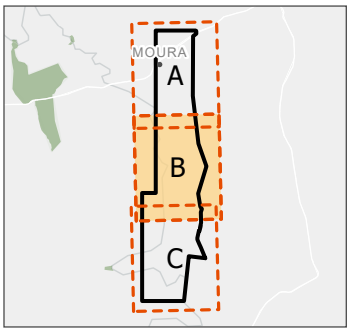
Legend

- ALA Records of Koala
- Watercourse
- Project Area
- Existing Westside infrastructure

Koala Habitat

- Breeding and foraging
- Climate refugia
- Dispersal
- Shelter vegetation





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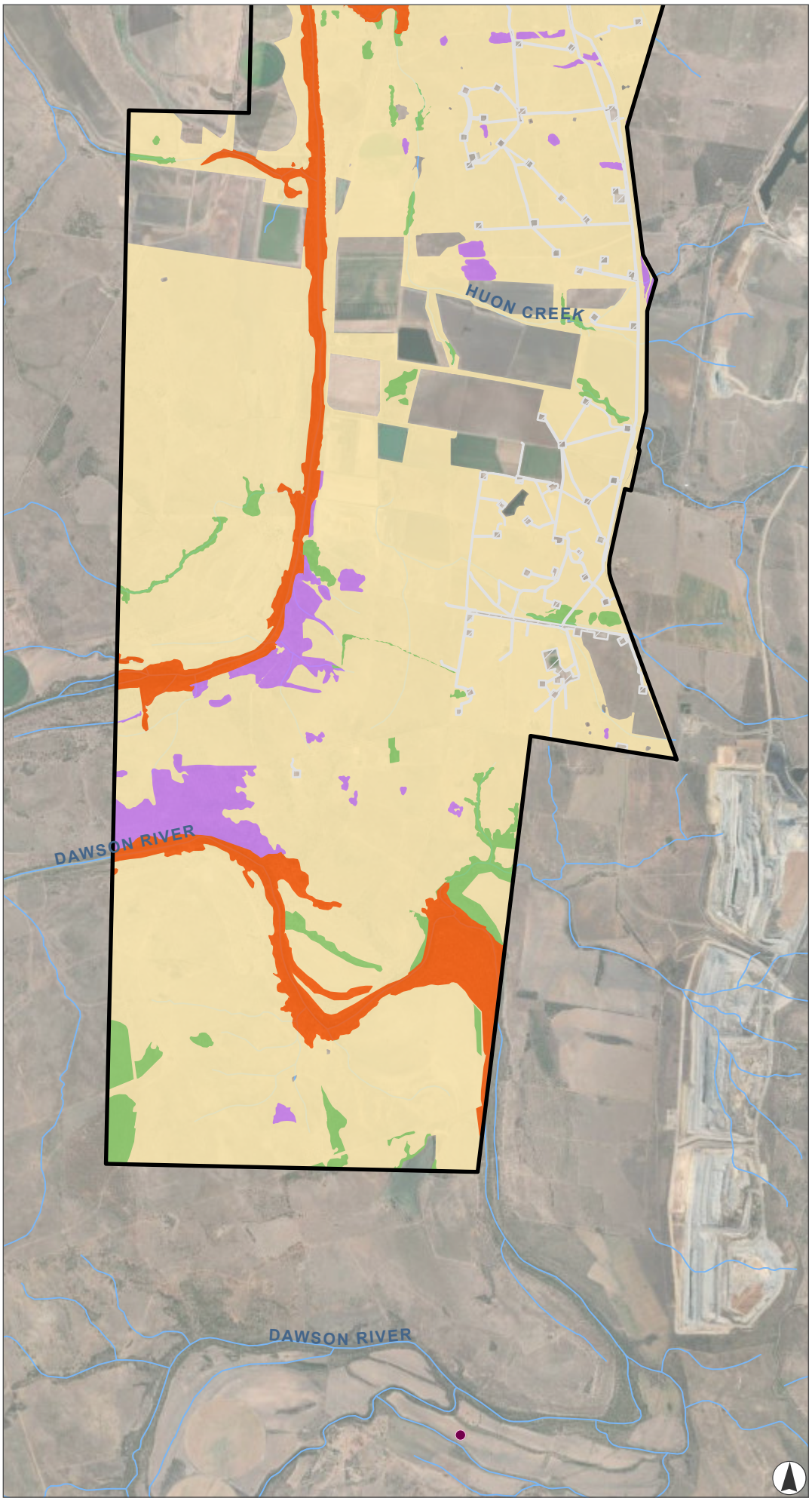


FIGURE 9.12C

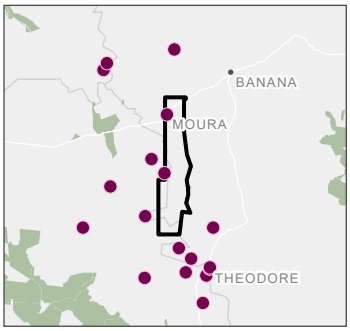
Koala *(Phascolarctos cinereus)* Habitat and Records

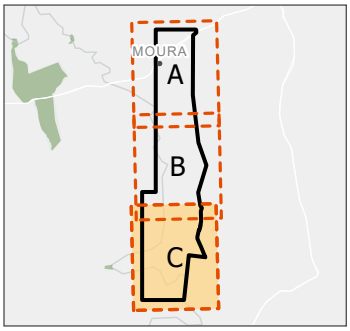
Legend

- ALA Records of Koala
- Watercourse
- Project Area
- Existing Westside infrastructure

Koala Habitat

- Breeding and foraging
- Climate refugia
- Dispersal
- Shelter vegetation





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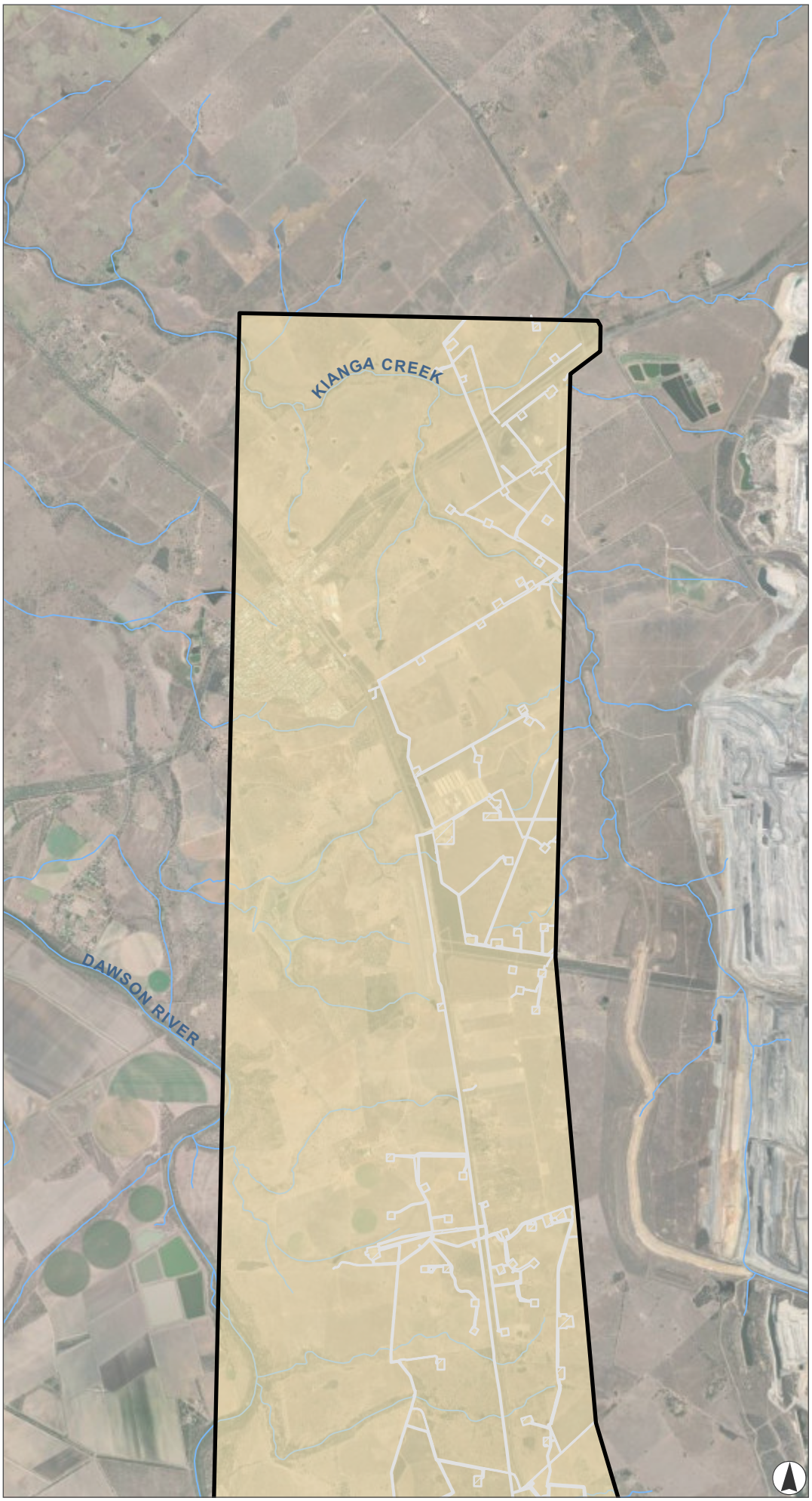


FIGURE 9.15A

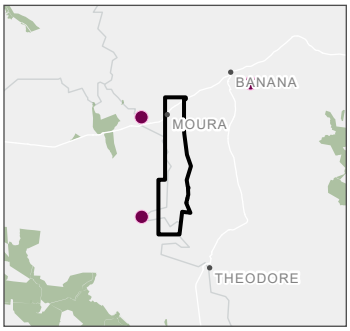
White-throated needletail *(Hirundapus caudacutus)* Habitat and Records

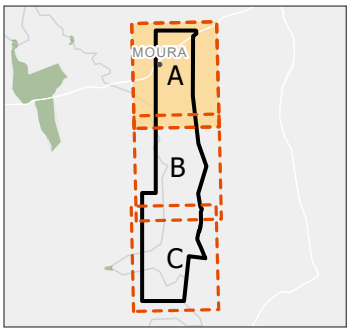
Legend

- ALA Records of White-throated Needletail
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated Needletail habitat mapping

- Foraging and dispersal





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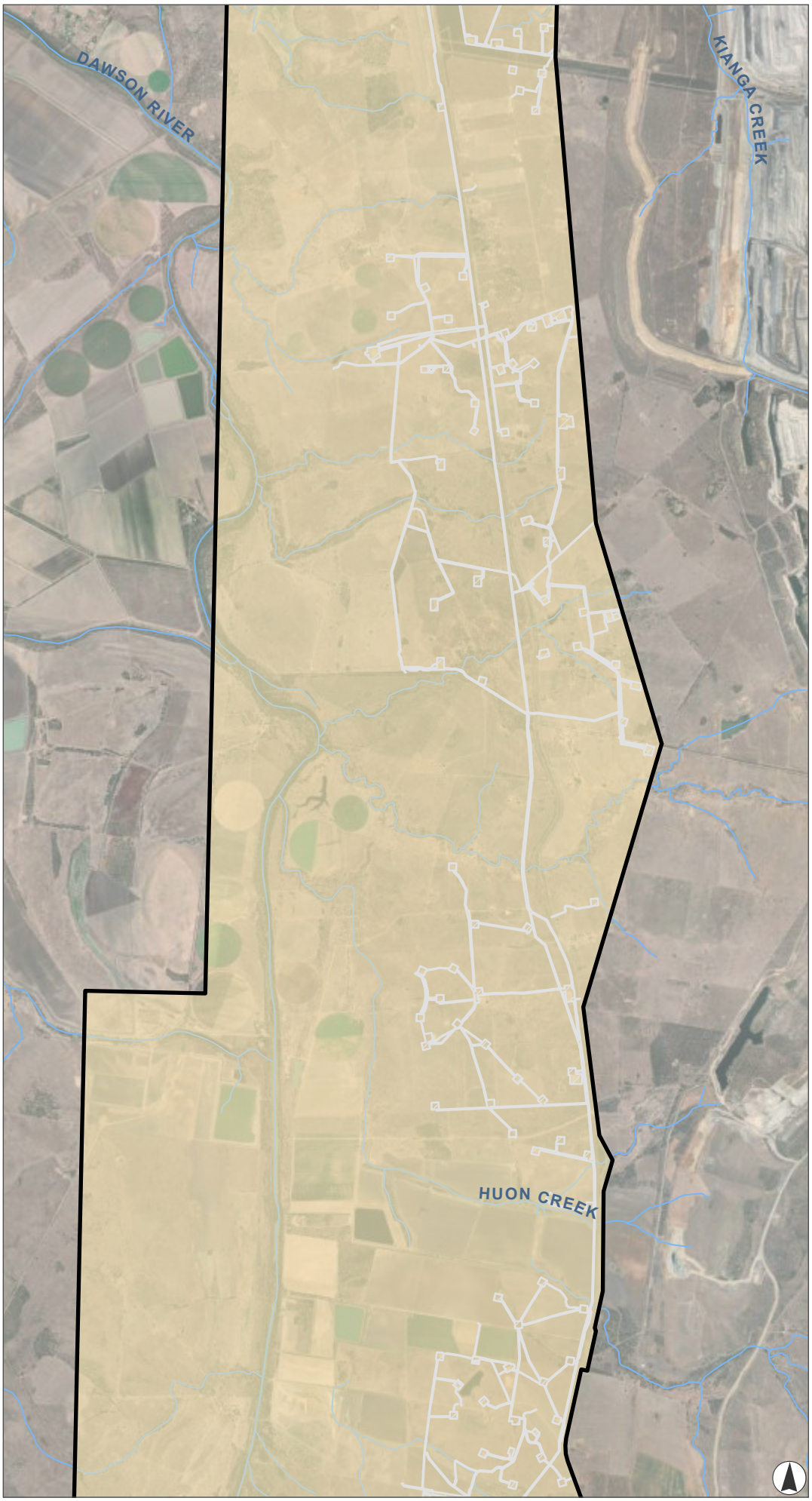


FIGURE 9.15B

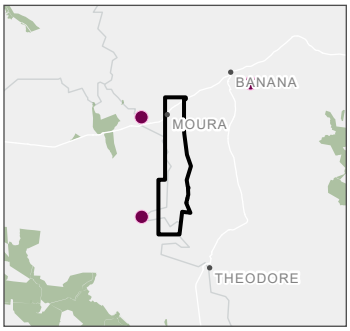
White-throated needletail *(Hirundapus caudacutus)* Habitat and Records

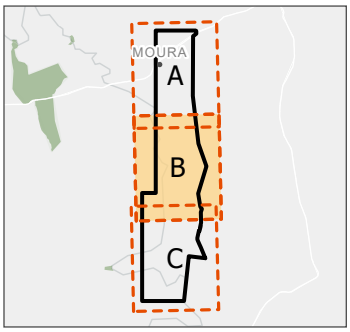
Legend

- ALA Records of White-throated Needletail
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated Needletail habitat mapping

- Foraging and dispersal





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Kilometres

Scale 1:80,000 at A4
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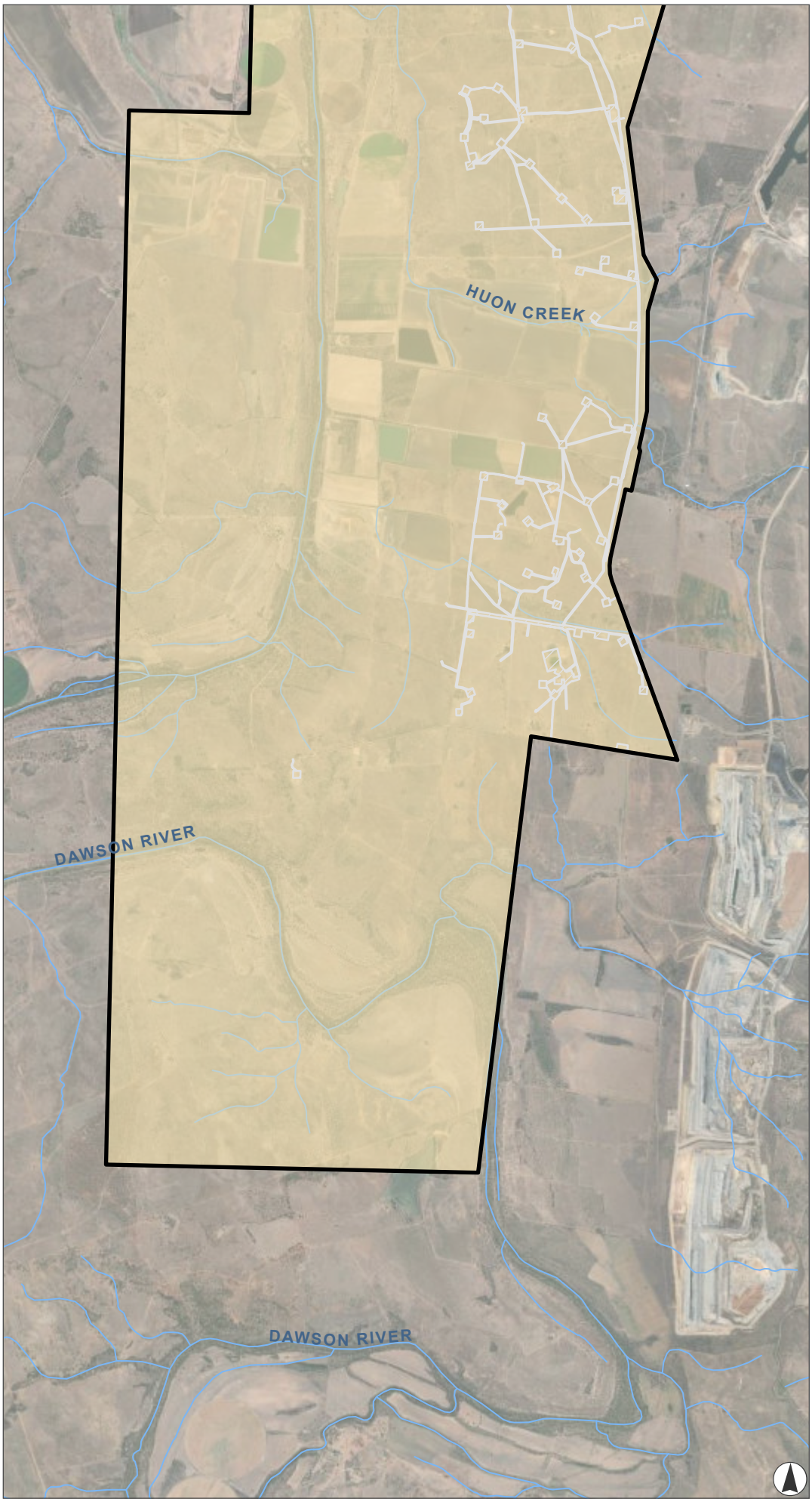


FIGURE 9.15C

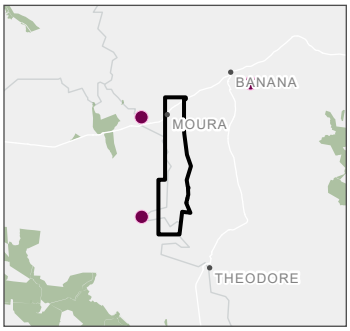
White-throated needletail *(Hirundapus caudacutus)* Habitat and Records

Legend

- ALA Records of White-throated Needletail
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated Needletail habitat mapping

- Foraging and dispersal



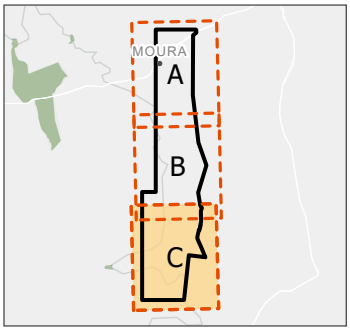


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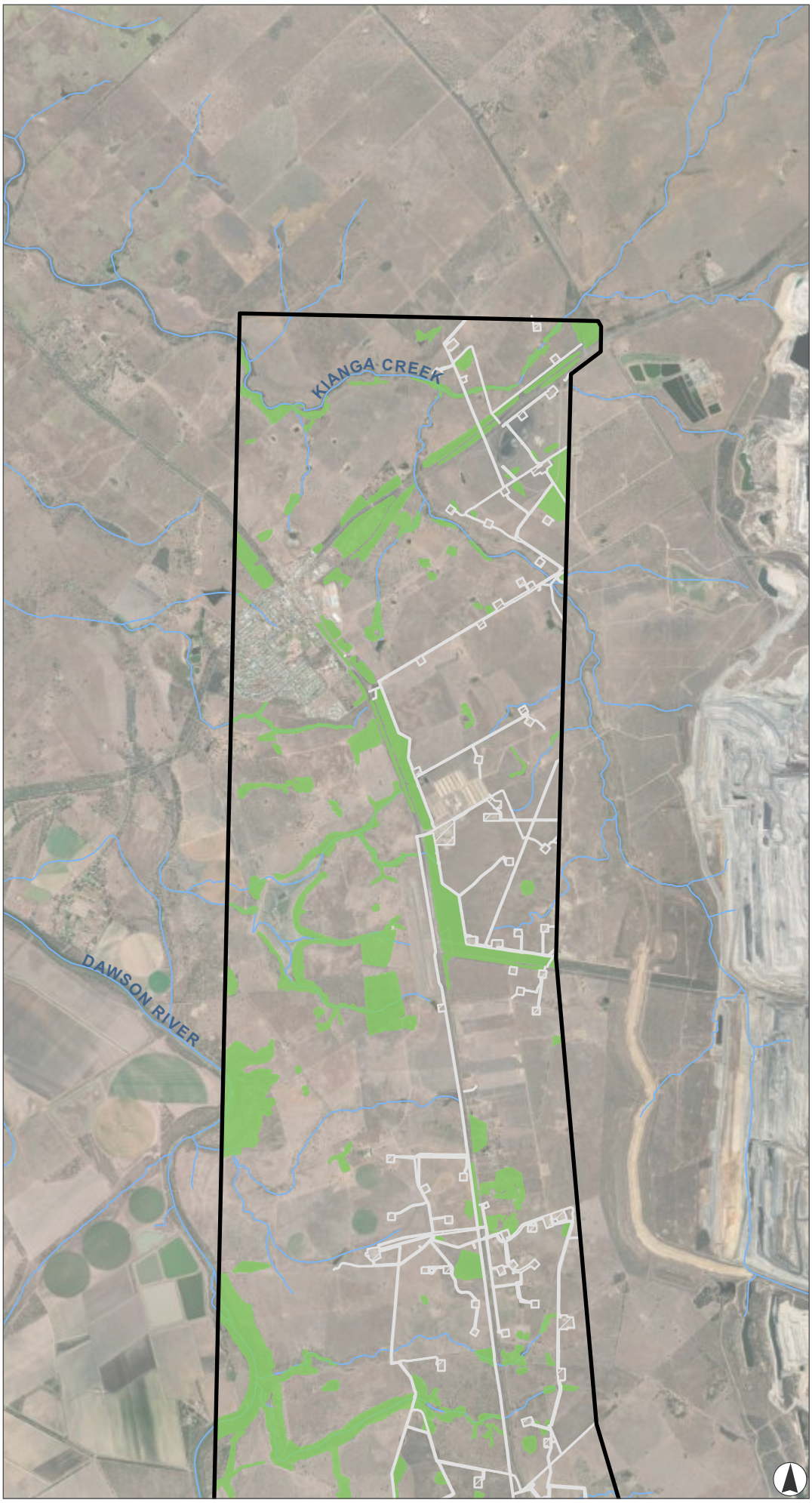
FIGURE 9.16A

Yakka skink *(Egernia rugosa)* Habitat and Records

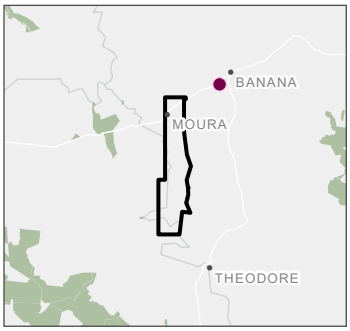


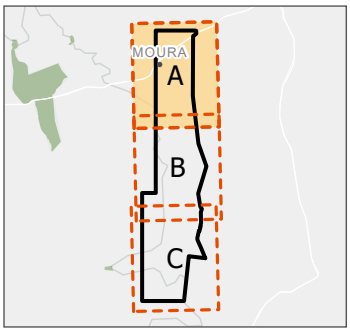
Legend

- ALA Records of Yakka skink
- Watercourse
- Project Area
- Existing Westside infrastructure

Yakka skink habitat mapping

- Breeding and foraging





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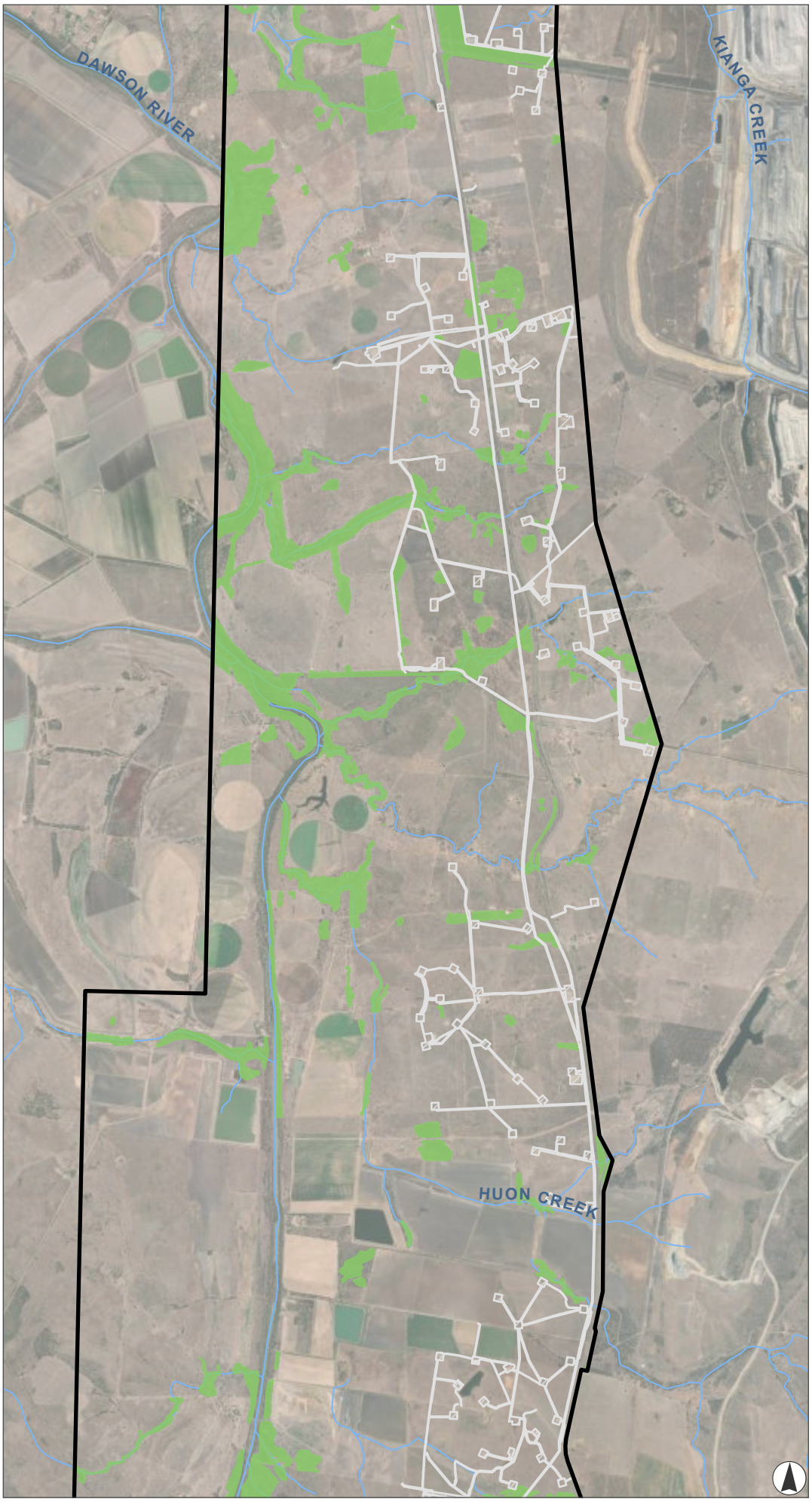


FIGURE 9.16B

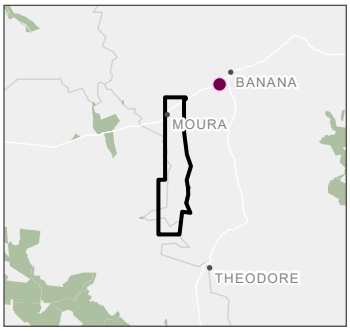
Yakka skink *(Egernia rugosa)* Habitat and Records

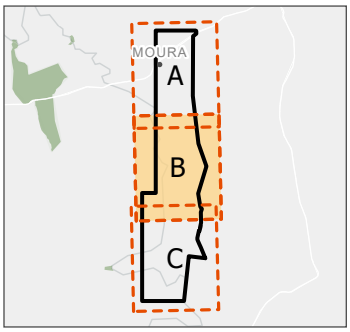
Legend

- ALA Records of Yakka skink
- Watercourse
- Project Area
- Existing Westside infrastructure

Yakka skink habitat mapping

- Breeding and foraging





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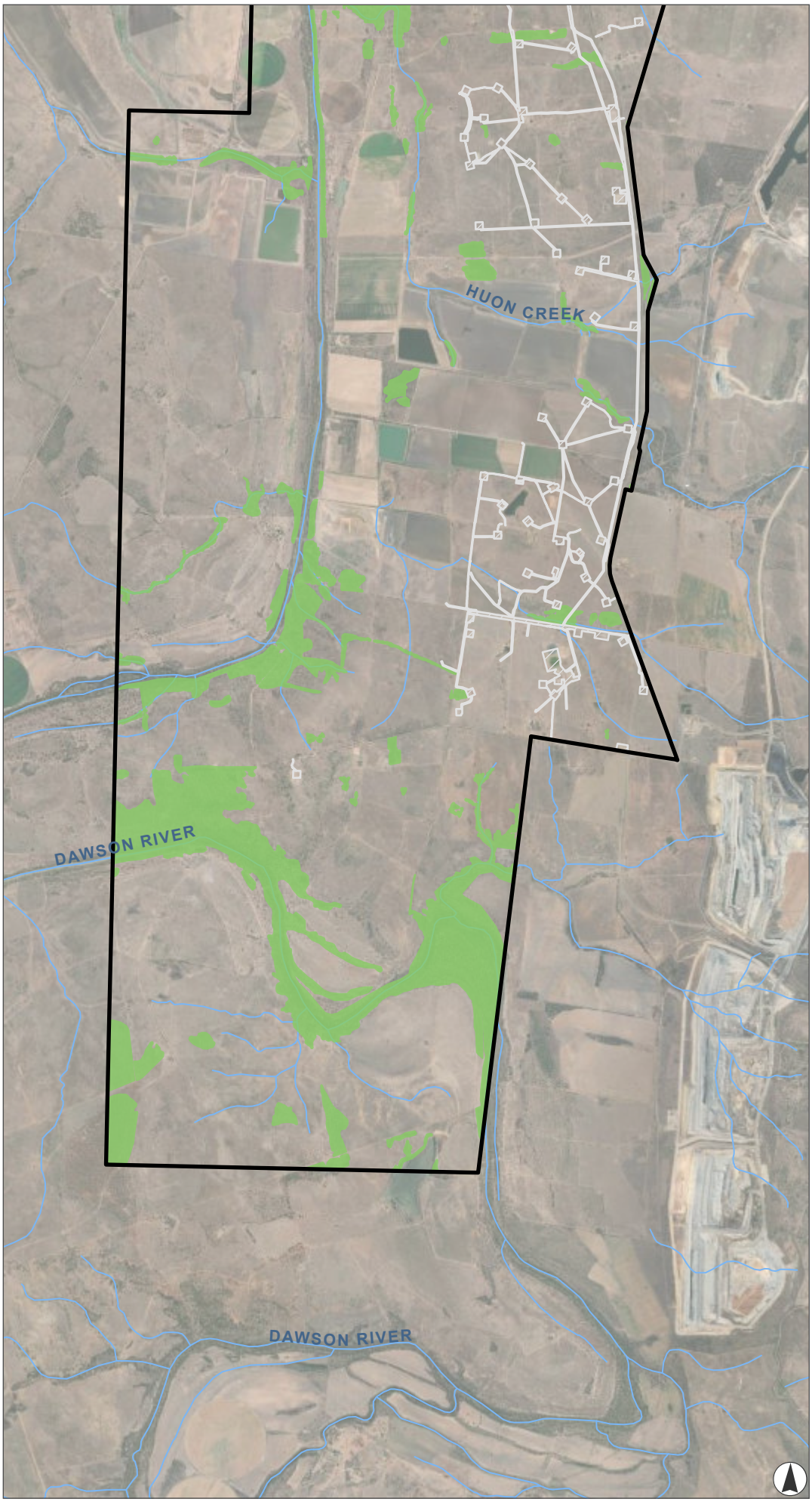


FIGURE 9.16C

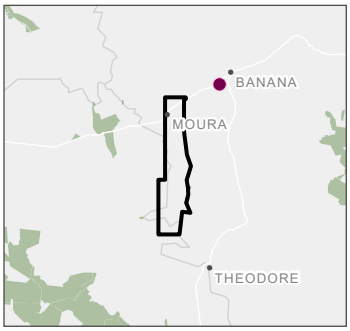
Yakka skink *(Egernia rugosa)* Habitat and Records

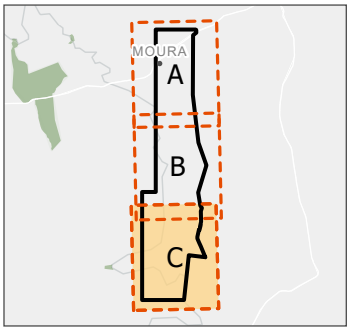
Legend

- ALA Records of Yakka skink
- Watercourse
- Project Area
- Existing Westside infrastructure

Yakka skink habitat mapping

- Breeding and foraging





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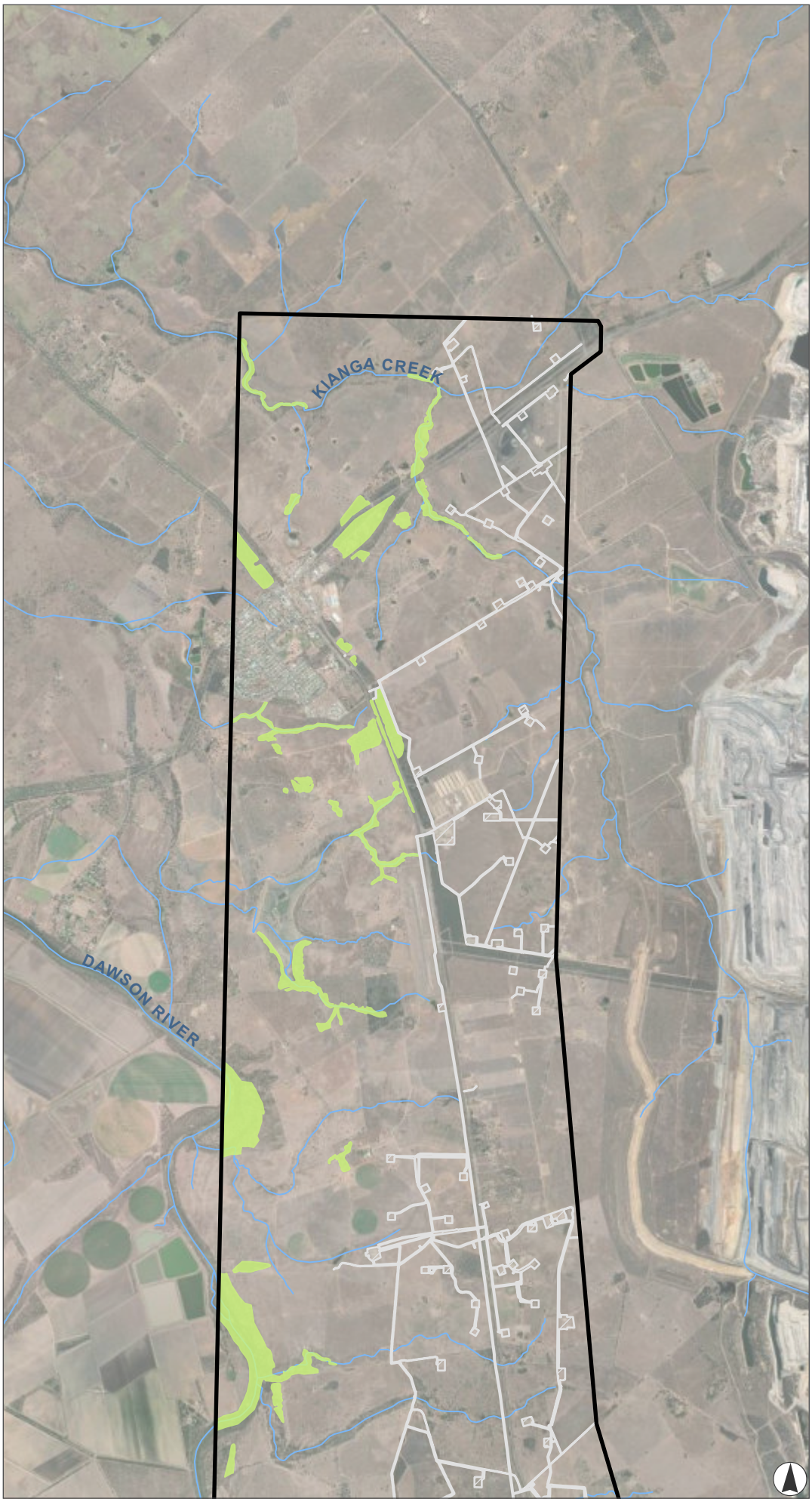


FIGURE 9.17A

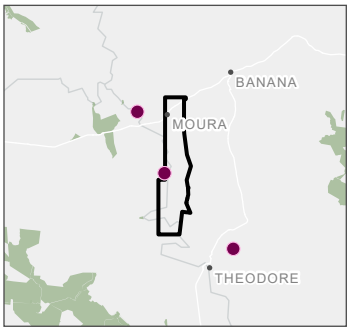
Greater glider (southern and central) *(Petauroides volans)* Habitat and Records

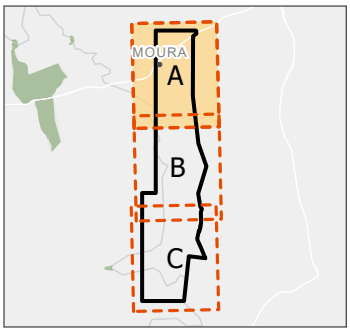
Legend

- ALA Records of Greater glider (southern and central)
- Watercourse
- Project Area
- Existing Westside infrastructure

Greater glider (southern and central) Habitat

- Denning





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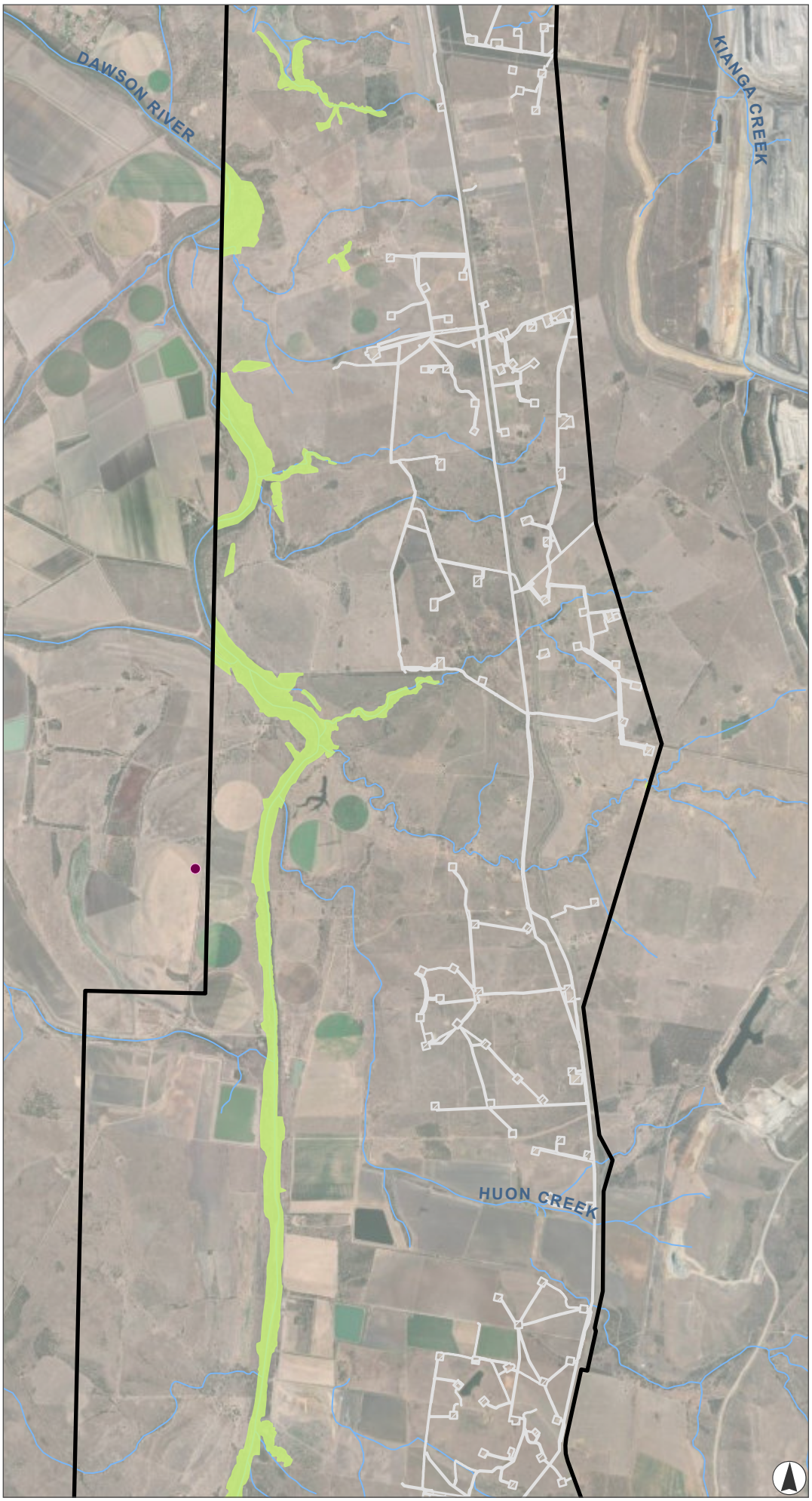


FIGURE 9.17B

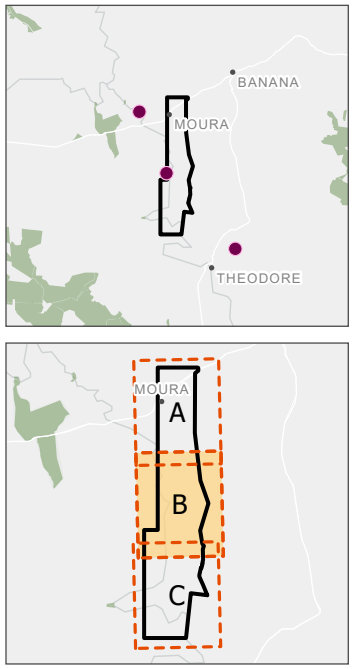
Greater glider (southern and central) *(Petauroides volans)* Habitat and Records

Legend

- ALA Records of Greater glider (southern and central)
- Watercourse
- Project Area
- Existing Westside infrastructure

Greater glider (southern and central) Habitat

- Denning



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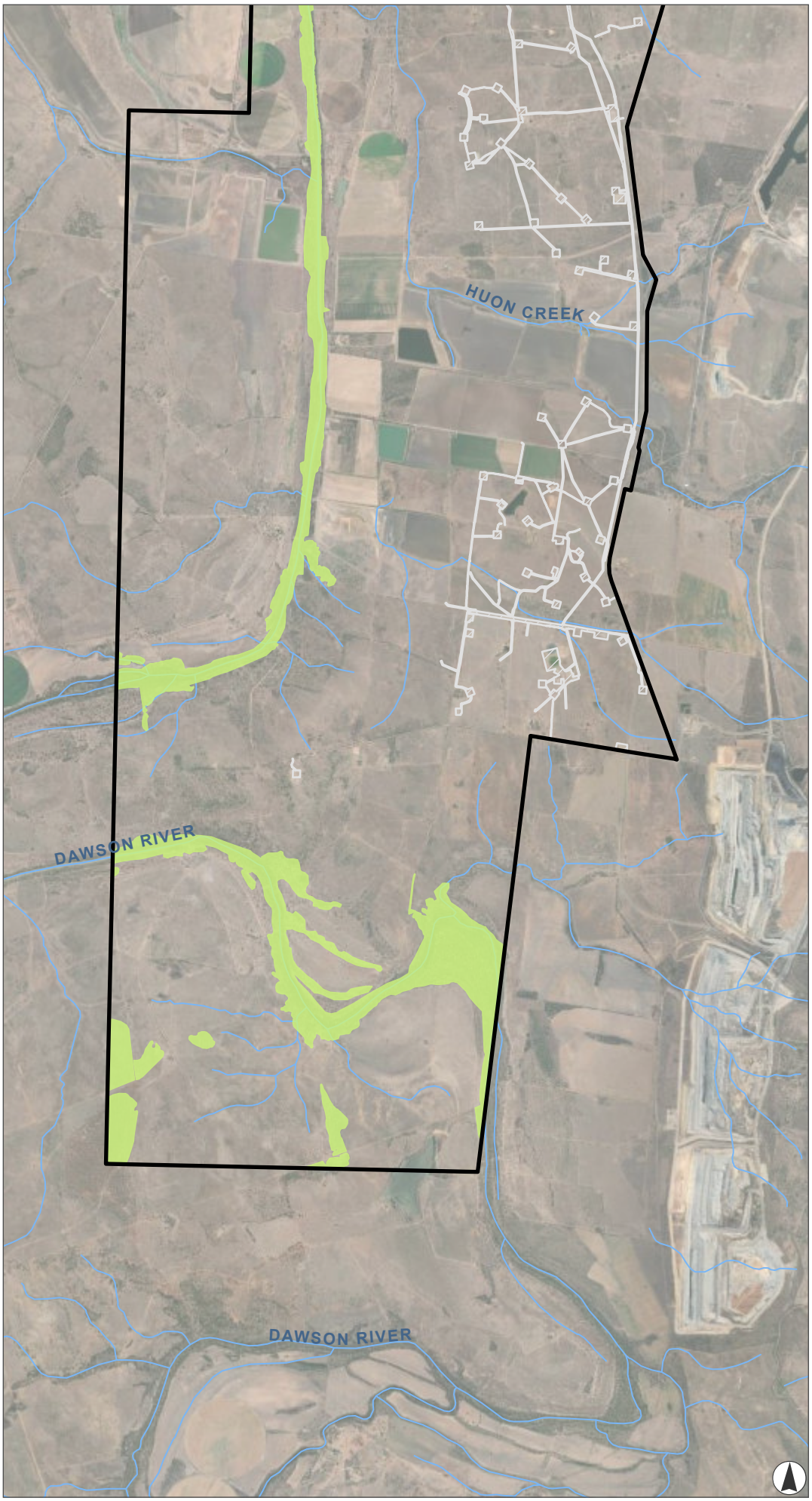


FIGURE 9.17C

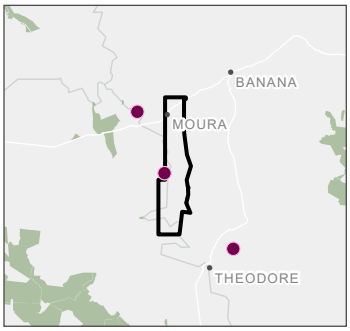
Greater glider (southern and central) *(Petauroides volans)* Habitat and Records

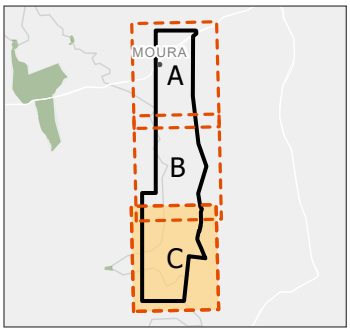
Legend

- ALA Records of Greater glider (southern and central)
- Watercourse
- Project Area
- Existing Westside infrastructure

Greater glider (southern and central) Habitat

- Denning





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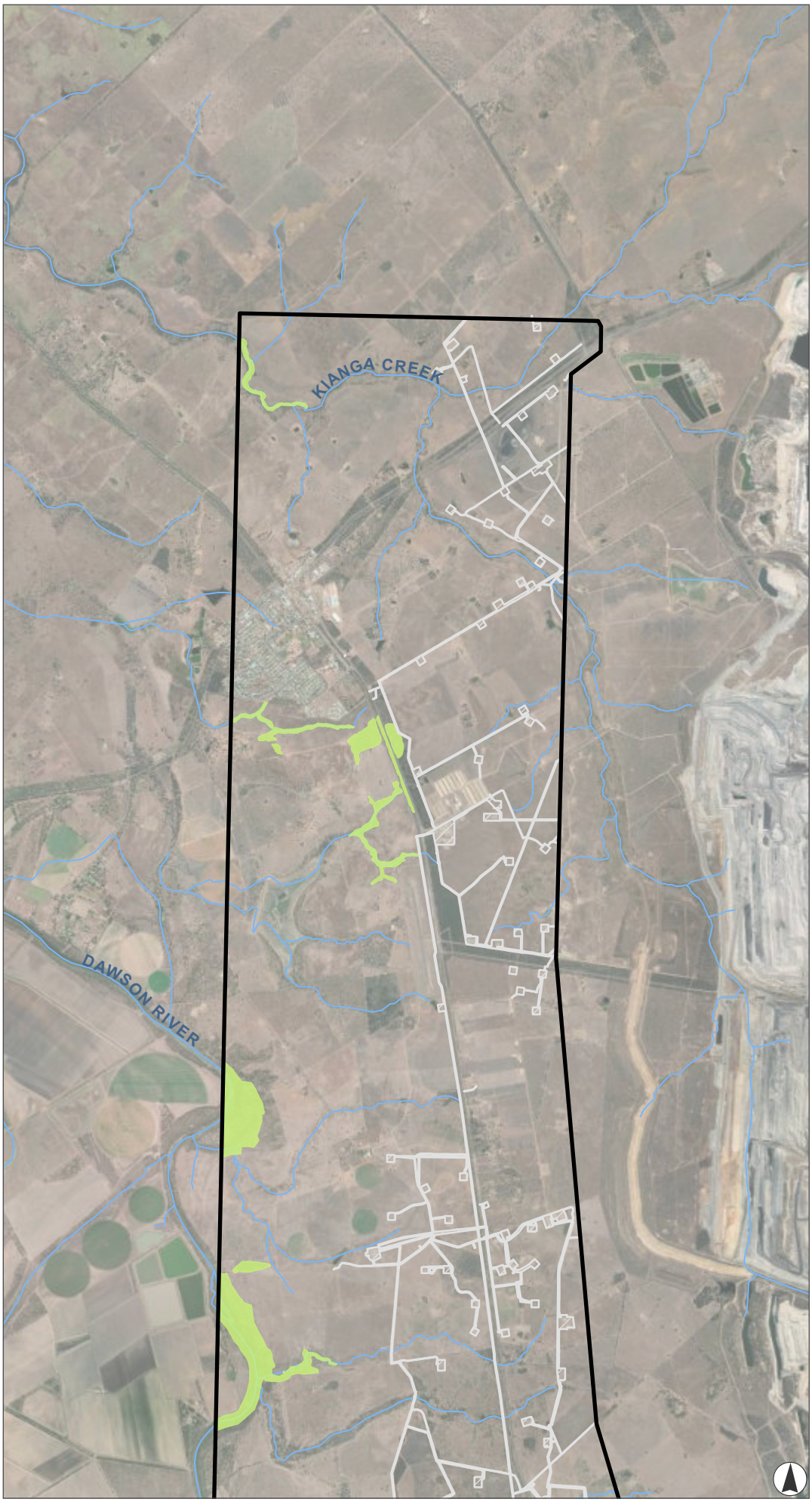


FIGURE 9.20A

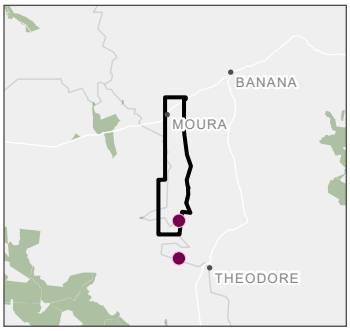
Yellow-bellied glider (south-eastern) *(Petaurus australis australis)* Habitat and Records

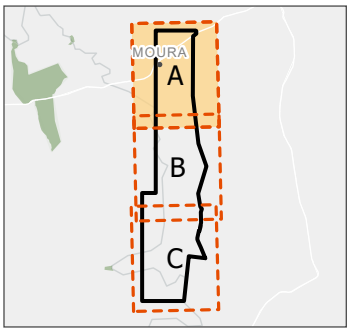
Legend

- ALA Records of Yellow-bellied glider (south-eastern)
- Watercourse
- Project Area
- Existing Westside infrastructure

Yellow-bellied glider (south-eastern) habitat mapping

- Denning, foraging and dispersal





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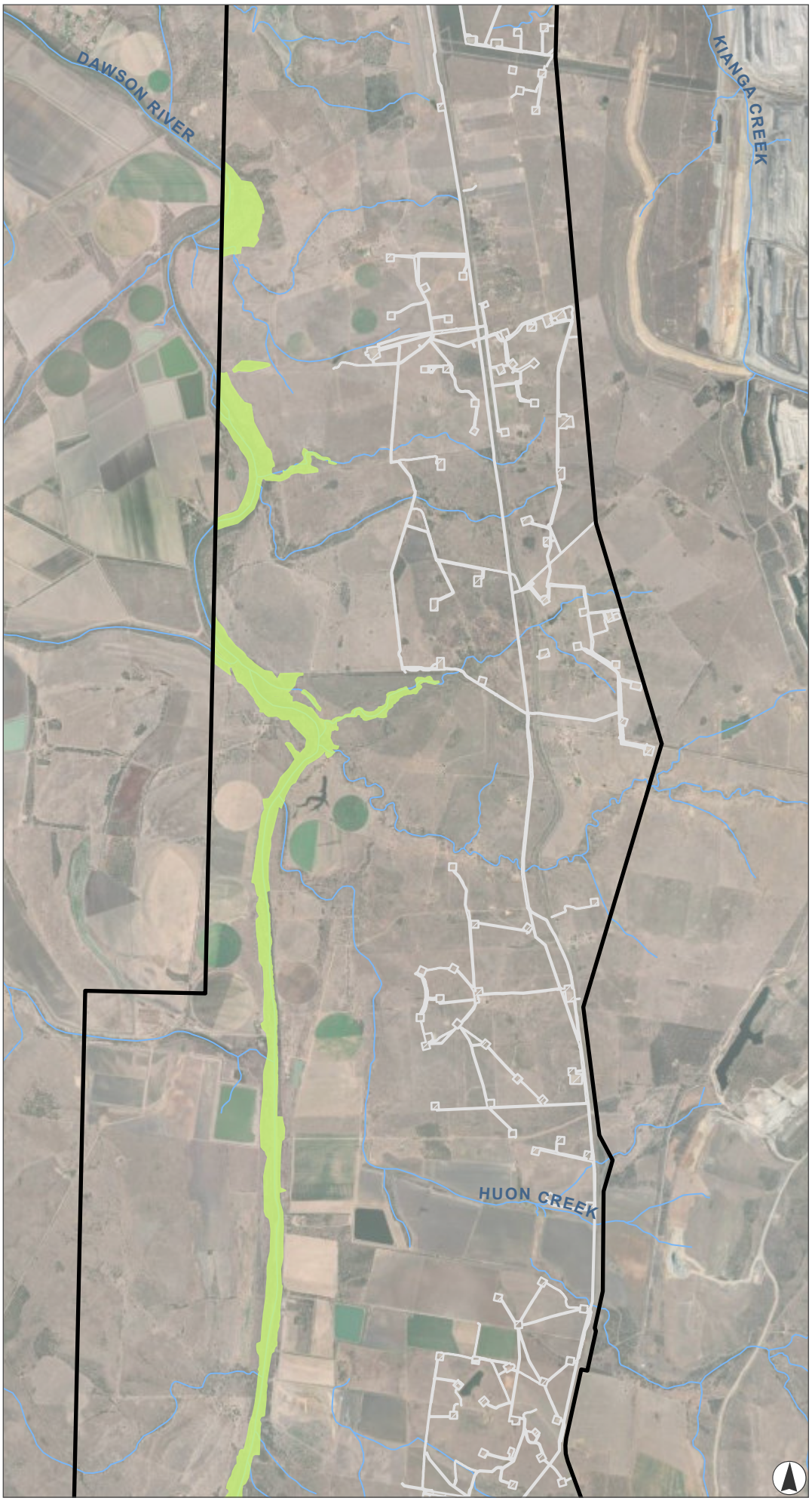


FIGURE 9.20B

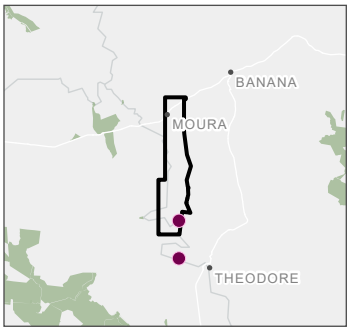
Yellow-bellied glider (south-eastern) *(Petaurus australis australis)* Habitat and Records

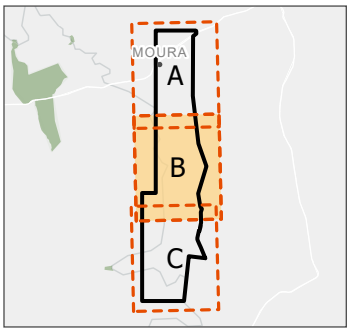
Legend

- ALA Records of Yellow-bellied glider (south-eastern)
- Watercourse
- Project Area
- Existing Westside infrastructure

Yellow-bellied glider (south-eastern) habitat mapping

- Denning, foraging and dispersal





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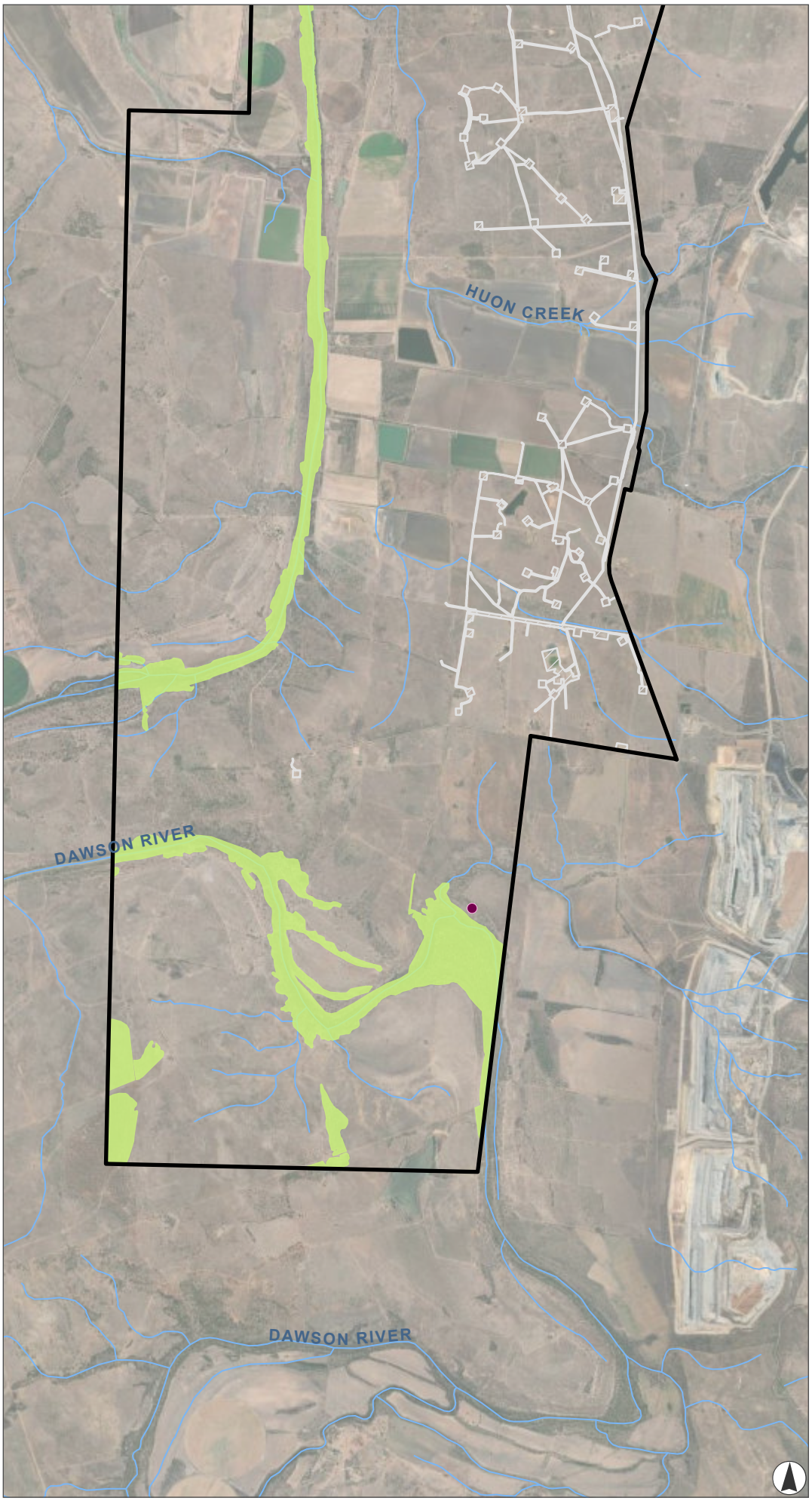


FIGURE 9.20C

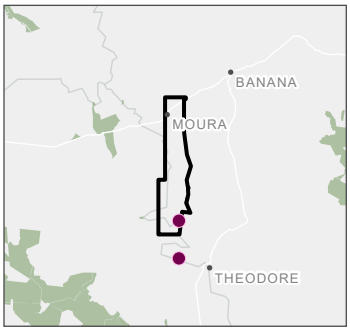
Yellow-bellied glider (south-eastern) *(Petaurus australis australis)* Habitat and Records

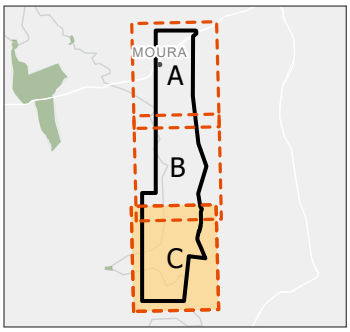
Legend

- ALA Records of Yellow-bellied glider (south-eastern)
- Watercourse
- Project Area
- Existing Westside infrastructure

Yellow-bellied glider (south-eastern) habitat mapping

- Denning, foraging and dispersal





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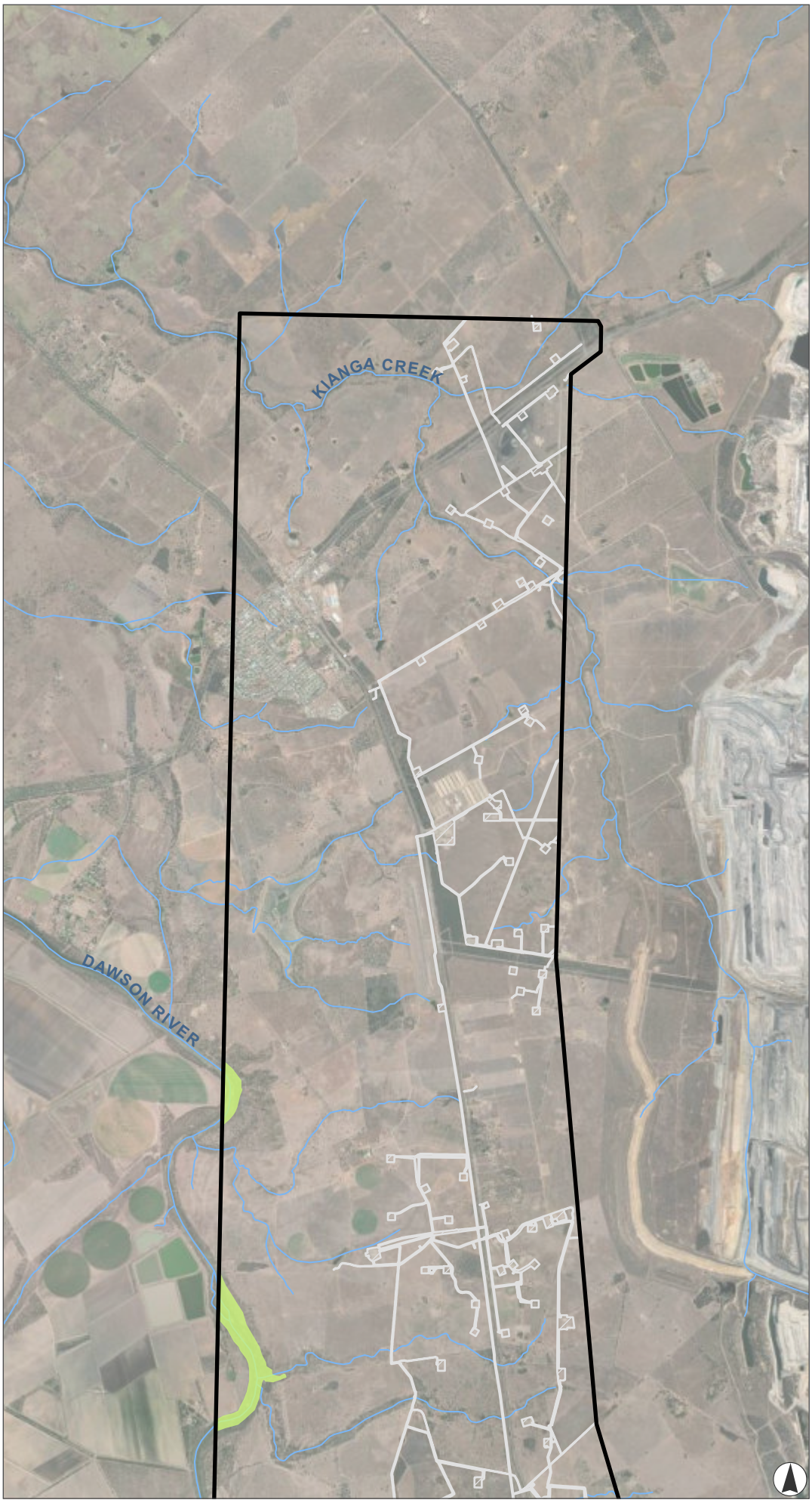


FIGURE 9.21A

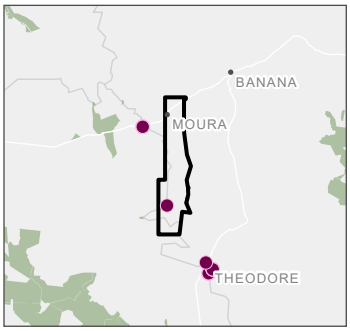
White-throated snapping turtle *(Elseya albagula)* Habitat and Records

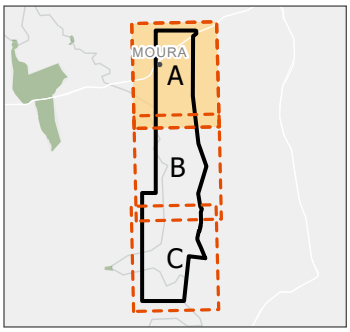
Legend

- ALA Records of White-throated Snapping Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated snapping turtle Habitat

- Breeding, foraging and dispersal





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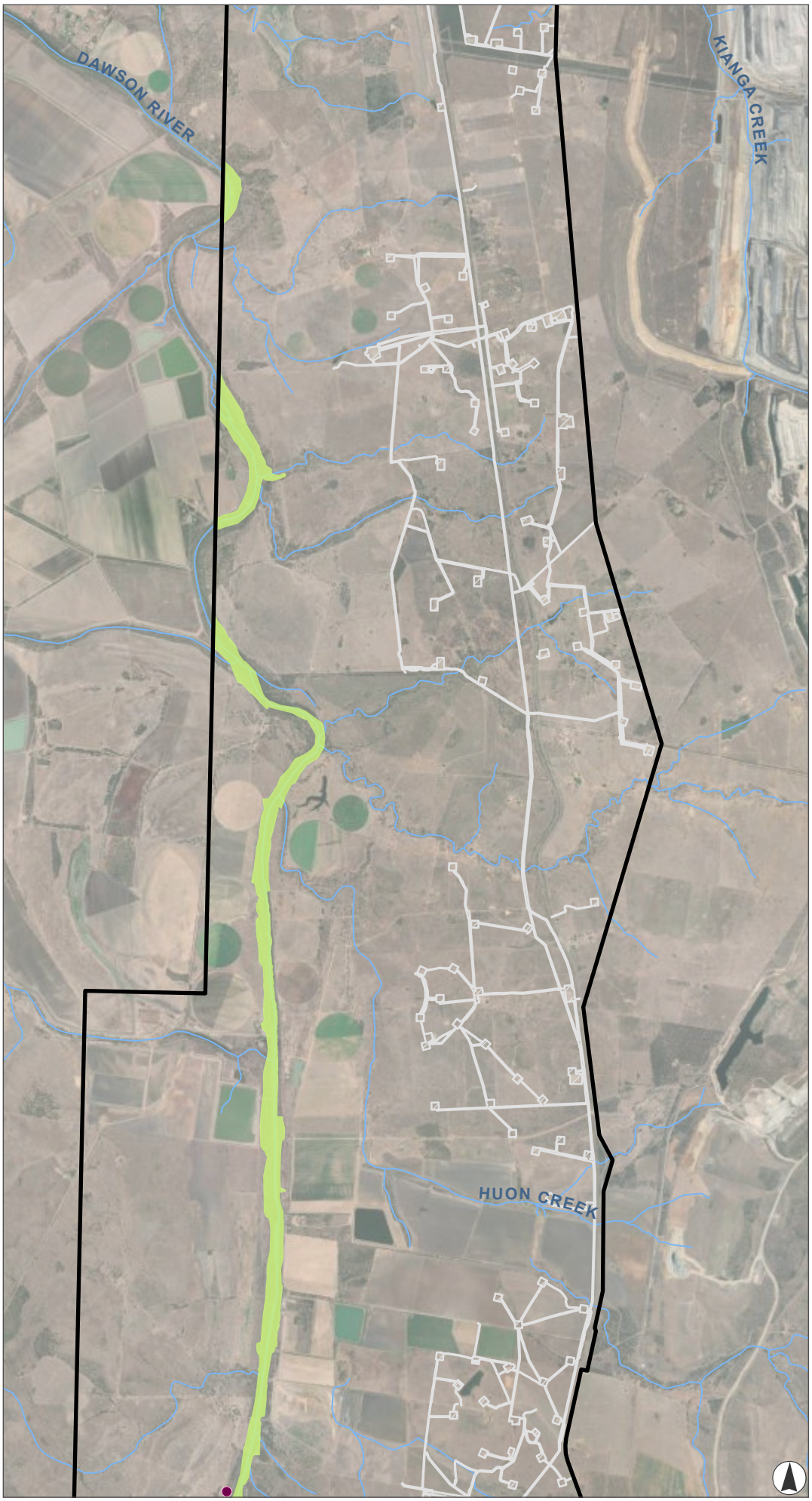


FIGURE 9.21B

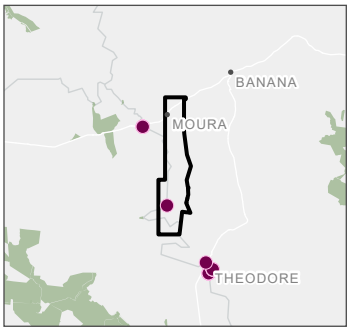
White-throated snapping turtle *(Elseya albagula)* Habitat and Records

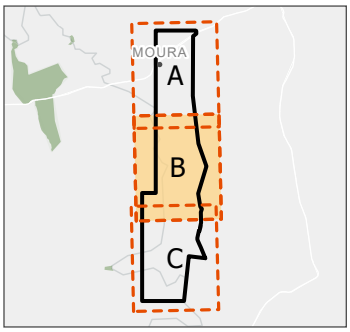
Legend

- ALA Records of White-throated Snapping Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated snapping turtle Habitat

- Breeding, foraging and dispersal





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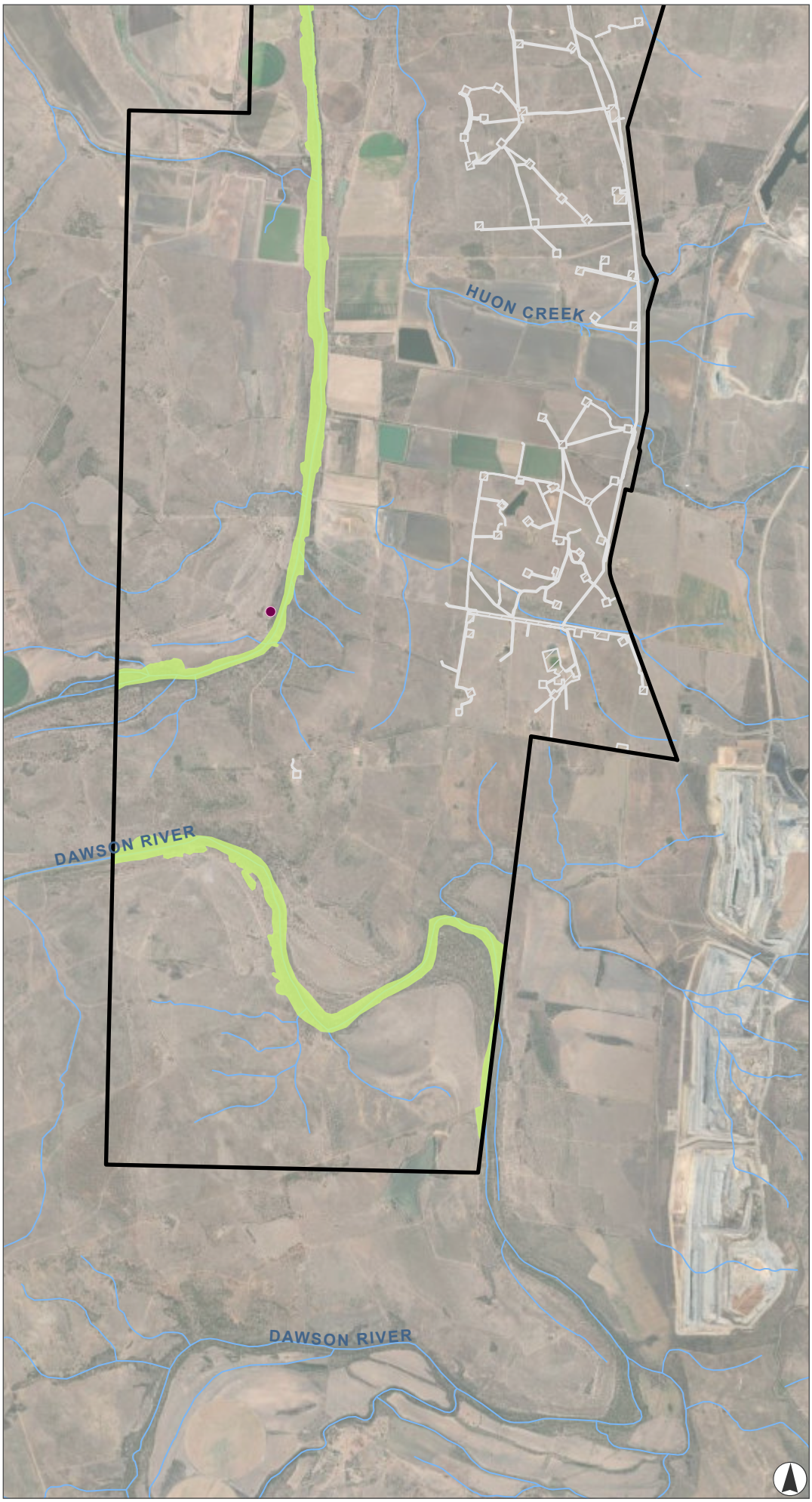


FIGURE 9.21C

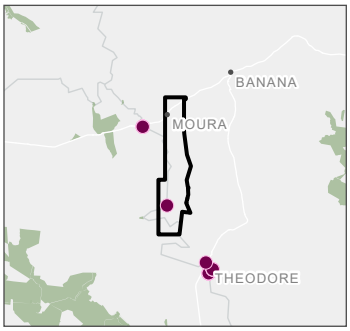
White-throated snapping turtle *(Elseya albagula)* Habitat and Records

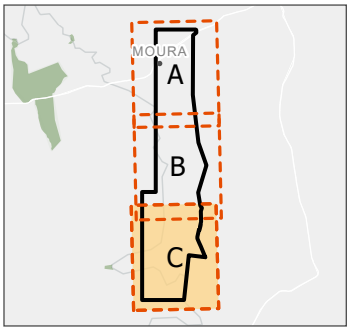
Legend

- ALA Records of White-throated Snapping Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

White-throated snapping turtle Habitat

- Breeding, foraging and dispersal





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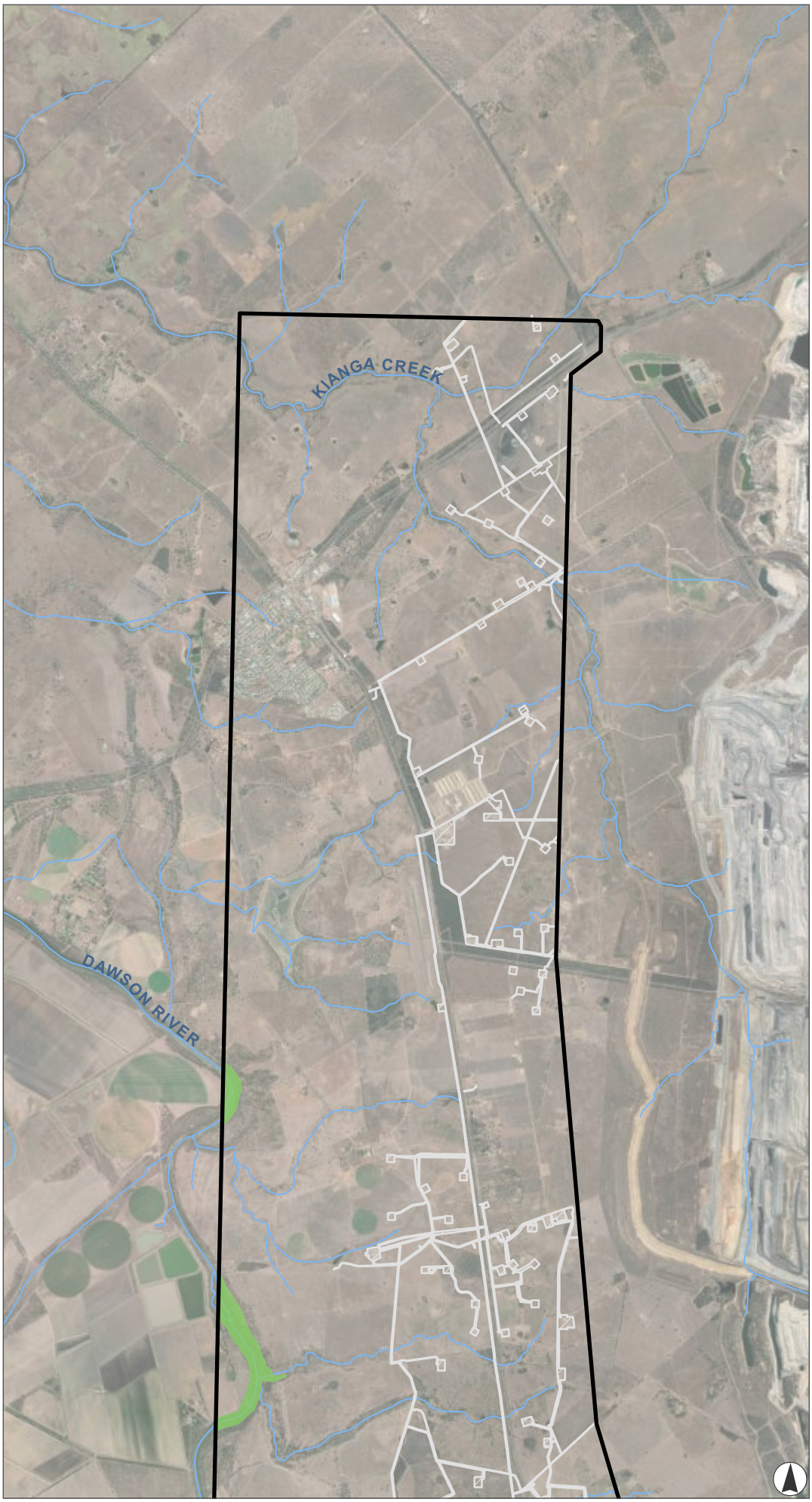


FIGURE 9.22A

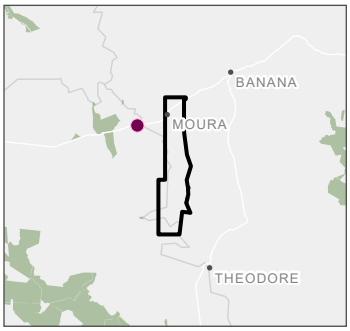
Fitzroy River turtle *(Rheodytes leukops)* Habitat and Records

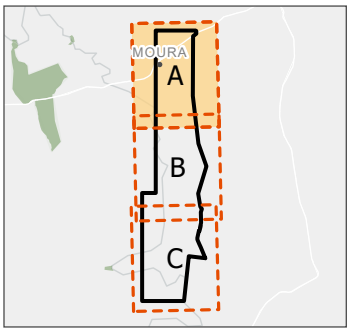
Legend

- ALA Records of Fitzroy River Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

Fitzroy River Turtle habitat mapping

- Breeding, foraging and dispersal





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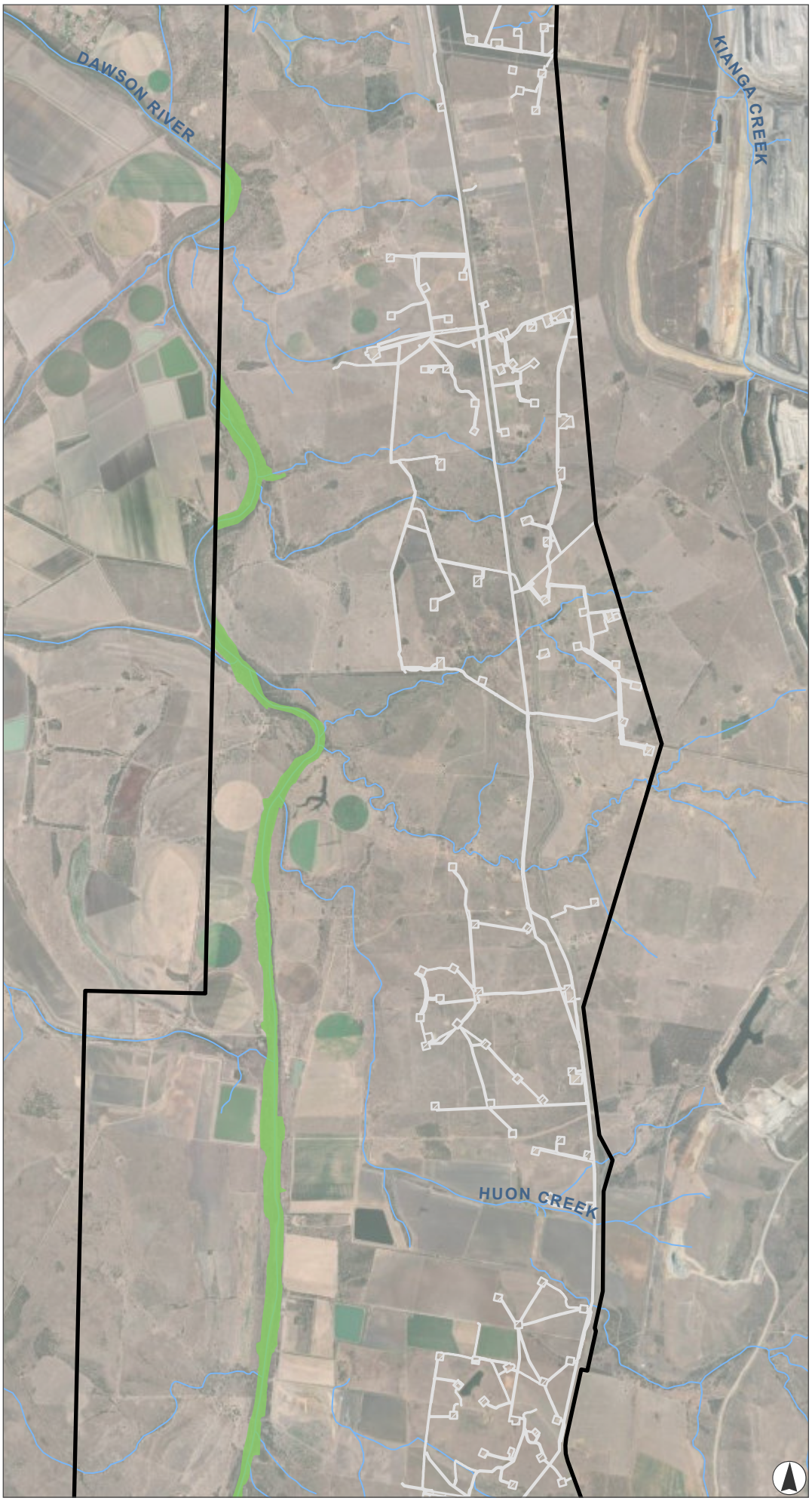


FIGURE 9.22B

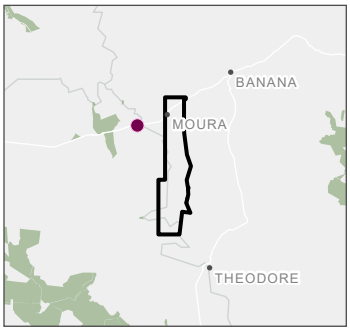
Fitzroy River turtle *(Rheodytes leukops)* Habitat and Records

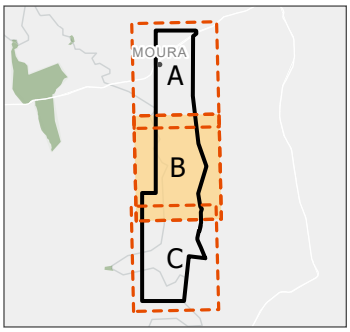
Legend

- ALA Records of Fitzroy River Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

Fitzroy River Turtle habitat mapping

- Breeding, foraging and dispersal





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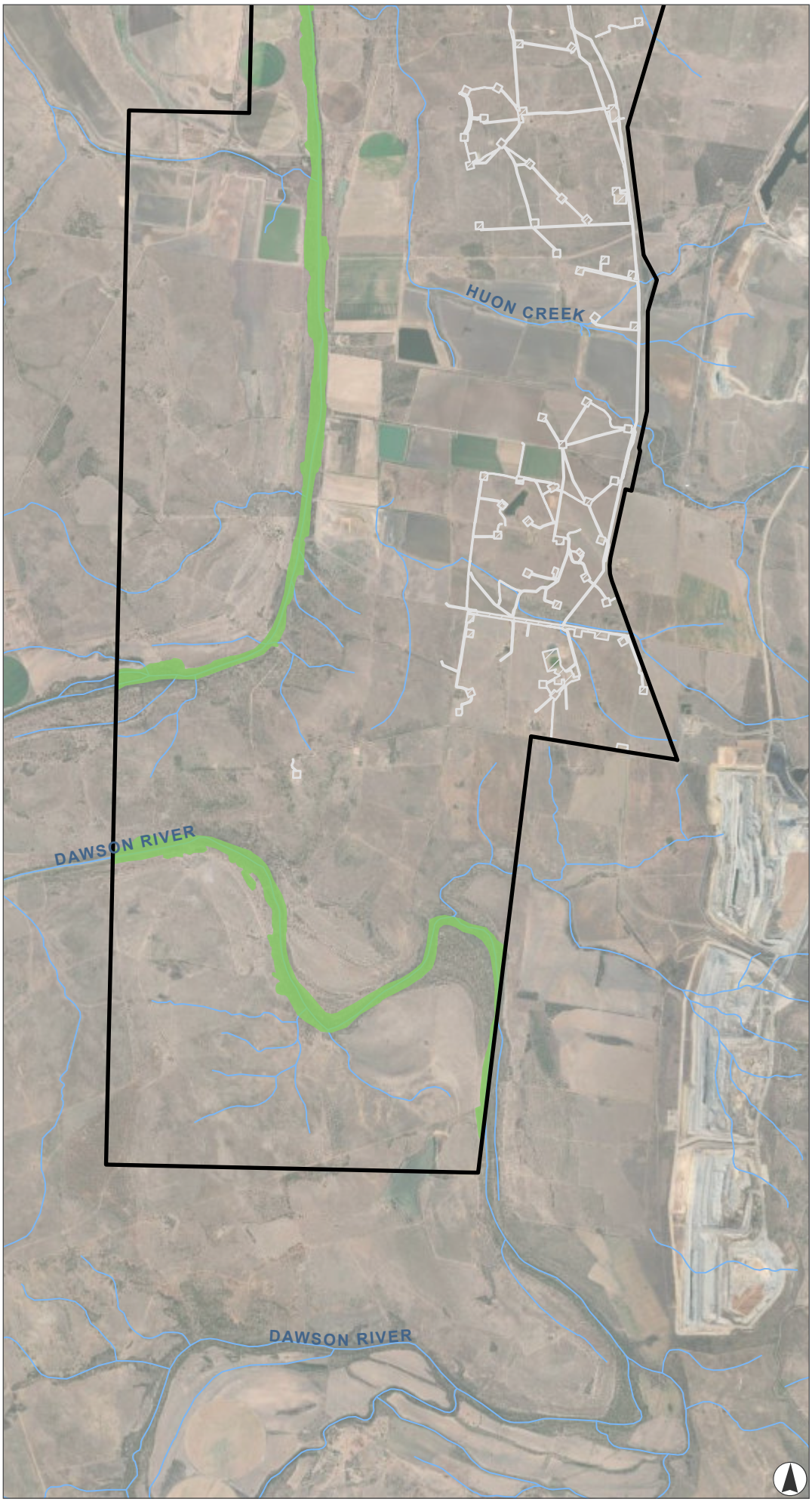


FIGURE 9.22C

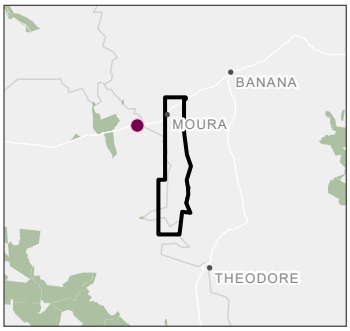
Fitzroy River turtle *(Rheodytes leukops)* Habitat and Records

Legend

- ALA Records of Fitzroy River Turtle
- Watercourse
- Project Area
- Existing Westside infrastructure

Fitzroy River Turtle habitat mapping

- Breeding, foraging and dispersal



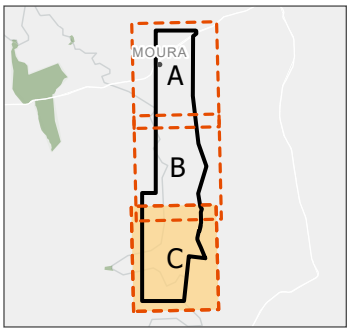


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FIGURE 9.23A

Boggomoss snail *(Adclarkia dawsonensis)* Habitat and Records

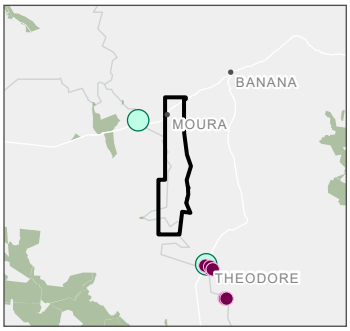


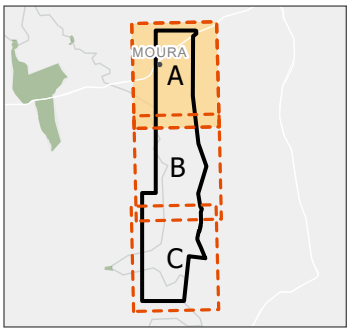
Legend

- ALA Records of Boggomoss Snail
- Weir
- Watercourse
- Project Area
- Existing Westside infrastructure

Boggomoss Snail Habitat

- Breeding and foraging





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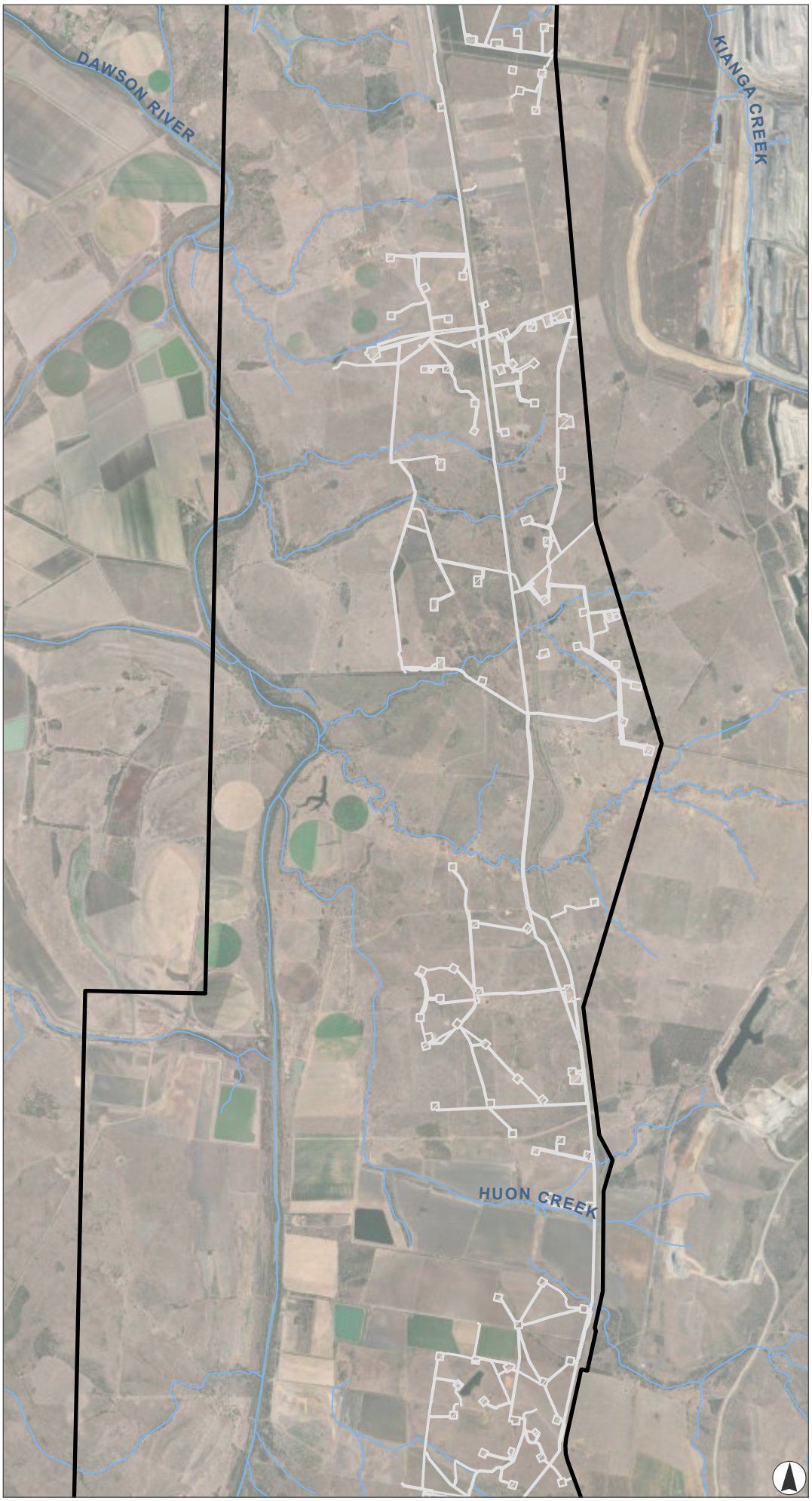


FIGURE 9.23B

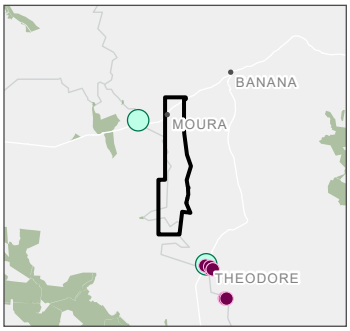
Boggomoss snail *(Adclarkia dawsonensis)* Habitat and Records

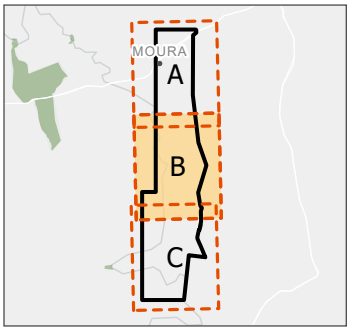
Legend

- ALA Records of Boggomoss Snail
- Weir
- Watercourse
- Project Area
- Existing Westside infrastructure

Boggomoss Snail Habitat

- Breeding and foraging





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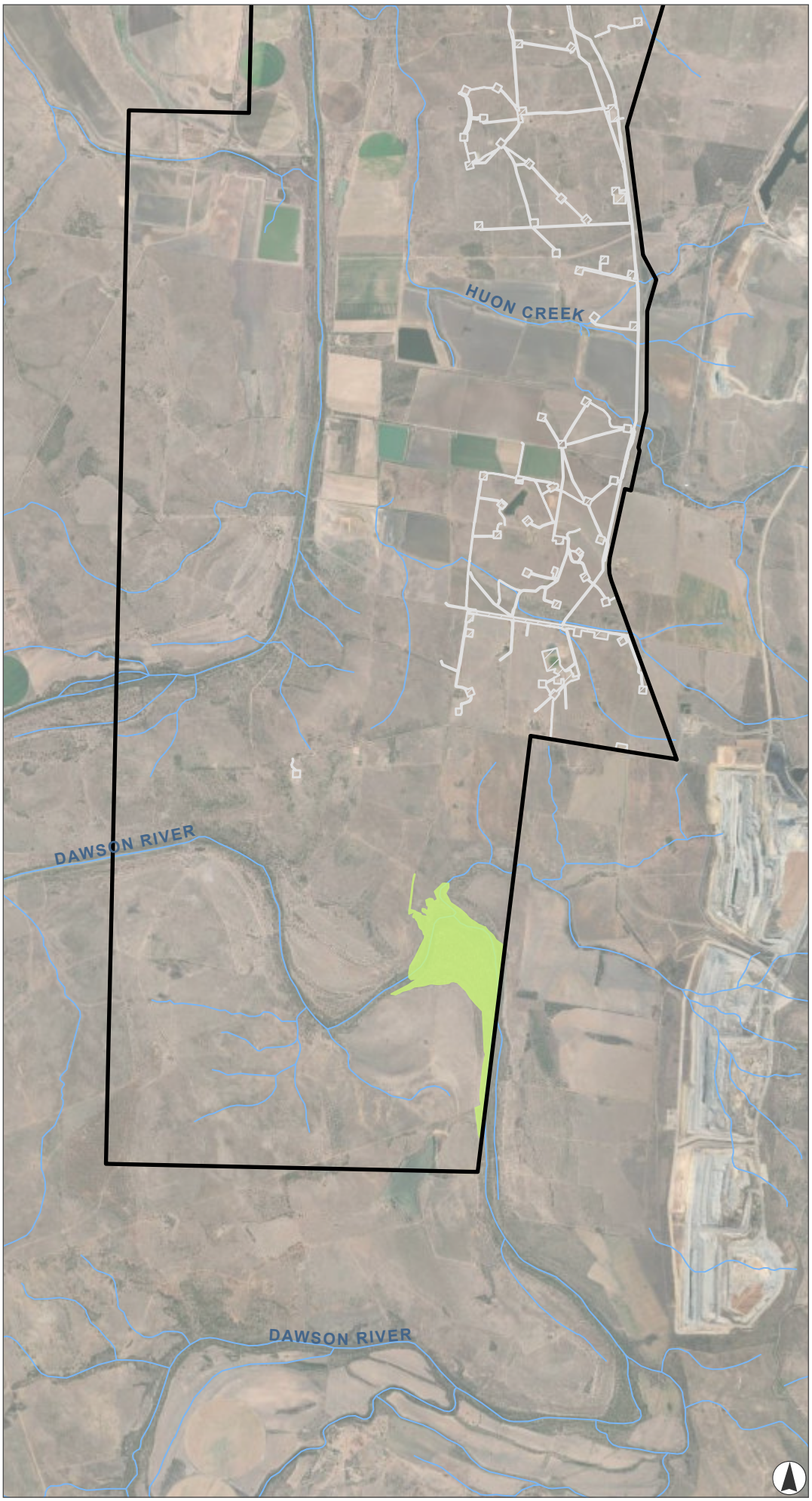


FIGURE 9.23C

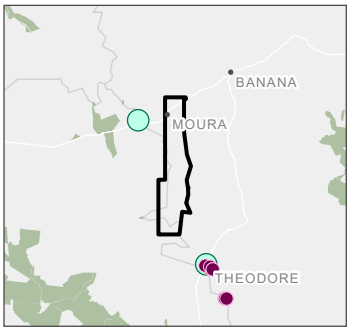
Boggomoss snail *(Adclarkia dawsonensis)* Habitat and Records

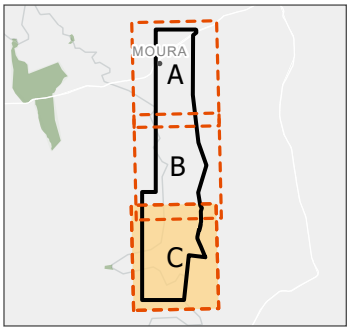
Legend

- ALA Records of Boggomoss Snail
- Weir
- Watercourse
- Project Area
- Existing Westside infrastructure

Boggomoss Snail Habitat

- Breeding and foraging





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DOCUMENT TITLE

Westside Corporation
Rehabilitation Management Plan

DOCUMENT DETAILS

Dept. Origin	Environment
Document #	WCL-0000-HS-PLN-011
Intranet Folder	Health, Safety, Environment & Risk
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1. Introduction

1.1 Project description

Westside Corporation Limited (Westside) operates a number of Petroleum Leases (PL), Pipelines (PPL) and Authorities to Prospect (ATPs) which are held by wholly-owned subsidiaries of Westside and their respective joint venture partners. The operations include the following tenures:

- PL94
- ATP769
- ATP 688
- PPL61
- PL1048
- ATP2027 (PLA1050)
- ATP602 (PLA1061)
- PPL182
- PL1049
- ATP2047
- PPL26

The Westside tenures are primarily located within the Banana Shire, located in the Bowen Basin in Central Queensland near the township of Moura. The fields are located directly to the west of, and in parts overlap, the Anglo Coal Dawson Coal Mine mining leases (the co-development area) which occupy a 30km long north-south length section adjacent to PL94. This Rehabilitation Management Plan has been prepared to cover all tenures; however please note that recent updates have been made focusing on the final 350 well heads for PL94 which is being assessed by the Department of Climate Change, Energy, the Environment and Water.

Westside tenure outside the Banana Shire includes ATP 688, which is within the Bowen Basin and approximately 110km west of Mackay. ATP 2047 is also within the Bowen Basin and is 20km east of the township of Taroom.

Westside Queensland tenures are depicted in Figure 1 below.

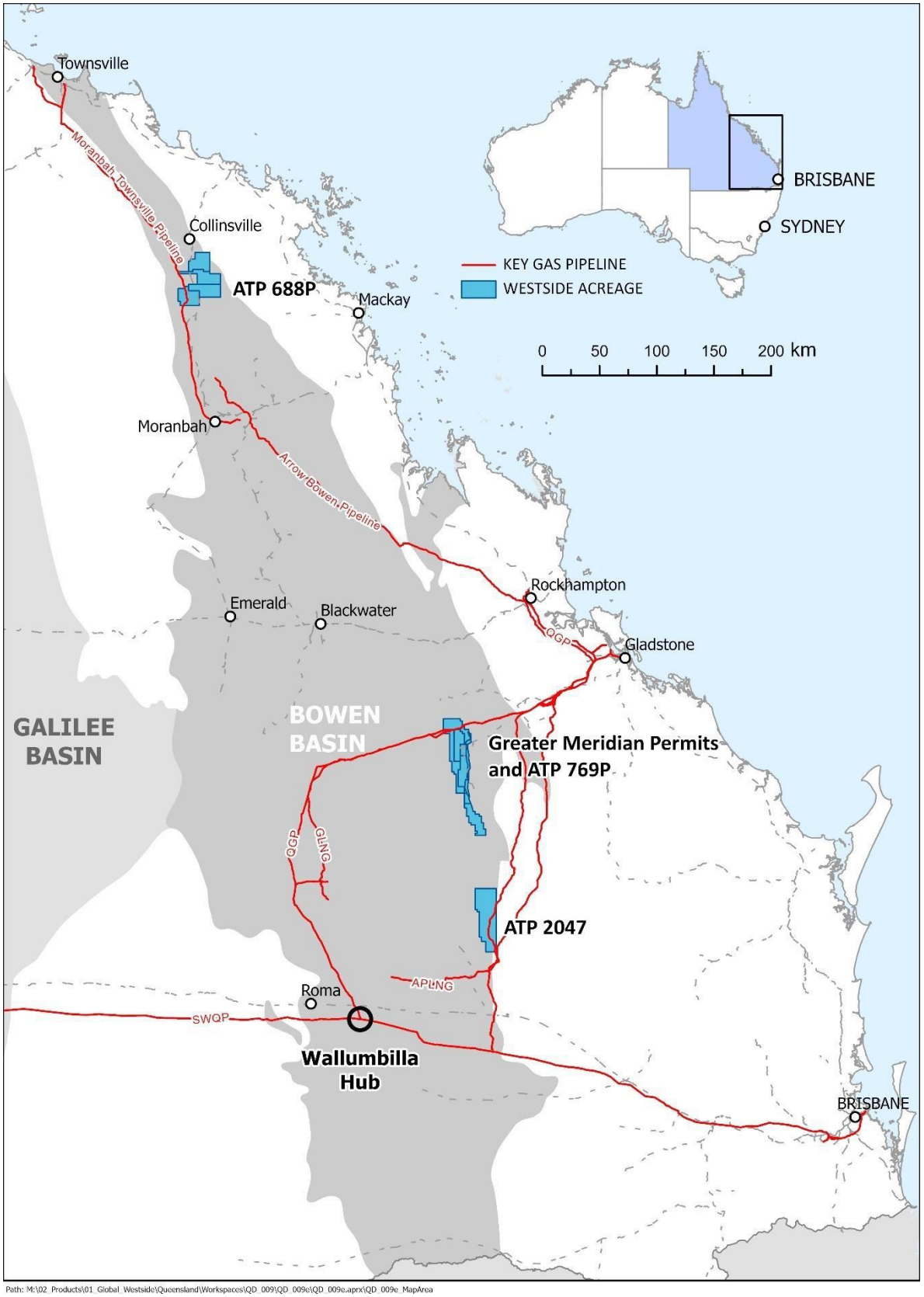

Figure 1 – Location map for Westside Tenure Areas

The Environmental Authorities (EAs) that this Rehabilitation Plan covers includes:

- EPPG00783713 (PL94)
- EPPG00622613 (ATP2027)
- EPPG00805913 (ATP602)
- EPSX01908114 (PPL182)
- EA002230 (PL1048 & 1049)
- EA0002048 (ATP2047)
- EPPG00551013 (PPL26)
- EPPG00693213 (ATP769)
- EPPG00704113 (ATP688)
- EPPG00486113 (PPL61)

EPPG00783713 permits well stimulation techniques such as hydraulic fracturing. It is not Westside's preferred approach, but it may be used in vertical wells as part of the completion of a well in PL94 to improve the gas flow rate. Such stimulation will be undertaken in accordance with the above EA and any associated regulations will be complied with.

The authorised petroleum activities to be carried out under the EAs generally includes:

- Seismic
- Exploration, appraisal and production wells
- Gas and water gathering networks
- Water treatment plants
- Gas sales pipelines
- Compressor stations
- CSG water containment facilities
- Laydown and stockpile areas
- Access tracks
- Workforce accommodation

2. Purpose

This Rehabilitation Management Plan ('plan') has been prepared to address rehabilitation activities within the Westside tenure areas. The plan has considered State Government legislation and approval conditions relating to rehabilitation activities. Specifically, this plan has been developed to address approval conditions within the relevant EAs. In addition, it also covers rehabilitation of EPBC matters, where applicable.

This plan has been prepared to describe how the Westside tenure areas will be rehabilitated following the cessation of petroleum activities, by providing the following:

- Rehabilitation strategy
- Rehabilitation criteria
- Rehabilitation methods
- Rehabilitation monitoring

Westside's rehabilitation efforts will aim to achieve a stable landform with self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas.

2.1 Document use

The function of this document is to identify the range of rehabilitation methods (section 4) that may be required to successfully undertake shaping and rehabilitation of land to a stable landform suitable for its designated land use. During the field development a variety of disturbance types (section 5) are undertaken and within this document the disturbance type is described and the rehabilitation objective outlined for the disturbance type, taking into consideration the rehabilitation methods from section 4.

Sections 7 identifies the methods to return land to a particular land use (pasture, cropping, native vegetation), identifying the variety of rehabilitation types and objectives that are necessary to achieve the designated land use and function. Section 8 identifies the success criteria to be used to identify if the rehabilitation has achieved the desired outcome. Section 9 covers the rehabilitation monitoring and reporting requirements.

3. Scope

3.1 Geographical extent

The Westside tenures listed in the project description are all located in the Queensland Bowen Basin. The tenures stretch from Collinsville in the north to Taroom in the south. The total tenure covers approximately 323,324 ha in the regional councils of Banana Shire, Western Downs Regional Council and Whitsunday Regional Council.

3.2 Land uses and tenure

The underlying land tenure within the Westside tenements is mostly freehold, with leasehold, reserve and State land also present. Land tenure is shown in Tables 8 – 16.

The dominate land use within the Westside tenures is agriculture with grazing as a significant portion of the agricultural activity as indicated in Tables 1 - 8.

Table 1: Land usage within ATP 2027

Total area (ha)	**50,505**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.45
Grazing natural vegetation/minimal use	88.58
Industry, manufacturing, utilities, transport and stockyards	1.99
Dry-land cropping	5.72
Irrigated cropping	1.60
Reservoir/dam/wetlands	10.54

Table 2: Land usage within ATP 2047

Total area (ha)	**74,200**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.01
Grazing natural vegetation/minimal use	96.24
Industry, manufacturing, utilities, transport and stockyards	0.16
Dry-land cropping	3.58
Irrigated cropping	0
Reservoir/dam/wetlands	0.02

Table 3: Land usage within ATP 602

Total area (ha)	**21,342**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	1.52
Grazing natural vegetation/minimal use	93.21

Industry, manufacturing, utilities, transport and stockyards	1.84
Dry-land cropping	2.84
Irrigated cropping	0
Reservoir/dam/wetlands	0.59

Table 4: Land usage within ATP 688

Total area (ha)	**95,937**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	3.96
Grazing natural vegetation/minimal use	94.79
Industry, manufacturing, utilities, transport and stockyards	0.22
Dry-land cropping	0
Irrigated cropping	0
Reservoir/dam/wetland	1.02

Table 5: Land usage within ATP 769

Total area (ha)	**23,391**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.06
Grazing natural vegetation/minimal use	91.26
Industry, manufacturing, utilities, transport and stockyards	1.12
Dry-land cropping	4.81
Irrigated cropping	1.33
Reservoir/dam/wetland	1.43

Table 6: Land usage within PL1048

Total area (ha)	**19,500**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.71
Grazing natural vegetation/minimal use	91.95
Industry, manufacturing, utilities, transport and stockyards	3.05
Dry-land cropping	3.8
Irrigated cropping	0
Reservoir/dam/wetland	0.49

Table 7: Land usage within PL1049

Total area (ha)	**17,500**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.04
Grazing natural vegetation/minimal use	93.07
Industry, manufacturing, utilities, transport and stockyards	1.36

Dry-land cropping	3.9
Irrigated cropping	0.68
Reservoir/dam/wetlands	0.94

Table 8: Land usage within PL94

Total area (ha)	**20,949**
Land use category	**% of development area**
Nature conservation (national park/other conserved area)	0.22
Grazing natural vegetation/minimal use	93.07
Industry, manufacturing, utilities, transport and stockyards	1.77
Dry-land cropping	3.14
Irrigated cropping	1.25
Reservoir/dam/wetland	1.42

The predominant land tenure in the development area is freehold, with the exception is ATP688 where leasehold is the dominant land tenure. The percentage of the total areacomprised by each land tenure category is summarised in Tables 8 – 16.

Table 9: Land tenure within ATP 2027

Tenure category	**% of development area**
Freehold	90.16
Leasehold	3.85
Reserve	0.65
State Forest	0
State Land	0.11
Roads and Easements	5.23
Water resource	0

Table 10: Land tenure within ATP 2047

Tenure category	**% of development area**
Freehold	65.18
Leasehold	26.62
Reserve	0.55
State Forest	5.37
State Land	0
Roads and Easements	2.28
Water resource	0

Table 11: Land tenure within ATP 602

Tenure category	% of development area
Freehold	82.58
Leasehold	10.84
Reserve	0.34
State Forest	0
State Land	0
Roads and Easements	1.53
Water resources	0
Profit a Prendre	4.71

Table 12: Land tenure within ATP 688

Tenure category	% of development area
Freehold	25.72
Leasehold	67.85
Reserve	0.14
State Forest	0
State Land	0.97
Roads and Easements	5.32
Water resource	0

Table 13: Land tenure within ATP 769

Tenure category	% of development area
Freehold	85.11
Leasehold	10.54
Reserve	1.36
State Forest	0
State Land	0.02
Roads and Easements	2.97
Water resources	0

Table 14: Land tenure within PL1048

Tenure category	% of development area
Freehold	96.38
Leasehold	1.14
Reserve	0.22
State Forest	0
State Land	0

Roads and Easements	2.15
Water resources	0

Table 15: Land tenure within PL1049

Tenure category	% of development area
Freehold	86.58
Leasehold	5.91
Reserve	0.58
State Forest	0
State Land	0.1
Roads and Easements	6.52
Water resources	0

Table 16: Land tenure within PL94

Tenure category	% of development area
Freehold	81.27
Leasehold	10.42
Reserve	0.58
State Forest	0
State Land	0.18
Roads and Easements	0
Water resources	0

4. Rehabilitation methods

4.1 Rehabilitation hierarchy

The overall goal of rehabilitating significantly disturbed areas that are no longer required for petroleum activities is to achieve the pre-disturbance land use – unless otherwise agreed with the landholder or other overlapping tenure holder and approved by the State government administering authority.

All significant disturbances are to be rehabilitated in a way that will meet the final acceptance criteria when compared to the adjacent land use or pre-disturbance land use – unless there is an alternative intended land use to be utilised by the landholder or an overlapping tenure holder. The alternative option away from the final acceptance criteria does not apply if the disturbance is a category A, B or C environmentally significant area where specific rehabilitation objectives are to be achieved.

Final rehabilitation goals will be determined according to the following hierarchy, in order of preference and prior condition:

1. Reinstatement and rehabilitation of the pre-disturbance land use.
    a) Where existing pre-disturbance: reinstating a self-sustaining and progressive native ecosystem with predominant species of the ecologically dominant layer where disturbance occurred within an environmentally sensitive area.
2. Establishing an alternative outcome for a higher environmental value than the prior land use
3. Reinstatement of the prior land use such as for the purpose of grazing or cropping
4. Establishing a beneficial use where land is intended to be utilised by the landholder or an overlapping tenure holder.

4.2 Reinstatement objectives

Reinstatement refers to restoration and stabilisation of land following project disturbance or maintenance activities to establish a stable landform suitable for the operational phase of the project. Reinstatement is a precursor to rehabilitation. Reinstatement is evaluated using criteria for progressive rehabilitation defined in the gas field Environmental Authorities.

4.3 Rehabilitation planning

4.3.1 Reinstatement planning

A site specific reinstatement plan will be developed by a suitably qualified person, addressing site specific measures to be implemented as part of the construction works to establish a stable area for the operational land use and support achieving the final rehabilitation objectives.

The site specific rehabilitation plan must include the following:

- Reinstatement and/or rehabilitation land use in accordance with the rehabilitation hierarchy
- Revegetation species and methods
- Land stabilisation and soil amelioration requirements

4.3.2 Final rehabilitation planning

A site specific decommissioning and rehabilitation plan will be developed by a suitably qualified person, addressing the site specific measures to be implemented as a part of the decommissioning and rehabilitation works to maintain/establish the desired operational land use. Attention to the environmental requirements are:

1. Exploring opportunities for reuse or retention of infrastructure for a beneficial use
2. Removing surface and/or underground infrastructure that may impede final rehabilitation
3. Decontaminating and rehabilitating surroundings, and as required from disturbance
4. Stabilising the landform and revegetating with consideration to the rehabilitation objective (e.g. pasture, cropping or native vegetation establishment)
5. Rehabilitation methods

For many infrastructure types, certain areas will be required to remain treeless during operations or may be intended to be utilised by the landholder or an overlapping tenure holder. These areas will be reinstated after construction.

It is important to recognise the rehabilitation objectives described in section 4.2 are applied only where they can be achieved for operating infrastructure or decommissioned infrastructure. Reinstatement may involve the return of soil, mulch, re-seeding with pasture grasses or native grasses and ground cover species or reliance upon natural regeneration. In some situations final reprofiling of the land form may not take place during reinstatement. An example of this is a well pad where a cut and fill is required to create a level surface for infrastructure, operational and maintenance requirements, and the well pad is required to remain open and free of shrubs and trees during operations.

Final rehabilitation may include return of woody native vegetation, where required in an environmentally sensitive area. This will take place once infrastructure is no longer required and is decommissioned. Any decommissioning plan for infrastructure should be informed by all environmental requirements.

4.4 Vegetation clearing

Woody vegetation will be collected during vegetation clearance for replacement and used during reinstatement. The following requirements must be adhered to for the clearing and stockpiling of vegetation:

- Prior to commencing clearing in timbered areas, consult with the landholder to agree any timber harvesting requirements such as setting aside felled logs for landowner use
- Habitat features including logs, hollow bearing trees and rocks will be identified and retained for habitat recreation through relocation adjacent to the disturbed area
- Woody vegetation (other than habitat features) will be use in rehabilitation
- Cleared vegetation must be stockpiled to facilitate spreading or salvaging within the disturbance area in a location that facilitates later use in rehabilitation. Gaps will be left in stockpiles to avoid impeding vehicle, stock or wildlife movements
- Vegetation stockpiles will be managed to reduce fire fuel loads at the base
- Vegetation stockpiles are to be stored separately to subsoils and kept free of waste and weeds

- Cleared vegetation should be stockpiled separately from topsoil where practicable and necessary to preserve topsoil
- Vegetation stockpiles will not be placed where they could obstruct flow or be washed away in a flow event
- Fire breaks will be established around non-linear and longer-term vegetation storages

4.5 Waste management and removal

Waste products with no further use may be generated during the rehabilitation process. All waste will be removed on the completion of rehabilitation and appropriately disposed of, including flagging, signage, surplus pipeline, litter, tree guards and stockpiles of unsuitable or surplus material.

Opportunities to eliminate the generation of wastes from the rehabilitation process will be sought through the monitoring of the types and volume of wastes generated with a view to substitute a product/or material where possible. Opportunities to reuse waste streams or recycle wastes whether internally or via an external service provider will be assessed. Where no other option is available wastes are to be disposed of in accordance with the relevant regulatory requirements and the requirements of the Westside Environmental Management Plan.

4.6 Natural regeneration

Trees and shrubs will be allowed to regenerate naturally on cleared areas not required to be kept tree free for the purpose of operation and maintenance, where this is consistent with the final land use objective. This will reduce barriers to fauna movement, especially to ground-dwelling fauna.

4.7 Soil management

4.7.1 Soil management groups

A range of soil types occur across the Westside tenures. For the purposes of this Rehabilitation Plan, the wide range of soils has been amalgamated into a series of soil groups (Table 17). Each soil group consists of soil types that have similar profile features as well as similar chemical and physical properties.

Table 17: Soil management groups

Major group	Soil family	Brief description	ASC (Isbell & NCST, 2016)
Alluvial soils	Clematis	Uniform coarse textures	Tenosols, Dermosols, Ferrosols
	Warrinilla	Medium to fine textures on coarse-textured substrata	Tenosols, Kandosols, Dermosols
	Moolayember	Coarse to medium textures on fine-textured substrata	Tenosols, Dermosols, Ferrosols, Kandosols
	Consuelo	Stratified soils with coarse- to fine-textured layers	Rudosols, Tenosols, Dermosols
Cracking clay soils	Teviot	Dark grey to very dark grey-brown, self-mulching soils on various sedimentary rocks (>90 cm)	Vertosols

Major group	Soil family	Brief description	ASC (Isbell & NCST, 2016)
	Pegunny	Gilgaied, very deep, mainly dark grey-brown soils on Tertiary weathered zone materials	Vertosols
	Rolleston	Non-gilgaied, deep, dark grey-brown to black soils on Tertiary weathered zone materials	Vertosols
	Vermont	Dark grey to grey-brown soils on alluvial materials	Vertosols
Dark, brown and grey-brown soils	Kinnoul	Shallow, uniform, medium- to fine-textured soils, alkaline subsoils	Dermosols, Ferrosols
	Cheshire	Deep, uniform or gradational, medium- to fine-textured soils, moderately to strongly alkaline subsoils	Dermosols, Ferrosols, Vertosols
	Carraba	Deep, uniform or gradational, medium- to fine-textured soils, strongly acid subsoils	Dermosols
Texture-contrast soils	Southernwood	Shallow soils (<60 cm), sandy or loamy surface soils, acid to mildly alkaline subsoils	Kurosols, Sodosols, Chromosols
	Medway	Shallow soils (<60 cm), sandy or loamy surface soils, moderately to strongly alkaline subsoils	Sodosols
	Taurus	Moderately deep to deep soils (>60 cm), thin sandy surface soils (<40 cm), moderately to strongly alkaline subsoils	Sodosols
	Luxor	Moderately deep to deep soils (>60 cm), thick sandy surface soils (>40 cm), acid to mildly alkaline subsoils	Kurosols, Sodosols, Chromosols
	Wyseby	Moderately deep to deep soils (>60 cm), thin loamy surface soils (<40 cm), acid to mildly alkaline surface soils	Kurosols, Sodosols, Chromosols
	Retro	Moderately deep to deep soils (>60 cm), thin loamy surface soils (<40 cm), moderately to strongly alkaline subsoils	Sodosols
Red and yellow earths	Dunrobin	Loamy red earths	Kandosols
	Struan	Loamy yellow earths	Kandosols
Uniform coarse-textured soils	Highmount	Deep sandy soils (>90 cm)	Rudosols, Tenosols
Shallow rock soils	Rugby	Very shallow, uniform, medium- to fine-textured soils	Rudosols, Tenosols, Dermosols, Ferrosols, Calcarosols

The Westside tenures are located in the Brigalow Belt North bioregion, Dawson River Downs subregion, in central Queensland. The Brigalow Belt North bioregion covers an area of 59,824 km^2 and is comprised of rugged ranges and alluvial plains. Dawson River Downs is an undulating area with outcrops of Tertiary and Bowen Basin sediments. Tertiary soils form flat to undulating plains and are dominated by brigalow (*Acacia harpophylla*) and softwood vegetation communities, and the exposed rocks of the underlying sedimentary basin form plains and hills with softwood scrub.

4.7.2 Topsoil management

Topsoil contains the majority of nutrients and water required by plants and supports seed growth and germination. The chemical and physical properties of topsoil can be easily altered by handling and storage methods.

For the proposed infrastructure site clearance and construction involving stripping of topsoil and associated vegetation to create areas for the new infrastructure. This can result in the loss of topsoil quantity and quality through incorrect stripping, prolonged soil exposure, erosion, nutrient leaching and loss of fertility.

Prior to commencing soil stripping, it is necessary to plan the source of topsoil for rehabilitation to maximise direct re-spreading and to minimise the length of time that soil is stockpiled. Topsoils will be stripped with care, stripped topsoil will be re-used by application to areas where a similar soil type is required for rehabilitation. Where this is not practicable, the topsoil will be separated and stockpiled on-site in piles no greater than 2m high to maintain the biological integrity. Topsoil stockpiles will have appropriate erosion and sediment controls in place as per the IECA best practice guidelines. These controls may include upgradient clean water diversion bunds/drains, down gradient sediment fencing. The level of controls is determined by the individual site location..

Where any follow up rehabilitation work is proposed, a shortage of topsoil is inevitable in some areas. This is particularly the case in the shallow stony soils, shallow texture contrast soils, and those within soil where clay content is significant in the surface material. In such areas, additional topsoil may need to be sourced from zones with substantial topsoil depths or alternative management measures may be required to overcome the potential shortfall.

4.7.3 Subsoil stripping

The objectives of subsoil management are to:

- prevent contamination of topsoil
- prevent degradation of the subsoil structure
- ensure reinstatement in the correct location and in the correct order
- ensure effective management of unused subsoil.

Subsoil will be removed and stockpiled separately from topsoil to prevent blending with topsoil and, ideally, stockpiles will be located close to where they are sourced.

4.7.4 Stockpiling

The objectives of stockpiling are to:

- minimise damage to and maintain fertility of stockpiled material
- ensure soil is stockpiled in a manner that will preserve its biological and chemical integrity
- ensure soils are used for rehabilitation purposes ensure stockpiles have minimal impact on surrounding environmental values.

In cases where the subsoil must be disturbed, it is essential that subsoil and topsoil be stockpiled separately, with a separation distance to ensure they are not mixed during construction or rehabilitation works.

Any backfill/subsoil material not utilised may be stockpiled in locations approved by landholders or removed prior to topsoil placement. Designated subsoil and topsoil stockpile locations will be determined prior to construction work. The following actions will be implemented when creating stockpiles, although site specific requirements, determined from analogue surveys, will be implemented where necessary as determined by the Environment Advisor in precedence to those outlined below:

- Topsoil stockpiles within strategic cropping land (SCL) will be managed in accordance to relevant approvals
- Gaps will be left at appropriate intervals to allow for drainage, and permit the movement of vehicles and fauna
- Topsoil stockpiled for an extended period (longer than three months) should be revegetated as soon as possible, by direct seeding with grasses to maintain biological activity and prevent weeds from growing, and to prevent soil loss through erosion, with consultation with landholders
- Where both topsoil and subsoil are stripped and stockpiled, topsoil stockpiles will be clearly sign-posted for easy identification and to avoid any inadvertent losses
- Topsoil will be stockpiled within well leases or right of ways (ROWs) and will not be stockpiled against fence lines or vegetation to be retained, and will be stockpiled separately from mulch
- Weeds on the stockpiles will be monitored and controlled to prevent establishment and spread
- Soil will be stockpiled close to where it is stripped in a manner that does not block diversion or natural drainage flow paths
- Long-term stockpiles will be located above historic flood levels (Q50) where possible
- Stockpiles will be located where they will not be disturbed by other activities
- Erosion and sediment control measures will be implemented where stockpiles are to be located within 200m of watercourses to prevent contamination of waterways.

4.7.5 Backfilling

The following actions will be implemented in backfilling of pipeline trenches:

- Pipeline trenches will be backfilled as soon as practicable after pipe laying
- Backfilled excavations should be suitably compacted to prevent subsidence while not impeding establishment of vegetation
- Excavated subsoils will be used for backfilling
- Backfill materials (i.e. padding sand and subsoil) will not be contaminated with general rubbish or any foreign material
- Subsoils will not be used as a surface capping layer
- Topsoil will not be used for backfill.

The following actions will be implemented in backfilling of trenches and other areas, although site specific requirements will be implemented where necessary in precedence to those outlined below:

- Pipeline trenches will be backfilled within three months after pipe laying

- During backfilling of pipeline trenches, soil must be replaced so that soil topsoil has limited mixing with subsoils
- Subsoil will not be contaminated with general rubbish or any foreign material
- Topsoil will not be used for backfill
- A suitable, clean backfill material will be imported where subsoils cannot be reused
- Excess subsoil material will be disposed of appropriately or stockpiled for use in future rehabilitation or respread elsewhere in consultation with landowners, avoiding mixing.

4.7.6 Re-profiling

The objective of re-profiling is to reinstate soils to a stable landform, which includes addressing the following landform design principles:

- Re-establishing surface drainage lines
- Reinstate the land to a land surface that is visually consistent with surrounding land features
- Re-profile to original contours and established drainage lines
- Minimise the potential for subsidence or erosion gullies to occur
- Replace top soil over subsoil.

Landform reinstatement involves surface contouring to create a stable land formation consistent with the surrounding landform. This ensures water flow over the surface is in cohesion with the surrounding landscape and minimises the risk of potential erosion. It also ensures that the final landform is consistent with the surrounding land features. Where required following decommission, surface contouring should be completed prior to re-spreading of topsoil. Contouring should pay particular attention to drainage lines for surface water flows to ensure erosion potential is minimised.

Earthworks may have impacted the existing landform through the re-profiling of local topography, alteration of drainage paths and soil de-stabilisation. In turn, this could change the local drainage patterns, visual character and degrade downstream water quality. General mitigation measures will be addressed throughout the Westside tenures to minimise potential impacts. These measures are:

- In areas of site leveling works, proposed formation levels will be set to reduce the need for significant cut and fill areas
- In areas where access tracks have been constructed the landform will be re-profiled to establish a landform consistent with the surrounding landscape and ensure it is in a stable condition
- Re-use of construction materials will be implemented to minimise the volume required from borrow pits
- Pipeline backfill and compaction of the fill will be controlled to minimise subsidence and the need for excessive temporary soil mounding.

4.7.7 Ripping and scarification

Prior to the re- spreading of the topsoil (where it has been retained), the ground surface may be ripped. Ripping assists with binding of the soil layers, increases retention time of water on the slope, aids water infiltration intothe soil increasing the opportunity of seed germination success and reduces the volume and velocity of runoff generated from the slope. Ripping may be undertaken along contours, particularly on heavily trafficked areas such as temporary access tracks, camps and hardstands and other areas compacted by construction activities. Areas with hard-set mud or clay such as drilling mud pits may also be ripped. Ripping depth should be reduced to no greater than 400mm in areas where pipelines are buried, as ripping any deeper could potentially result in the rupture of buried pipelines.

After topsoil is spread the surface may be lightly scarified to assist with relief of compaction, binding of the soil layers, water penetration and plant establishment. Scarification should be completed prior to seeding (after topsoil is spread) and should ensure no subsoil is ripped to the surface. The scarification should be completed using the rear mounted ripping tyres of a grader or a purpose designed harrowing implement rear mounted on a tractor. Scarification can also be achieved by ploughing of the sub-surfacematerial prior to topsoil reinstatement. A figure eight or zigzag rip lines may be appropriate to preventrill erosion in flat to low gradient areas.

4.7.8 Soil amelioration

Soil amelioration may be required where grazing and cropping is the final desired land use, as the addition of fertiliser to soils required for native vegetation may not be beneficial to native species and could instead create conditions suitable for weed growth. Soil amelioration techniques that may be used include:

- Addition of organic or inorganic fertilisers
- Addition of gypsum or lime
- Incorporation of mulch, compost or other organic matter.

4.7.9 Topsoil re-spreading

For all disturbances where soil has been removed, soil preparation may include the re-application of topsoil from the original clearing. Where applicable, topsoil will be re-spread to the following specifications, although site specific requirement will be implemented where necessary as determined by the Environment Advisor in precedence to those specifications outlined below:

- Topsoil will be respread over watered and scarified or ripped subsoils in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated
- Topsoil is to be spread back over in an even layer and left ‘rough’ (rather than smooth and compacted) to minimise potential erosion, increase water infiltration and to trap seed or alternatively will be scarified as outlined in section 4.7.7
- Topsoil will cover the entire width of the disturbed area so that there is no exposed sub-surface material. This will ensure seeding and germination has the best opportunity to ‘take’, enabling establishment of groundcover with weather permitting
- A greater amount of topsoil may be re-spread over exposed areas if conditions permit

- If insufficient topsoil exists, additional materials may be sourced from other locations but confirmation of the source and quality, including that it is weed free, must be obtained by the Environment Advisor. The importing of topsoil must be approved by landholders
- Topsoil application will only take place following initial reinstatement of the subsoil, construction of contour banks on steep slopes and compaction of subsoils to account for subsidence
- Topsoil stockpiled for extended periods will be turned over and mixed prior to replacement. However, this is only required if thorough mixing is unlikely to occur during re-spreading
- Vehicle movement will be restricted following topsoil re-spreading.

4.8 Erosion and sediment control

Erosion can have an adverse effect on soil productivity and the associated agricultural value. Additional effects can include, but are not limited to, undermining of structures (such as fences), exposure of pipelines, stream bank erosion, downstream sedimentation, and decline in fertility through loss of soil structure, and increased dust generation and poor rehabilitation. Further rehabilitation works may be required to stabilise eroded areas.

Erosion levels are expected to be more significant in the coarser textured soils, where there is little structure and organic matter to assist in binding the soil. Deep clay soils have a low to moderate erosion rating where undisturbed. However, as the subsoils can be sodic to strongly sodic, these soils will erode due to clay dispersion where soil is exposed through vegetation removal. Such soils can be particularly prone to gully and tunnel erosion.

Where applicable, the following erosion and sediment control measures are proposed:

- Where diversion of runoff water around an infrastructure site is required, design will need to be mindful of possible erosion effects, including the instigation or exacerbation of gully and tunnel erosion
- Sediment basins will be constructed on the downhill side of major facility sites, such as temporary accommodation facilities, when they are near sensitive water courses
- Drainage lines and areas of concentrated water flow near major facilities will be inspected regularly for erosion and to determine whether remedial action is required
- Sediment and erosion control measures and areas receiving concentrated flows will be inspected on a regular basis, replaced where damaged and emptied following rainfall events, if required
- Erosion and sediment control measures, such as contour banks, will be placed at frequent intervals along flow paths, where appropriate, and multiple discharge locations will be created to ensure discharges have low velocities and volumes, rather than channelling discharges to a central point, which can exacerbate erosion
- Point source discharges of runoff will be directed into stable waterways and/or drainage lines with engineering controls, such as scour protection and flow velocity limits, where required
- Vegetation will be progressively cleared to minimise the area of soil exposed
- Slopes will be re-vegetated as soon as possible after disturbance
- Stockpiles and/or exposed soil areas, such as unsealed access tracks, which are exposed for prolonged periods or have been identified as problem soils (erosive/dispersive) will be stabilised

as required. This will be done using chemical surface stabilisers, physical alternatives such as crushed rock, or direct seeding with grasses

- Diversion and erosion and sediment control devices will be fully implemented to provide effective erosion control prior to land disturbance activities, and will be kept in place and maintained fully functional until the area has been effectively rehabilitated
- Tracks will preferably be aligned across slopes, but where this is not possible, contour banks will be used at intervals appropriate to the slope and soil type to control the flow of surface water
- Where pipelines are located along slopes, trench breakers will be installed in the backfill at intervals appropriate to the steepness of the slope to prevent water tunnelling along the buried pipe and contour banks will be installed on the surface to divert water away from the disturbed areas
- Erosion and sediment control devices are to be constructed in accordance with *IECA Best Practice Erosion and Sediment Control Guidelines 2008*.

Site specific erosion and sediment control plans will be prepared by a suitably qualified person to direct the application of erosion and sediment control measures. Erosion and sediment control plans will identify the measures undertaken to manage erosion and sediment, the type and location of erosion and sediment control devices and management.

The construction and monitoring of erosion and sediment control devices to ensure they are installed and appropriately designed to the specifications of the site specific erosion and sediment control plans will be the responsibility of the principle contractor on-site who has suitably qualified personnel to inspect and monitor the operation of erosion and sediment control devices.

Inspection and maintenance of erosion and sediment control devices will be the applicable method in mitigating effects to water quality downstream from these devices. Water quality monitoring may be conducted downstream from erosion and sediment control devices if there is a major weather event based failure of the erosion and sediment control device.

4.9 Revegetation

4.9.1 Pasture establishment

For progressive rehabilitation or decommissioning, areas where grazing or cropping is the required final land use will be sown with appropriate pasture species as agreed with landholders e.g. via conduct and compensation agreements (CCAs). This will be undertaken irrespective of whether the site is to undergo re-instatement or final rehabilitation. Local native grasses such as *Dicanthium sericeum* (Queensland Blue Grass) may be used in some situations, such as where it is desirable to return an area to grazing on unimproved native pasture or stabilisation prior to revegetation.

A direct seeding method can be undertaken using a spreader attached to the rear of a tractor which delivers seed onto the soil. Seeding is to take place after ploughing, but before harrowing. When harrowing is undertaken after seeding, the seed is covered with a small layer of soil to assist in the germination process. Alternatively a drill seeder with press wheels may be used. In this case harrowing is not required as drilling allows the depth of seed burial to be controlled. Using machinery such as tractors on steep slopes should be

avoided. Hand seeding is recommended on steep slopes due to safety concerns regarding the use of machinery in these areas. Rehabilitation crews should assess each site on a case-by-case basis, according to the topography and level of risk involved if machinery is utilised. Hydro-seeding and hydro-mulching may be used on steep slopes to encourage more rapid revegetation, and therefore stabilisation of the rehabilitated area.

4.9.2 Seeding for reinstatement to achieve pre-disturbance condition

In situations where an area is required to remain treeless during operations such as gathering lines and pipelines, the species selected will include native grasses and groundcover species only if native vegetation is the final land use objective. If pasture or cropping is the final land use objective, the area will be seeded with pasture grasses as outlined in the above section.

4.9.3 Direct seeding of native species for final rehabilitation

The selection of species that will be used in the rehabilitation process where native vegetation is the final land use objective will be guided by adjoining undisturbed areas. Species selection will also be guided by soil conditions, micro-climate and aspect of the new land form. Seed will be sourced from reputable local seed suppliers that provide local provenance seed stock.

Where applicable, seeding is to be undertaken as soon as practicable after the topsoil has been re-spread and natural profile restored, and topsoil has been spread, but before spreading mulch. Sowing will take advantage of the most appropriate season for germination and establishment of seedlings (i.e. immediately before the commencement of the wet season). Direct seeding will be undertaken following the technique outlined in section 4.9.1 above.

Direct seeding with grasses may be undertaken in areas where the rapid re-establishment of vegetation cover is required (e.g. watercourse crossings, steep slopes and other potential high erosion areas). In such situations, and on batters and dam embankments, hydro-seeding or hydro-mulching may be undertaken to enable ground cover to establish rapidly on erosion prone areas. The need for hydro seeding and hydro-mulching will be assessed on a site-by-site basis. Native grasses or sterile exotic grasses must be used to ensure exotic grasses do not become established. Ground cover as a rehabilitation indicator will be monitored.

Where practicable fencing off from stock may be required, depending on adjacent land use, to facilitate revegetation and regrowth until site stability is established.

4.9.4 Planting

There may be certain situations where tubestock planting will also be required, such as where species unsuited to direct seeding must be established to meet the pre-disturbance vegetation conditions. Requirements for tubestock planting are as follows:

- Species to be selected for planting will be sourced from local provenance seed
- Tubestock will be planted in the early wet season (December – February)
- Spacing will be determined according to the species, but will typically be 2m apart for most tree species

- Tubestock will be watered immediately following planting
- Mulch will be placed around tubestock, but should not touch the stems
- Fencing will be required following planting to prevent browsing damage.

Where tubestock is required it should be obtained from local nurseries or contract grown locally. The seed for tubestock must be obtained from local provenance seed (refer to section 4.10 below). Tubestock must be free of weeds before planting.

Transplanting may be appropriate for certain species such as stoloniferous grasses and native species that sucker from an underground rhizome or other rootstock. This has the advantage of establishing a root system rapidly in erosion prone areas, and enabling some species that do not readily set seed to be re-established. However this can only occur where a suitable source of transplants is located nearby, for example an adjacent area that is to be cleared. In undertaking transplanting, the following should be considered:

- Undertake transplanting in the early wet season (December – February)
- Ensure that the source site is located close to the recipient site
- Ensure that soil is removed at sufficient depth with the transplant so as to retain most of the root system
- Ensure as much topsoil as possible is retained with the transplant
- Minimise the time between transplant removal and planting to prevent drying out
- Water transplants immediately following planting

4.10 Seed procurement

To meet Project requirements for direct seeding, seed will need to be purchased for pasture and native species, with a preference for local provenance seed of species adapted to local conditions. For pasture grasses, both native and exotic species will be considered in consultation with landholders.

Westside will ensure that seed is procured from parties that follow sound seed collection methodologies, such as *FloraBank Guideline 6: Native seed collection methods* (Mortlock and the Australian Tree Seed Centre, 1999). Such guidelines recommend the collection of good quality seed from an appropriate source, which is critical to the successful of the project planting programs. This will ensure that seed is collected in a sustainable manner, from well documented locations.

It is desirable that procured seed is collected as locally as possible, preferably from undisturbed naturally occurring remnant vegetation within the Project site, and in the vicinity of the intended rehabilitation areas. For this reason, seed may be procured from a range of individuals and organisations that have the local knowledge and site access, to be able to collect suitable local provenance seed.

When procured seed is not of local provenance, efforts should be made to match the key environmental characteristics of the intended rehabilitation sites, including rainfall, temperature and simple soil characteristics (e.g. soil texture).

Seed should be procured from parties that can vouch that the seed is of good genetic quality, viable and has been collected in a manner that supports this. Seed should have been collected from healthy and viable

natural populations. Where practical, collection should be from at least 10-20 plants widely spaced across individual populations.

4.11 Vegetation re-spreading

For new excavations in existing disturbances or proposed infrastructure where native vegetation and other fauna habitat elements (surface rocks and felled timbers) have been stockpiled, they will be re-spread after seeding as follows:

- Material will be evenly spread over the area to assist in the distribution of seed stock and provide shelter for fauna
- To prevent weed and soil pathogen spread and assist with appropriate re-vegetation and soil micro-organism recovery, topsoil, mulch and habitat elements will be sourced from salvage specific to that site
- Felled vegetation will not be burnt unless directed by the regulatory authority
- Any large logs or hollows will be returned to provide habitat for local species. On steep slopes these will be re-laid along the contour
- Mulch should be spread evenly once seeding and planting has been completed. It is important that mulch is spread in a thin layer (50mm or less). This will allow seeds to germinate and will not inhibit seed growth and therefore groundcover establishment. If the mulch is spread too thick, the seeds will take longer to germinate slowing the rehabilitation process
- If excess mulch needs to be utilised, contour banks and erosion control structures can be constructed using mulch instead of soil.

4.12 Weed management

4.12.1 Weed species

Declared weeds are present within the Westside tenures and are recognised weeds of national significance. Of particular importance are Parthenium (*Parthenium hysterophorus*), a Class 2 pest plant and a weed of national significance. Parthenium is known to occur within the Westside tenure areas and must be managed to prevent spread (section 4.12.2).

Some weed species are a potential threat to rehabilitation, given the nature of the proposed activities (particularly clearing and soil disturbance during construction).

4.12.2 Prevention of spread

Prevention is considered the most effective way of minimising the introduction of new weed species, and the spread of existing weed species across the project area. The movement of vehicles and plant equipment are significant contributors to the introduction and spread of weed species. Preventing weed introduction and spread will be achieved through:

- controlling access across the project area
- implementing vehicle hygiene procedures
- utilising existing and mobile vehicle wash down facilities

- regular mapping of weed infestations, and the sharing of this data across the broader project team
- training staff and contractors in weed identification and vehicle hygiene procedures
- managing known infestations that lie directly within, or adjacent to, the infrastructure sites.

Measures to prevent the introduction and/or spread of significant weed species across the project area and to the surrounding land are deployed by Westside. Westside utilises preventative measures for weed management in the first instance. Westside does rely on employees and contractors to follow the Vehicle and Mobile Plant Weed Hygiene Procedure, which aligns with the requirements under the *Biosecurity Act 2014*. Proactive weed treatment is also done in coordination with landowners' weed management programs.

4.12.3 Weed treatment

Priority weed infestations will be identified and will be the focus of treatment application works for the site to reduce the potential for these species to spread to new, unaffected areas across the Project area and to surrounding lands. Treatment applications will be selected on a species-by-species basis depending on the effectiveness of the application to control each species, the size and growth stage of each infestation and the timing of application. Surrounding land use and weather conditions will also be considered when choosing a treatment application.

Treatment applications may employ mechanical, chemical, biological and land management methods to reduce the size of infestations and minimise the potential to spread to new, unaffected areas.

4.13 Pest management

Pest animals have major economic, environmental and social impacts and can cause significant damage to crops and seriously affect Australia's livestock industries by preying on stock and competing for pasture as well as causing severe land degradation by promoting soil erosion, stream turbidity and the spread of weeds. Under the *Biosecurity Act*, it is a legal requirement of all landowners or landowning state agencies to control declared pests.

Pest animal species that are likely to be present include:

- *Oryctolagus cuniculus* (European Rabbit)
- *Sus scrofa* (Feral Pig)
- *Canis familiaris* (Wild Dogs including Dingoes and Dingo hybrids)
- *Canis vulpes* (Red Fox)
- *Felis catus* (Feral Cat)
- *Mus musculus* (Mice)
- Macropods.

Control of these pests will be undertaken by landholders. However, Westside will support regional pest control activities.

4.14 Fire prevention measures

The risk of bushfire is a concern of all landholders and rehabilitation works as a bushfire can severely impact upon all land uses. The damage to crops, fodder, buildings and other farm infrastructure from fire can be devastating to landholder livelihoods. The Westside tenure development must maintain the safety of people and property by either avoiding areas of high or medium bushfire hazard or by mitigating any introduced risk. Bushfire risk within Westside operations will be managed by utilising a variety of measures as follows:

- Monitoring of a bushfire weather forecasting to be able to forewarning neighbours of the bush fire risks around Westside activities
- Observation of fire bans for high risk days/seasons where practical
- Implement fire prevention measures during construction
- Selected staff and contractor bushfire education and training
- Preparation and implementation of emergency response plans tailored to individual situations
- Implementation of fire prevention, fire watch, and fire response procedures during construction and operation, particularly within forested areas
- Provision of fire breaks around major facilities, plant and equipment
- Cooperate with the Rural Fire Service and adjoining landholders in respect to any controlled burning
- Consultation with the Rural Fire Service and landowners on matters of mutual interest (e.g. defining which Westside dams can be used for fire water, and clearly sign posting dams that are unsuitable for firefighting purposes)
- Installation of emergency shutdown systems.

4.14.1 Fuel reduction

Landowners may have existing fire management controls at a property scale including fuel reduction to protect Landowners assets.

Fuel reduction may include any or a combination of the following; stick raking, slashing and burning of fuels or combination of any of these methods. On a long term basis, burning of adjacent timbered areas on a regular rotation to reduce the fuel loads and the consequent intensity of a wildfire passing through the area may be undertaken.

These activities are undertaken by landowners and Westside will assist by protecting our petroleum infrastructure during the fuel reduction burns. This may include cleaning up fire breaks, monitoring the control burn with firefighting equipment available to protect the petroleum infrastructure.

4.14.2 Ecological fire requirements

Fire sensitive plant communities are those that can be killed or severely damaged by fire. These communities contain species that are not adapted to fire and are therefore fire intolerant. Fire is not required as an ecological process to promote regeneration of species in such communities. Examples of fire sensitive vegetation types include Brigalow woodlands and Semi Evergreen Vine Thicket (SEVT) communities. In addition to plant communities, individual flora and fauna species and their habitats, including Commonwealth

and State listed Endangered, Vulnerable; Near Threatened (EVNT) species maybe prone to fire. As such, fire may need to be excluded from populations and habitats for ecological reasons providing health and safety is not compromised by the action. Individual Listed Species Management Plans, both for Threatened Ecological Communities (TECs) and listed EVNT species should be referred to for specific ecological fire requirements.

4.15 Ongoing rehabilitation maintenance

Following rehabilitation works, limited access to infrastructure will be allowed to perform essential maintenance requirements. All other traffic is prohibited on topsoil areas and should remain off the rehabilitation areas to enable successful establishment of groundcover. Fencing of rehabilitation areas may be required to prevent grazing, with fences to be removed once sufficient vegetation cover has established.

Maintenance will take place to ensure the following objectives are met:

- Landforms remain stable
- Erosion control measures remain effective
- Stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters
- Plants show healthy growth and recruitment is occurring
- Declared weed species are controlled on rehabilitated areas to a level consistent with the surrounding property and prevented from spreading to unaffected areas.

It will not be feasible to water all seeded areas, however creek banks and steep slopes may be selected for watering as identified by the Environmental Advisor as a high risk area. This will ensure groundcover is established and erosion is minimised. Wherever tubestock planting or transplanting is undertaken, follow-up watering may be necessary depending on climatic conditions with the focus to achieve sufficient groundcover. Watering is to be undertaken with water of a quality suitable for the purpose that meets EA standards and landscape requirements.

4.16 Rework

Upon decommissioning and final rehabilitation, sites not displaying stability or adequate vegetation cover through either regrowth or direct seeding may undergo re-seeding. Where further rehabilitation works are required the following will be undertaken dependent of the scale and type of rehabilitation undertaken as a minimum:

- Works will be conducted in consultation with the relevant landholder
- Re-contouring of erosion control measures, re-seeding, or reinforcement of scour protection on stream banks if damaged during flood activity
- Access will be restricted, with consideration of landholder access requirements, to facilitate rehabilitation has been successful
- If subsidence is observed, corrective actions will include backfilling of depressions and re-seeding as required
- Appropriate weed control will be undertaken as required.

5. Disturbance type

This section provides a summary of the types of infrastructure constructed or to be constructed, and where relevant, specific details for the rehabilitation of this infrastructure. Depending of the length of operation, rehabilitation may include reinstatement after installation only, or rehabilitation after the removal of infrastructure. Specific techniques for infrastructure types are summarised in Table 18.

Prior to the commencement of disturbance (i.e. vegetation clearing), and the final site selection, environmental, cultural heritage, landholder and engineering constraints will be addressed as per the Permit to Disturb process.

The disturbance type also creates a land use constraint resulting from the type of disturbance that has occurred. The infrastructure that has been put in place may prevent the land from being used for its original purpose, until such time as the infrastructure is decommissioned. However where the infrastructure is temporary, these land use constraints will be temporary.

For all disturbed areas, the various Environmental Authorities applicable to the Westside tenures requires that rehabilitation of disturbed areas must take place progressively and maintained as works are staged and new areas are disturbed this is to be achieved within 12 months after a significantly disturbed area is no longer required for petroleum activities.

Table 18: Rehabilitation techniques for infrastructure (disturbance) types

Infrastructure type	Rehabilitation technique
Seismic survey	• Allow slashed and mulched seismic survey lines to regenerate naturally • Where necessary or where heavy machinery has been used to clear a path, utilise suitable equipment to provide compaction relief
Well pads (production wells, exploration/appraisal)	• Reinstatement following the completion of drilling to reduce well pad to the operating footprint. Re-profiling will not occur at this time and progressive rehabilitation undertaken (section 5.2) • Revegetation with native grasses and ground cover species or pasture grasses (cropping or grazing) similar to adjoining undisturbed land (section 4.9). • On the completion of operations, undertake decommissioning and final rehabilitation, including re-profiling of cut and fill batters • Seed final rehabilitation areas where pasture grasses (cropping or grazing) as determined by adjoining undisturbed land (section 4.9.1)

Infrastructure type	Rehabilitation technique
Tanks and stimulation dams (that require earthworks)	**Tank** • Test the contents of the tank to determine the waste management strategy for the contents • Remove the contents of the tank for re-use, recycling or disposal depending on the analysis of the contents • Remove tank • Break up concrete • Site profiling: depressions filled to return landforms to match • Surrounding topography (section 4.7.6) • Topsoil re-spreading (section 4.7.9) • Revegetation in accordance with (section 4.9) **Stimulation Dam** • Test the contents of the tank to determine the waste management strategy for the contents • Remove the contents of the tank for re-use, recycling or disposal depending on the analysis of the contents • Remove synthetic liners • Management of clay core materials: where clay has been used in embankments or as a liner, this will be re-spread, shaped and capped with topsoil for revegetation or stockpiled for reuse • Site profiling: the dam embankments would be pushed in and depressions filled to return landforms to match surrounding topography. Any retained subsoil would be used to infill dams (section 4.7.6) • Topsoil re-spreading: Topsoil will be placed to a minimum depth of 250mm (section 4.7.9) • Revegetation in accordance with (section 4.9)
Gas and water gathering lines	• Allow portion of RoWs and ancillary activities (laydowns and stockpile areas associated with the RoWs) not required to remain open to regenerate naturally (section 4.9) • Remediate unnecessary laydown and stockpile areas (section 4) • Seed areas required to remain open with native grasses and ground cover species or pasture grasses (cropping or grazing) (section 4.9) • Seed areas not required to remain open with pasture grasses (cropping or grazing) (section 4.9)
Ancillary disturbances for laydown and stockpiling	• Allow ancillary activities (laydowns and stockpile areas) not required to remain open to regenerate naturally (section 4.9) • Remediate unnecessary laydown and stockpile areas (section 5.5) • Seed areas required to remain open with native grasses and ground cover species (remnant vegetation) or pasture grasses (cropping or grazing) (section 4.9) • Seed areas not required to remain open with tree species determined from analogue site surveys (remnant vegetation) or pasture grasses (cropping or grazing) (section 4.9)

Infrastructure type	Rehabilitation technique
Central compressor station	• On the completion of operations, undertake decommissioning and final rehabilitation
Dam transition to landowner	• Landholder engagement for retention of constructed dams • Treatment/remediation of dam contents (section 5.7) • Infrastructure handover
Dams	• Treatment/remediation of dam contents (section 5.7) • Management of clay core materials: where clay has been used in embankments or as a liner, this would be re-spread, shaped and capped with topsoil for revegetation or stockpiled for reuse • Site profiling: the dam embankments will be pushed in and depressions filled to return landforms to match surrounding topography. Any retained subsoil would be used to infill dams • Topsoil Re-spreading, topsoil will be placed to a minimum depth of 250mm • Undertake re-seeding of topsoil with a seed mix appropriate for the final land use as agreed to by landholders or determined from adjoining undisturbed land (section 4.6)
Below ground power lines	• Backfill trenches with subsoil then topsoil (section 4.7) • Seed areas above power lines with native grasses and ground cover species (remnant vegetation) or pasture grasses (cropping or grazing) (section 4.9)
Access tracks	• Where tracks are to be retained, any wheel ruts will be graded and erosion-control measures such as the construction of diversion drains will installed before handing back to the landholder • Temporary access tracks not required for operations or to be retained by the landholder will be rehabilitated by ripping to remove compaction (section 4.4.6), re-spreading stockpiled topsoil (section 4.4.8) and revegetation following section 4.9
Camps	• Undertake reinstatement of areas not required to remain open during operations (section 5.10) • On the completion of operations, undertake decommissioning and final rehabilitation
Drilling camps	• Undertake reinstatement of areas not required to remain open during operations (section 4) • On the completion of operations, undertake decommissioning and final rehabilitation
Borrow pits	• Backfill with stockpiled subsoil, re-profile allowing for natural depression or change of land use (i.e. a dam), undertake ripping and spread topsoil (section 4) • Undertake re-seeding of topsoil with a seed mix appropriate for the final land use as agreed to by landholders in accordance with section 4.6

5.1 Seismic survey

5.1.1 Description of activity

Seismic surveys produce detailed images of the subsurface which are used to understand the geology of an area. Seismic surveys generate sound waves in the ground and record the sound energy that reflects from various rock layers within the earth. The sound energy is generated by a vibroseis truck, and the sound energy is received by geophones which are placed on the ground. The acquisition of sound energy response is designed to minimise disturbance by co-locating seismic survey lines with roads, tracks or other agricultural disturbances, however if required lines may be cleared to allow access for four-wheel drive and vibroseis truck vehicles. Typically clearing would be slashing and mulching in areas with heavy vegetation with root stock left in situ. Occasionally some bulldozing may be required if terrain is difficult to access.

5.1.2 Rehabilitation process

Any areas cleared as an action of seismic surveying where slashing or mulching have been undertaken will be allowed to rehabilitate through regeneration via the remaining seed bank and root stock. Any locations that required clearing with heavy machinery such as a bulldozer will require restoration with suitable equipment for task to stabilise the soil surface and provide for natural regeneration. All wastes are to be removed. Any disturbed farm infrastructure will be repaired and left in an operational condition.

5.2 Well pads (Production wells, Exploration/Appraisal)

5.2.1 Description of activity

In regard to development areas, typically well pads are spaced at 1000 to 1200m and in regard to exploration and appraisal wells are positioned to assess field prosperity, though spacing for both varies according to a range of site physical and environmental constraints. The maximum disturbance associated with the establishment of a typical pad is 2ha. Well construction disturbance footprint is reduced at the completion of drilling/establishment to an operation area of 0.5ha and this is maintained for the operational life of the well, typically up to 30 years.

5.2.2 Rehabilitation process

In regard to proposed well infrastructure rehabilitation of well sites will consist of two primary processes, reinstatement and final rehabilitation after decommissioning. Reinstatement will commence on the completion of primary drilling but before the completion rig is mobilised. Works will include the removal of any drilling fluids and the mud within the sumps will be allowed to solidify. Sumps will then be mixed-buried-covered as per the Environmental Authority conditions.

Following the removal of the completion rig, further reinstatement will take place. The disturbance footprint will be reduced to an area of approximately 0.5ha including a hardstand. Ripping of compacted muds will be required before soil is replaced. Reinstatement will include site stabilisation and seeding with grasses as outlined in section 4.9.2. Re-profiling of cut and fill batters will not occur until final rehabilitation.

For well infrastructure final rehabilitation of well sites will include the following steps as required:

- Decommissioning/removal of infrastructure (to be addressed in a separate decommissioning plan)
- Cut and fill batters will be profiled to re-instate the land surface (section 4.7.6)
- Compacted hardstand areas will be ripped (section 4.7.7)
- Stockpiled topsoil will be respread (section 4.7.9)
- Topsoil will be seeded with pasture grasses, or native species where native vegetation is the required final land use (section 4.9)
- Fencing to exclude livestock during rehabilitation operations.

5.3 Tanks and stimulation tanks

5.3.1 Description of activity

Proposed wells may require stimulation to enable successful gas production as part of the completion of the well. This will primarily be by hydraulic fracture stimulation.

Hydraulic fracture stimulation or hydraulic fracturing is an existing, proven and accepted well completion technology to increase the flow of fluids and gas from the target formation to the wellbore. Fraccing involves pumping fluid (usually water containing sand/silica grains) into coal cleats at a high rate and pressure to form and extend a fracture in the coal reservoir. This creates a high conductivity pathway to the well bore and increases the gas production capability from the well.

After fraccing, the production fluids will be stored in either 4 mega litre tank located on a pad before transport to a treatment facility for treatment. During the field development phase the containment facility are typically replaced with a water gathering system which gathers the produced fluid to pre-treatment tanks prior to treatment through the Water Treatment Facility.

5.3.2 Rehabilitation process

Produced water and stimulation tanks would be decommissioned once the well meets its objective. The process for rehabilitating of tanks will involve the following:

- **Remove remaining water:** remaining water will be pumped out and transported to a water treatment plant for treatment
- **Removal of tank:** the tank structure will be removed and recycled
- **Break up of concrete:** the concrete foundations will be broken up and removed for recycling
- **Topsoil re-spreading:** stockpiled soil will be spread back over the area in accordance with section 4.7.9
- **Revegetation:** revegetation will then take place in accordance with section 4.9.

5.4 Gas and water gathering line

5.4.1 Description of activity

Flow from each well is separated into water and gas in a small vessel called a wellhead separator. After separation occurs at the wellhead, the low pressure CSG from each of the wellhead separators flows into a system of low pressure buried pipelines which will operate for the life of the Project.

Low pressure pipelines interconnect all wells operating in a specific area to form the gas gathering system. The entire gas gathering system up to the compressor facility will be constructed from high density polyethylenepipe (PE) buried at least 750mm below ground level.

The ROW for the gas and water gathering lines will be dependent on the number of parallel pipelines within the ROW and ground-truthed constraints.

Where possible, the gathering network will be installed in areas of previous disturbance. This includes adjacent to existing infrastructure, access tracks, property and fence boundaries where environmental impact is minimised.

5.4.2 Rehabilitation process

No additional disturbance outside of the existing operational footprint is expected.

Areas will be reinstated with back fill and topsoil being returned within three months after pipelaying and revegetation as outlined in section 4.9. Areas required to remain vegetation free during project operations (access tracks and areas above pipelines) will be revegetated with pasture grasses (where cropping is the final land use), or native grasses and ground cover species (where native vegetation is the final land use).

5.5 Ancillary disturbances for laydown and stockpiling

5.5.1 Description of activity

Laydown and stockpile locations are co-located with development areas and can relate to many disturbance types described in Table 18. These storage locations will accommodate the materials associated to the development project and store stockpiles of soils where required or where soil/vegetation overburden exists in the development. These storage areas are to operate in the short and long-term dependent upon their function; as such they will be available for rehabilitation at the end of useful or strategic function or at the completion of Project operations.

5.5.2 Rehabilitation process

Laydown facilities will be developed to effectively support the development activity. These laydown areas will be sized in accordance with disturbance limits.

Construction of laydown and stockpile areas will be undertaken as follows, once where necessary vegetation clearing, topsoil soil stripping and stockpiling has been completed:

- Where required cut and fill will be used to produce a flat pad and to minimise the requirements for cartage of additional fill material. Local material will be sourced for hardstand areas when required from borrow pits/quarries
- Contouring will be completed to ensure any existing runoff is diverted around the storage area using suitable erosion and sediment control devices.

5.6 Compressor station and booster stations

5.6.1 Description of activity

The Westside tenures have a number of compressor stations and multiple satellite booster stations. Gas enters a compressor station via the gas gathering system. The gas is compressed and dehydrated to remove any remaining water which may have been transferred with the gas through the gas gathering system. The compressed gas may then be sent to the high pressure gas pipeline system for transmission to the main gas transmission pipeline.

Compressors will not be decommissioned until Project completion; however, some small areas not required to remain open for Project operations will be progressively rehabilitated.

The compressor station equipment mainly consists of a raw gas inlet and separation system, a gas compression system, a gas dehydration system, and ancillary equipment.

5.6.2 Rehabilitation process

Disturbed areas not required for operations will be rehabilitated as outlined in section 4. Following decommissioning at the completion of the project the remaining areas associated with the compressor stations or booster stations will be rehabilitated to the surrounding land use in accordance with section 4.

Final rehabilitation of compressor stations and boosters will include the following steps as required:

- Decommissioning/removal of infrastructure (to be addressed in a separate decommissioning plan)
- Cut and fill batters will be profiled to re-instate the land surface (Section 4.7.6)
- Compacted hardstand areas will be ripped (Section 4.7.7)
- Stockpiled topsoil will be respread (Section 4.7.9)
- Topsoil will be seeded with pasture grasses, or native species where native vegetation is the required final land use (Section 4.9)
- Fencing to exclude livestock during rehabilitation operations.

5.7 Dams and tanks

5.7.1 Description of activity

Dams that operate for the storage of associated water include:

- Low hazard dams
- Produced water transfer dams
- Brine storage dams

Tanks that operate as associated water storage include:

- Break tanks for the gathering network and pumping station
- Feed tanks for the water treatment plant
- Brine storage tank

Dams and tanks have multiple purposes supporting CSG water management. During exploration, pilot ponds (low hazard dam) or tanks are used to evaporate produced water. During development dams and tanks can be used as transfer facilities, feed storage for water treatment, gathering breaks to assist in pumping to move water around the field prior to treatment. Brine ponds or brine tanks are used to store brine from the water treatment process and further evaporate the brine prior to the final salt disposal.

Depending on the contents to be stored in dams and the size of the dam determines the hazard assessment category, which is determined using the latest version of the *Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*. The hazard assessment category influences the design of the dam, considerations to minimise the risk of loss of containment through seepage, overtopping or structural failure in accordance with the relevant hazard assessment category.

Tanks are not high hazard structures under the *Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.* The tanks are designed for the storage of associated water with double liners and leak detection sumps.

5.7.2 Rehabilitation process

Dams will be maintained so as to prevent environmental harm until the dam is decommissioned. As per state policy and financial assurance arrangements, landholders upon whose land dams are built will be given the option to keep the dams for their own water storage purposes, if also agreed to by the administering authority. Prior to this occurring however any water entry point must be decommissioned to no longer accept in flow from petroleum activities, residue in the dam must be quantified and tested to demonstrate that it is safe and the contained water must be of a quality suitable for the intended ongoing use by the landholder or overlapping tenure holder.

Depending on the results of the testing of the residue, Westside will manage any waste with the appropriate controls for its transport, transfer and disposal.

Dams which are no longer required by any party will be decommissioned in a manner which avoids any ongoing environmental harm. Once the associated water or brine is removed, the dams will require rehabilitation to remove any source of potential contaminants and return the land to a useable form. The landform will be re-instated such that it will no longer function as a dam and will be stable. The process for decommissioning and rehabilitating the dams will involve the following major components:

- Remove and recycle synthetic liners, if present
- Complete an investigation of the bottom of the dam and the dam walls to identify any land contamination
- In the case were some leakage of the liner system has occurred a full contaminated land assessment will be undertaken as per the *National Environment Protection (Site Assessment) Measure 1999*
- Depending on the results of the investigation will determine the remediation solution for the dam. Options could include:
    - removal of soils to a waste facility
    - soils removed and treated in a remediation area adjacent to the dam
    - in situ treatment of contaminated soils where required through the site assessment
    - materials capped beneath the rooting zone and above any surface aquifers.
- Retain clay materials where clay has been used as part of the containment system. Clay will be stockpiled for reuse where appropriate or shaped and capped with topsoil for revegetation. Where clay cannot be reused, it will be ripped and covered with subsoil

Rehabilitate the site by pushing in dam embankments and filling in depressions to return landforms to match surrounding topography. Any retained subsoil would be used to infill dams and adequate topsoilor suitable amended growth medium for rehabilitation, guided by section 4.

Produced water tanks would be decommissioned once petroleum activities are completed. The process for rehabilitating produced water tanks will involve the following:

- **Remove remaining water:** remaining water will be pumped out and transported to a water treatment plant for treatment or disposed at a waste disposal facility that can accept the waste.
- **Removal of tank:** the tank structure will be removed and recycled
- **Break up of concrete:** the concrete foundations will be broken up and removed for recycling
- **Topsoil re-spreading:** stockpiled soil will be spread back over the area in accordance with section 4.7.9
- **Revegetation:** revegetation will then take place in accordance with section 4.9.

5.8 Water treatment plant

5.8.1 Description of activity

Westside tenures utilise water treatment facilities to treat produced water for beneficial uses like stock water, irrigation, dust suppression and construction activities.

The water treatment plant is connected to the field through a water gathering network and is buffered with above ground storage tanks strategically located to support the water gathering network.

The water treatment plant equipment is made up of feed tanks, pre-treatment facilities, reverse osmosis (RO) units in two 40ft containers, balance tanks, brine tanks, pumps, chemical tanks and chemical storage.

5.8.2 Rehabilitation process

Disturbed areas not required for operations will be rehabilitated as outlined in section 4. Following decommissioning at the completion of the project the remaining areas associated with the water treatment plant will be rehabilitated to the surrounding land use in accordance with section 4.7.6.

Final rehabilitation of compressor stations and boosters will include the following steps as required:

- Decommissioning/removal of infrastructure (to be addressed in a separate decommissioning plan)
- Cut and fill batters will be profiled to re-instate the land surface (section 4.7.6)
- Compacted hardstand areas will be ripped (section 4.7.7)
- Stockpiled topsoil will be respread (section 4.7.9)
- Topsoil will be seeded with pasture grasses, or native species where native vegetation is the required final land use (section 4.9)
- Fencing to exclude livestock during rehabilitation operations.

5.9 Access tracks

5.9.1 Description of activity

Access tracks provide temporary and permanent access to proposed facilities within the Westside tenures. These access tracks need to be constructed to form a slightly domed shape allowing water to shed through

appropriately placed erosion and sediment control devices and discharged into broad flat vegetated drains. In determining the location of access tracks, consideration is being given to the proximity of existing roads, the needs of the landowner and the local environment.

5.9.2 Rehabilitation process

Temporary access tracks not required for operations or to be retained by the landholder will be closed and reinstated to a condition compatible with the surrounding land use. This will involve ripping to remove compaction (section 4.7.7), re-spreading stockpiled topsoil (section 4.7.9), and re-vegetation following section 4.9.

Access tracks in existence prior to petroleum activities and where tracks are to be retained, any wheel ruts will be graded and erosion-control measures such as the construction of diversion drains will installed before handing back to the landholder.

5.10 Camps

5.10.1 Description of activity

Accommodation camps are co-located with laydown yards, compressor stations or well pads. Camps and support facilities and services will be provided during the construction phase including site offices, lunch rooms and ablution blocks. Accommodation facilities will include individual units, mess halls, recreational facilities, utilities, car parking, sewage treatment plants, administration facilities and waste management areas.

5.10.2 Rehabilitation process

Long-term camps will not be available for rehabilitation until after final project decommissioning. Disturbed areas not required for operations will be rehabilitated as outlined in section 4.

Following decommissioning at the completion of the project the remaining areas will be rehabilitated to the surrounding land use in accordance with section 4.

5.11 Drilling camps

5.11.1 Description of activity

Drilling camps (fly camps) are located central to the drilling campaign during the construction phase for a region or in regard to exploration and appraisal often a single location. These camps are co-located with laydowns or well pads. These camps include accommodation to house personnel, associated facilities such as site offices, lunch rooms, ablution blocks and parking. As these camps are to operate in the short-term they available for rehabilitation upon completion of the regional or site specific drilling activities.

5.11.2 Rehabilitation process

Temporary camps will be rehabilitated following the completion of use. The temporary camps are modular transportable buildings, they will be transported off-site and disturbed areas not required for operations will be rehabilitated to the surrounding land use in accordance with section 4.

5.12 Borrow pits

5.12.1 Description of activity

Borrow pits are an incidental activity under the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act) necessary for the construction of infrastructure.

Material to be extracted is likely to include gravel (for access tracks and drill pads) sand and clay (for lining dams). Borrow pits will be operational until the required material has been extracted. Borrow pits will be decommissioned and rehabilitated as soon as extraction is completed, when not needed for operational maintenance or as agreed by the landholder. Any ongoing landholder management of a borrow pit will be via development approval under the *Planning Act 2016*, where borrow pits are not exclusively used for petroleum activities.

5.12.2 Rehabilitation process

Backfilling of the site with subsoil is required to ensure the surface is in close alignment with the natural contours of the existing landscape while allowing for a lower surface due to material that has been extracted. Backfilling should be completed to ensure surface subsidence is avoided (section 4.7.5). Following the replacement of topsoil (section 4.7.9), direct seeding will be required (section 4.9).

6. Residual pollution risks and management and mitigation strategies

6.1 Notifiable activities

Activities that have been identified as likely to cause land contamination are listed in Schedule 3 of the *Environmental Protection Act 1994*. Under the Act, landowners or occupiers and local government must inform the Department of Environment and Science (DES) that land has been or is being used for a notifiable activity. Land that has been or is being used for a notifiable activity is recorded on the Environmental Management Register (EMR), which is maintained by DES.

Areas within the Westside tenures that include these notifiable activities will be registered on the EMR. Land may be removed from the EMR if the landowner or occupier has information that shows the listing was either incorrect, i.e. the land has not been used for a notifiable activity or that the land is not contaminated. Land is removed from the EMR if, after a site investigation report has been submitted to the administering authority, no contamination is found or work is done to satisfactorily remediate the land.

Section 6.3 provides an outline of the site investigation process to be employed in association with any land parcels where notifiable activities have taken place and or hazardous materials have been released.

6.2 Hazardous materials

The list of hazardous materials in use by development and operations within Westside tenure is centrally located in a register managed by the Stores team.

All chemicals will be stored and handled in accordance with the relevant legislative requirements and Australian Standards including the provisions of:

- AS 3780:2008 – the storage and handling of corrosive substances
- AS 3833:2007 – the storage and handling of mixed classes of dangerous goods
- AS 1940:2004 – the storage and handling of flammable and combustible liquids.

6.2.1 Notification of hazardous material release

Westside utilises a software database to manage incidents for all field activities conducted by the workforce including contractors.

The workforce is encouraged to report incidents and observations to support continual improvement. External environmental incident/spill reporting will be in accordance with current regulatory guidelines and the environmental authority. Westside will notify the DES Pollution Hotline (1300 130 372) or local office as soon as practicable after becoming aware of any release of contaminants not in accordance with the conditions of the environmental authority or any event where environmental harm has been caused or may be caused.

Westside has a Crisis and Emergency Management Plan to ensure incidents and emergencies are appropriately managed in accordance with the HSE policy.

6.3 Site investigation

Preliminary site investigations are conducted to determine the presence or absence of site contamination where notifiable activities have been conducted, where evidence of leakage or spillage of hazardous material is detected.

A preliminary site investigation will includes the following components:

- Development of a site history
- An inspection of the site
- A basic sampling program to determine if contamination is present
- Report preparation.

Investigations will be conducted by suitably qualified persons. The *Environmental Protection Act 1994* requires persons submitting contaminated site investigation reports to be members of a prescribed professional organisation listed in Schedule 8 of the *Environmental Protection Regulation 2008*. Persons conducting site investigations should hold appropriate qualifications and have experience relevant to the investigation.

A comprehensive site history of the investigation area will identify all past and present potentially contaminating activities. Information obtained from the site history research will be used to assess the potential for contamination on the site and determine the most appropriate locations for sampling. Sampling is required in areas where the site history research indicates that possible contaminating activities have been conducted. Site history information will be supported by all available copies of original site plans, local authority zoning records, flammable and combustible liquids licence details, sewage/trade waste and stormwater drainage plans, aerial photographs, environmental licences etc. All available evidence, including verbal interviews and analysis reports, will be included. Interviewees' relationship to site activities should be documented.

The possibility of contamination due to activities on adjacent land and the possibility of contamination extending beyond the site boundaries should also be examined.

Areas which have received imported fill should also be assessed.

Site investigations should be conducted in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* and attending Schedules and the provisions of the *Environmental Protection Act 1994*.

6.4 Mitigation strategies

6.4.1 Dams

Dams are utilised for the storage regulated wasted including associated water, brine and other by-products. Therefore, dams have a risk, albeit low, to cause contamination if there was a failure in a liner.

6.4.2 Soils

Contaminated soils will be assessed following the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Where remediation is required, contaminated soils will undertake further assessment and be remediated to site specific needs following the preferred order or options for site clean up and management:

- On-site treatment of the soil so that the contaminant is managed so the associated hazard is reduced to an acceptable level
- Off-site treatment of excavated soil so that the contaminant is managed so the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.

Purpose built soil remediation areas may be established for the remediation of contaminated soil from various locations. Dependent upon the preferred order for site clean up contaminated soils may be transported to the purpose built soil remediation area for remediation. Following the removal of contaminated soils visual inspections and contamination testing will be undertaken to confirm that all contaminated soil has been removed.

Subject to assessment soil remediation strategies may include:

- Excavating contaminated soil and burying it at one location on-site (this reduces the number of areas containing contaminated soil)
- Installing horizontal, vertical or reactive barriers
- Constructing an engineered landfill cell on-site (for situations with shallow groundwater, permeable soils, leachable contaminants or very high results)
- Solidifying (locking contaminants in solidified matrix) or stabilising (converting contaminants to a less mobile and/or less toxic form, typically by chemical reaction) when contaminants are highly leachable, then incorporating with one of the above options
- Land farming volatile contaminants and reusing soil on-site (if no sensitive receptors are nearby)
- Land farming volatile contaminants at an off-site location then returning the soil to site
- On-site or off-site treatment, for example thermal desorption
- In situ biological (e.g. air stripping, sparging or venting) or chemical treatments. These can be considered for permeable soils but are usually slow processes.

7. Rehabilitation type

7.1 Rehabilitation hierarchy

The overall goal of rehabilitation is to reinstate land to the pre-disturbance land use unless otherwise agreed to by Westside, the landholder, and the administering authority. However, where this is not practical, final rehabilitation goals will be determined according to the following hierarchy, in order of preference.

1. Reinstatement of the previous land use (e.g. cropping and grazing).
2. Reinstatement of a self-sustaining progressive native ecosystem

7.2 Remnant native vegetation

7.2.1 Disturbance

Following decommissioning, all areas will be rehabilitated to a stable landform with self-sustaining vegetation, containing species similar to adjoining undisturbed areas.

7.2.2 Rehabilitation objective

The process of developing specific goals for individual sites for the species to be established, the required species diversity, the required abundance, the required ground cover and habitat variables, composition and the required cover percentage will involve the following:

1. Determine the correct Regional Ecosystem (RE) of the site to be disturbed as to the adjacent highest quality standing community
2. Assessment of adjacent land use to develop criteria for each RE for species diversity, composition, ground cover, habitat variables and foliage cover
3. Set criteria for each location were remnant revegetation recovery is undertaken
4. Monitor rehabilitation against set goals for the RE and that of the EA conditions

All infrastructure considers the ecological constraints, fauna corridors, pre-disturbance values and the surrounding landscape. This includes linking rehabilitated areas with undisturbed native vegetation to provide larger areas of wildlife corridors where feasible.

7.2.3 Rehabilitation technique

The aim of the rehabilitation following disturbance of all native vegetation is to restore a stable landform, with self-sustaining vegetation cover and species similar to adjoining undisturbed areas. There will be differences in the techniques for revegetation of the dominant species within each RE, based on these species natural regeneration processes in response to fire and other natural disturbances.

The general revegetation technique for native vegetation, upon decommissioning will be as required with preference to direct seeding as outlined in section 4.9.3. Planting of native vegetation will be a consideration post monitoring rounds and if required through observation may be undertaken to improve the species diversity, and cover percentage to achieve final acceptance criteria objectives.

The seed mix for areas of native vegetation will be determined by the vegetation composition of surrounding undisturbed areas. Consideration will be given to a seed mix including native grass species that will provide good protection from erosion in the short term but also allow shrubs and tree seedlingsto establish successfully. In areas where vegetation is removed, but the soil and roots are not extensively disturbed, natural regeneration only will be relied upon only for revegetation.

7.3 Flora species (and communities) of conservation significance

Eleven flora species and/or communities that are known to occur within the region and are listed as Endangered or Vulnerable under the EPBC Act and the *Nature Conservation Act 1992* (NC Act) and Near Threatened under the *NC Act*. A list of the known threatened ecological communities in the Brigalow Belt Northern Bioregion is provided in Table 19.

Table 19: Threatened flora and communities

Status[1]		Family	Scientific Name	Common Name	Source[2]	Records	Likelihood of Occurrence
NCA	EPBC						
E	E	*Acanthaceae*	*Xerothamnella herbacea*	–	PM/WO	23	High
NT	–	*Asteraceae*	*Rutidosis lanata*	–	WO	1	Low
V	–	*Cyperaceae*	*Cyperus clarus*	–	WO	1	Moderate
NT	–	*Euphorbiaceae*	*Bertya pedicellata*	–	WO	2	Low
V	E	*Poaceae*	*Dichanthium queenslandicum*	King Blue-grass	PM/WO	4	High
LC	V	*Poaceae*	*Dichanthium setosum*	Bluegrass	PM	0	Low
V	V	*Rhamnaceae*	*Polianthion minutiflorum*	–	WO	1	Low
E	E	*Solanaceae*	*Solanum dissectum*	–	PM/WO	28	High
E	E	*Solanaceae*	*Solanum johnsonianum*	–	PM/WO	48	High
E	–	*Solanaceae*	*Solanum elachophyllum*	–	WO	12	High
V	V	*Surianaceae*	*Cadellia pentastylis*	Ooline	PM/WO	2	Moderate

1. Status: LC = Least Concern, NT = Near Threatened, V = Vulnerable, E = Endangered, CE = Critically Endangered
2. Source: WO = Wildlife Online Database, PM = EPBC Protected Matters Report

7.3.1 Rehabilitation objective

The primary objective will be to avoid threatened ecological communities and populations of flora species of conservation significance. Where impacts are unavoidable, the rehabilitation objective in relation to significant flora is the successful rehabilitation of flora species, or establishment of offsets to ensure no net loss of individuals or populations (as determined as necessary from environmental surveys). The rehabilitation objective will be determined for specific sites where populations are detected on an individual species or ecosystem basis in regard to TECs on the advice of suitably qualified person with experience in rehabilitation and/or outlined in Significant Species Management Plans.

7.3.2 Rehabilitation techniques

Natural regeneration will be used to rehabilitate areas containing flora species of conservation significance if the soil is not removed. Direct seeding or tree planting with native tree and shrub species representative of the RE and habitat will also be undertaken upon asset decommission. Propagation and replanting of tubestock of plant species will be undertaken where established to be effective for that particular species (refer to individual Species Management Plans and individual species recovery plans). Specific requirements for propagation by seed, cuttings or other techniques are outlined in Species Management Plans.

In addition to the general rehabilitation techniques listed above, the following specific control measures may need to be put in place during the rehabilitation process but are dependent upon site specific benefits:

- Install erosion and sediment control measures to protect the location/s of conservation significant flora from scouring and sedimentation without significantly altering surface waterconditions
- Avoid broad-scale spraying of herbicides for weed management in proximity to populations of flora species of conservation significance
- Undertake fencing of areas until plant populations have re-established, to prevent grazing or browsing damage
- Implement weed control measures where weeds are identified a threat to flora species of conservation significance as outlined in section 4.12Weed management
- Implement pest animal control measures as outlined in section 4.13
- Implement ecological fire management guidelines as outlined in section 4.14

7.4 Habitat of fauna species of conservation significance

Thirteen terrestrial fauna species of special conservation significance are known or considered possible occurrences within the Westside tenures. Threatened fauna known to be present and potentially present in the Project area are presented in Table 20.

Table 20: Threatened fauna

Scientific Name	Common Name	NC Act Status
Petauroides volans	Greater glider	Endangered
Phascolarctos cinereus	Koala	Endangered
Denisonia maculata	Ornamental snake	Vulnerable
Elseya albagula	Southern snapping turtle	Endangered
Rheodytes leukops	Fitzroy river turtle	Vulnerable
Falco hypoleucos	Grey falcon	Vulnerable
Geophaps scripta scripta	Squatter pigeon	Vulnerable
Grantiella picta	Painted honeyeater	Vulnerable
Hirundapus caudacutus	White-throated needletail	Special Least Concern
Rostratula australis	Australian painted snipe	Endangered

Scientific Name	Common Name	NC Act Status
Delma torquata	Collared delma	Vulnerable
Egernia rugosa	Yakka skink	Vulnerable
Furina dunmalli	Dunmall's snake	Vulnerable

7.4.1 Rehabilitation objective

For any new infrastructure proposed the primary objective is to avoid habitat of fauna species of conservation significance. Where impacts are unavoidable the rehabilitation objective in relation to fauna habitat is the successful rehabilitation of fauna species habitat through the return of habitat devices or fallen timber or via establishment of offsets.

7.4.2 Rehabilitation techniques

Natural regeneration will be used to rehabilitate the habitat of fauna species of conservation significance where soil is not removed. Direct seeding or tree planting where required with native tree and shrub species representative of the adjoining undisturbed land and habitat will also be undertaken where required. It will be necessary to ensure rehabilitation includes food trees appropriate to the fauna species, the habitat, and land tenure type.

If habitat of species of conservation significance is located within riparian vegetation downstream of the clearing site or in adjacent wetland areas, the following measures will also be implemented but are dependent upon site specific benefits:

- Install erosion and sediment control measures to protect the habitat from scouring and sedimentation without significantly altering surface water conditions
- Minimise impacts of infrastructure on temporary shallow wetlands through alteration of drainage conditions or siltation
- Avoid the broad application of herbicides, insecticides and other chemicals near wetlands and other water bodies.

7.5 Pastoral land

7.5.1 Disturbance summary

Pastoral land occurs within the Westside tenures, including Class A crop land; Class B limited cropping land and Class C pastoral land as defined by the *State Planning Policy 1/92: Development and Conservation of Agricultural Land (GQAL Policy).*

7.5.2 Rehabilitation objective

The aim of rehabilitation is to restore the production potential of pastoral land. Westside will determine the required land use of individual properties in consultation with landholders. This will guide soil preparation, amelioration, fertilisation and determine the seed mix that is applied.

The process of identifying rehabilitation goals for individual pastoral properties is as follows:

1. Consult with landholders regarding final land use and seed mixes
2. Undertake grass check monitoring during monitoring activities and upon final rehabilitation
3. Undertake a final soil and land capability study after reinstatement.

7.5.3 Rehabilitation technique

Areas where grazing is the required final land use will be sown with appropriate pasture species, as agreed with landholders. Local native grasses may be used in some situations, such as where it is desirable to return an area to grazing on unimproved native pasture. Fencing off from stock, in negotiation with thelandholder, may be required to facilitate pasture establishment, until such time as sufficient vegetation cover has established to stabilise soils.

7.6 Cropping land

7.6.1 Disturbance summary

Class A GQAL (crop land) occurs in the Westside tenure and Strategic Cropping Land (SCL) also occurs in the area. The location of major infrastructure such as the plants, accommodation facilities and dams has been selected to minimise the impact to agricultural land's productive capacity.

Where possible, access tracks and associated pipelines have used existing tracks, fence lines and road reserves unless direct access through properties is required for health and safety reasons.

7.6.2 Rehabilitation objective

The aim of rehabilitation in regard to cropping land is to restore the production potential of cropping land. Westside will determine the required land use of individual properties in consultation with landholders. This, and the soils ground-truthing and mapping surveys will guide soil preparation. Although cropping is the desired final land use, areas may be sown with sterile grass species to stabilise soils.

The process of identifying rehabilitation goals for cropping land is as follows:

1. Consult with landholders regarding final land use and seed mixes
2. Undertake annual crop monitoring during monitoring activities and upon final rehabilitation.

7.6.3 Rehabilitation technique

Careful management of topsoil and subsoil will form an important component of the rehabilitation strategy and are discussed in section 4.7 to optimise the rehabilitation outcomes post disturbance. Access tracks will be constructed as prescribed in section 5.9. However, on cropping land, access tracks may not be gravelled and may be a wheel rut track only as determined via assessment of appropriate health, safety and environmental considerations. At the completion of construction, wastes will be removed, temporary access routes will be closed and soils will be replaced in the order in which excavation was carried out.

Before topsoil re-spreading on cropping land, where topsoil has been stockpiled, it may be re-analysed as required. If undertaken re-analysis will, as a minimum, require the analysis of pH, electrical conductivity, chloride, cations (calcium, magnesium and sodium), exchangeable sodium percentage and soil fertility (including nitrogen, phosphorous, potassium, sulphur and micronutrients). Additional nutrients (specifically

nitrogen and phosphorus-based fertilisers, depending on the type of revegetationplanned) or conditioners may be required to improve topsoils and return them to a productive state for cropping. Fertilisers and soil supplements will be used only as necessary and with the agreement of landholders where required from soil analysis or as a corrective action should rehabilitation prove unsuccessful.

Following topsoil re-spreading, areas will be sown with appropriate cover grass species or not, as agreed with landholders which may occur as reinstatement aligns to proposed cropping regime. Fencing off from stock, in negotiation with the landholder, may be required to facilitate grass establishment, until such time as sufficient vegetation cover has established to stabilise soils.

7.7 Riparian areas and watercourse crossings

Riparian areas and watercourses have the potential for higher biodiversity than the surrounding landscape. They provide water for many flora and fauna species adapted to specialist habitats characterised by permanent/semi-permanent surface water.

7.7.1 Rehabilitation objective

For any new infrastructure proposed the primary objective is to minimise impacts to riparian areas and watercourses. Where riparian areas cannot be avoided, mitigation measures will be adopted including minimising the area of disturbance and impacts on riparian vegetation and water quality. Mitigation measures are outlined in the Code for self-assessable development: *Temporary waterway barrier works and the Guideline – activities in a watercourse, lake or spring associated with mining operations.*

Where clearing of riparian vegetation is unavoidable the objective will be to rehabilitate the creek banks and riparian vegetation not required for operational use, as soon as practical, post-construction. This rehabilitation will be consistent with the surrounding environment and contours of the channel at the time of construction. A further objective is to minimise erosion and destabilisation of creek banks, and restore vegetation and fauna habitat.

7.7.2 Rehabilitation techniques

Rehabilitation of waterway crossings will involve re-contouring disturbed areas to match the surrounding land as soon as practicable after pipe laying and backfilling. Erosion controls will be constructed or installed, where necessary. The surface will usually be lightly scarified before spreading the topsoil, to promote vegetation re-growth and protect against the topsoil loss.

Rehabilitation will be undertaken in adherence to the *Code for self-assessable development: Temporary waterway barrier works* and the *Guideline – activities in a watercourse, lake or spring associated with mining operations,* ensuring that:

- Any water ingress into trenches will be handled with pumping from the trench utilising APIA Code methods for sediment and erosion control
- Temporary facilities such as waterway barriers will be removed and the areas rehabilitated
- Seed spreading will be carried out in areas at risk of erosion or in densely vegetated watercourses to enhance natural regeneration
- Pipelines will be backfilled and normal flow reinstated as soon as practicable.

7.8 Stock routes

For any new infrastructure as proposed the primary purpose of the stock route network is to provide for travelling stock, although other secondary uses may occur within a stock route. These other uses may include the short-term adjustment of parts of the route, the establishment of watering agreements with private landholders, and the construction and maintenanceof stock route facilities. A road that is a stock route may be used as a transport corridor for vehicles or for communication and utility infrastructure facilities, for example phone, power and gas lines. Impacts on stock routes will generally arise from the clearing of vegetation and ground disturbance associated with the laying of gas and water pipeline networks. No plant or water storage sites will be located within a stock route.

7.8.1 Rehabilitation objective

Parts of the stock route network disturbed or affected by works are to be rehabilitated upon completion of the project to a state that is safe for travelling stock and drovers, and the travelling public, and is consistent with the area's pre-disturbance state unless otherwise agreed by DES and the local government.

7.8.2 Rehabilitation techniques

Ground disturbance to stock routes will be rehabilitated as soon as practicable following the cessation of construction activities. Stock routes will be rehabilitated so as to return the disturbed areas to a status consistent with the surrounding area. Rehabilitation will be undertaken following the methods outlined in section 4.

8. Success criteria

8.1 By approval conditions

Westsides Environmental Authorities require significantly disturbed areas that are no longer required for the on-going authorised resource activities, must be rehabilitated within 12 months and be maintained to meet the acceptance criteria. Westside Rehabilitation success criteria are provided in the Westside Environmental Authorities listed in Table 21. Success criteria will be achieved through monitoring and compliance providing evidence of criteria met as prescribed in Table 21.

Table 21: Rehabilitation success criteria

Environmental Authority	Application	Success Criteria Rehabilitation 2 -4	Indicators	Measurable success criteria
EPPG00805913 (ATP 602) EPPG00704113 (ATP 688) EPPG00693213 (ATP 769) EPPG00622613 (ATP 2027) EPPG00783713 (PL94) EA0002230 (PL1048 & PL1049) EPPG00551013 (PPL26) EPPG00486113 (PPL61) EPSX01908114 (PPL182) Streamlined model conditions for future applications	All significantly disturbed areas no longer required for ongoing petroleum activities	Non-polluting	Land suitability Subsidence and erosion	No subsidence or gully erosion observed for at least five years
	All significantly disturbed areas no longer required for ongoing petroleum activities	The landform is stable	Subsidence and erosion	No subsidence or gully erosion observed for at least five years
	All significantly disturbed areas no longer required for ongoing petroleum activities	Land is re-profiled to consistent contours as to surrounding landform	Land suitability	Level of backfill and contours are consistent with surrounding landform or provides suitable stability
	All significantly disturbed areas no longer required for ongoing petroleum activities	Surface drainage lines have been re-established	Subsidence and erosion	No subsidence or gully erosion observed for at least five years within the originally disturbed location
	All significantly disturbed areas no longer required for ongoing petroleum activities	Topsoil is reinstated	Soil suitability	Topsoil layer is identifiable in the disturbance area that is reasonably equivalent to the undisturbed soil community
	All significantly disturbed areas no longer required for ongoing petroleum activities	Groundcover is growing	Foliage cover	A suitable vegetative layer has established to a similar condition of the undisturbed adjacent vegetation

Environmental Authority	Application	Success Criteria Rehabilitation 2 -4	Indicators	Measurable success criteria
	All significantly disturbed areas intended for landholder use or overlapping tenure holder	Greater than or equal 70% of native ground cover species richness	Vegetation richness	A suitable vegetative layer has established to a minimum 70% species richness of the undisturbed adjacent vegetation
	All significantly disturbed areas intended for landholder use or overlapping tenure holder	Greater than or equal to the total percent ground cover	Foliage cover	A suitable vegetative layer has established to a similar cover percentage of the undisturbed adjacent vegetation
	All significantly disturbed areas intended for landholder use or overlapping tenure holder	Less than or equal to the declared plant pest presence	Pest cover	Disturbed sites do not contain a greater density of declared pest plant species than present on the undisturbed adjacent vegetation
	All significantly disturbed areas intended for landholder use or overlapping tenure holder	Regional Ecosystem recovery	Regional Ecosystem	A Regional Ecosystem of the broad vegetation group to the adjacent vegetation is recovering through recruitment and displaying species present in stands of ecosystems of adjoining vegetation
	Significantly disturbed ESA/REs vegetation	Greater than or equal 70% of native ground cover species richness	Vegetation richness	A suitable vegetative layer has established to a minimum 70% species richness of the undisturbed adjacent vegetation
	Significantly disturbed ESA/REs vegetation	Greater than or equal to the total percent ground cover	Foliage cover	A suitable vegetative layer has established to a similar cover percentage of the undisturbed adjacent vegetation
	Significantly disturbed ESA/REs vegetation	Less than or equal to the declared plant pest presence	Pest cover	Disturbed sites do not contain a greater density of declared pest plant species than present on the undisturbed adjacent vegetation

Environmental Authority	Application	Success Criteria Rehabilitation 2 -4	Indicators	Measurable success criteria
	Significantly disturbed ESA/REs vegetation	A greater than or equal to 50% organic litter cover and density of coarse woody material is present	Fauna species diversity Habitat availability	Maintain a minimum 50% equal density of habitat structures such as coarse woody material and organic litter present in disturbance area in comparison to adjacent vegetation is present
	Significantly disturbed ESA/REs vegetation	Species belonging to the ecologically dominant layer (EDL) are present	Vegetation richness	All EDL species present in the best quality adjoin vegetation are showing recruitment or are present in the disturbance area

8.2 By disturbance type

Success criteria will apply to all areas irrespective of the type of infrastructure that was located on the site. However, there is certain infrastructure that will require specific criteria due to the nature of disturbance, such as evaporation dams. Success criteria specific to certain infrastructure are outlined in Table 22 below.

Table 22: Rehabilitation success criteria for specific disturbance type

Disturbance type	Rehabilitation objective	Indicators	Measurable success criteria
Borrow pits	Surface is in close alignment with the natural contours of the existing landscape while allowing for a lower surface due to material that has been extracted	Visual consistency Land surface	Level of backfilled borrow pits is consistent with surrounding soil, while allowing for a lower surface due to extraction
Pipeline ROWs (following backfilling and reinstatement)	A stable landform	Subsidence and erosion gullies	No subsidence or erosion gullies observed
	Exhibit no subsidence or erosion gullies for the life of the operational pipeline	Subsidence and erosion gullies	No subsidence or erosion gullies observed
	Be re-profiled to a level consistent with the surrounding soils	Land surface	Level of backfilled pipelines is consistent with surrounding soil
	Be re-profiled to original contours and established drainage lines	Land surface and drainage lines	Original contours and drainage lines re-established

Disturbance type	Rehabilitation objective	Indicators	Measurable success criteria
	Be visually consistent with surrounding land features	Visual consistency	Land features of pipeline ROWs are visually consistent with the surrounding area
	Be vegetated with groundcover as a minimum to ensure erosion is minimised	Vegetation cover	Landform is stable, with self- sustaining vegetation of similar composition to adjoining undisturbed land
Well sites	A stable landform	Subsidence and erosion gullies	No subsidence or erosion gullies observed
	Exhibit no subsidence or erosion gullies for operational life of the well/well pad	Subsidence and erosion gullies	No subsidence or erosion gullies observed
	Be re-profiled to a level consistent with the surrounding soils	Land surface	Level of well site/pad is consistent with surrounding soil
	Be re-profiled to original contours and established drainage lines	Land surface and drainage lines	Original contours and drainage lines re-established
	Be visually consistent with surrounding land features	Visual consistency	Land features of the well site/pad are visually consistent with the surrounding area
	Be vegetated with groundcover as a minimum to ensure erosion is minimised	Vegetation cover	Landform is stable, with self- sustaining vegetation of similar composition to adjoining undisturbed land

8.3 By rehabilitation type

Rehabilitation success criteria will also differ by the final land use (rehabilitation type) of the area to be rehabilitated, as outlined in Table 23.

Table 23: Rehabilitation success criteria based on rehabilitation type

Rehabilitation type	Rehabilitation objective	Indicators	Measurable success criteria
Watercourse crossings	Rehabilitation consistent with surrounding environment and contours of the channel at the time of construction	Erosion control measures in place Channel contours Water quality	• Erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person • Creek rehabilitation will be consistent with surrounding environment and contours of the channel • No ongoing contamination of waterways
Native vegetation	Rehabilitation consistent with surrounding vegetation and environment	Vegetation presence Land holder satisfaction	• Rehabilitation will be similar to the species of surrounding vegetative environment • Landholder is satisfied that no greater management input than for other land in the area being used for a similar purpose is required.
Validated cropping land	Restore the production potential of cropping land	Land holder satisfaction Land suitability	• Landholder is satisfied that no greater management input than for other land in the area being used for a similar purpose is required for it be used for cropping. • All significantly disturbed land is reinstated to the pre- disturbed land use.
Grazing land	Restore the production potential of pastoral land	Pasture condition Land holder satisfaction	• Pasture condition is similar to the condition of adjacent pastures. • Landholder is satisfied that no greater management input than for other land in the area being used for a similar purpose is required for it be used for grazing

Rehabilitation type	Rehabilitation objective	Indicators	Measurable success criteria
Stock routes	Safe for travelling stock and drovers, and the travelling public	Subsidence and erosion	• No subsidence or major erosion gullies
	Consistency with the areas pre-disturbance state	Land surface and drainage lines	• Original contours and drainage lines re-established

9. Monitoring and compliance reporting

9.1 Monitoring type, method and frequency

9.1.1 Monitoring post-construction

9.1.1.1. Visual monitoring

An annual monitoring regime will be undertaken to ensure management actions for the prevention of erosion and sedimentation during vegetation clearing, topsoil stripping, subsoil management, stockpiling activities, rehabilitation activities, weed control, water diversion, erosion and sediment control activities and watercourse protection activities are being implemented and are appropriate for the site conditions:

- Visual monitoring using a checklist (and photographic records, where they exist) to ensure all actions are being implemented in accordance with the requirements outlined in this plan
- Formal inspections using a checklist (and photographic records, where they exist) to ensure there are no incidences of soil subsidence or erosion resulting from construction activities and to identify any erosion repair works that might be required
- Following high rainfall events watercourse crossings of pipelines and tracks will be inspected to assess the stability of the channel and banks
- Record keeping of the above in a GIS database or Westside server.

A significant focus of monitoring is completed during the warranty period (usually 1 year) provided by the construction contractor. Any defects in rehabilitation like subsidence, soil inversion, poor germination is then the responsibility of the contractor.

Where the monitoring identifies areas that require corrective actions, these actions will be set up within Westside's Work order process and require the corrective actions to be undertaken within 3 months of the work order being created.

For self-performing projects the focus is still to complete the monitoring during and at completion of construction to ensure the reinstatement has been completed correctly, there is a stable landform and sufficient cover.

Visual checks are completed on a daily basis by the contractors and Westside field staff during construction, with any anomalies being reported immediately for rectification. Formal inspections are undertaken on a monthly basis by the environmental advisor or land access advisor to ensure reinstatement and rehabilitation is competed and successful.

9.1.1.2. Vegetation monitoring

Once reinstatement activities have been successful and progressive rehabilitation of petroleum assets has begun an annual vegetation monitoring program is undertaken to ensure reinstatement and progressive rehabilitation is on track to meet the final rehabilitation criteria at the end of petroleum activities. Westside uses a checklist approach to document the rehabilitation over time to provide the required documentation for the final rehabilitation certification.

Westside works with landowners for pasture monitoring which includes recording the condition of pastures, timber and soil, and estimating sustainable production rates. Monitoring measures the cover of grass species

including annual, perennial, native and introduced grasses. Westside utilises the monitoring to provide information to landowners to sign off on the rehabilitation work undertaken on their properties and to enable handing the site back to the landowner.

9.1.1.3. Weed monitoring

The distribution of weeds will be recorded through an active inventory of declared and environmental weeds, including the distribution of weeds within rehabilitated areas. All staff and contractors will be trained in the identification of weeds and required to report their occurrence to the Land access or Environment Advisor.

Monitoring of the extent and distribution of weed populations including new infestations and weeds within rehabilitated areas will include the following:

- Monitoring will include previously disturbed and rehabilitated areas, retained vegetation, and buffer areas
- Monitoring of known weed infestations will be taken before and a suitable time frame after treatment to determine treatment success
- Photos will be taken prior to and a suitable time frame after treatment applications to provide a visual assessment of the effectiveness of methods to reduce weed density
- Record keeping of the above in a geographic information system (GIS) database

9.1.2 Monitoring on the completion of the rehabilitation

Monitoring and reporting will be completed to meet the success criteria in Table 21 at the end of petroleum activities. Checklists will be completed at different stages of infrastructure development, predominately upon work site transfer and for site handover. High risk areas like erosive soils, creek crossings, cut and fills, flood prone areas will be identified by the environmental advisor or land access advisor for higher frequency monitoring. Sign-off of rehabilitation works is required on completion to ensure rehabilitation has been undertaken to the required standard.

9.2 Data and document management

Westside has a data management system that includes:

- a GIS with the GPS locations of monitoring points and GIS layers for certain variables that are monitored where practical
- procedures and check lists to ensure all rehabilitation steps are recorded
- a photographic record of all photo monitoring, where they exist, with the GPS locations and direction of orientation off all photo monitoring points.

9.3 Compliance reporting, contents and frequency

9.3.1 Environmental authority reporting

Westside reports to the administrating authority regarding the status of disturbance, progressive rehabilitation and final rehabilitation associated with project activities. Detailed schedule of disturbance is submitted to the administering authority as part of the annual return processes. Disturbance and rehabilitation spatial data is supplied as part of the Environmental Rehabilitation Cost and the Plan of Operation (for P&G 2004 tenures) and annual return process.

10. Responsibility

10.1 Westside

10.1.1 Inductions and training

Westside will develop inductions and training for all staff and contractors undertaking rehabilitation works, to ensure they are familiar with the procedures outlined in this Rehabilitation Plan and are able to locate and report weed infestations and other hazards.

10.1.2 Field Superintendent/Environment Advisor/Land Access

The Field Superintendent is accountable for the rehabilitation outcomes.

The Field Development Manager will be responsible for determining if site specific control measures (such as erosion and sediment control measures and weed control) are required.

The in Land Access/Environmental Advisor will be responsible for undertaking on-site checks to ensure the procedures in this Rehabilitation Plan are followed.

11. Definitions, Abbreviations and Documents

11.1 Definitions

In this document, the following definitions apply:

Table 24: Definitions

Term	Definition
Decommissioning	To withdraw something from active service. This typically involves the removal of project infrastructure on the completion of a project.
Progressive Rehabilitation	The process by which significantly disturbed areas are rehabilitated to their pre-disturbance land use with the same species and density of cover to that of surrounding undisturbed areas, as soon as practicable following the completion of any construction or operational works
Recovery	The process of protecting, conserving and managing a listed threatened species or a listed threatened ecological community
Regeneration	Vegetation that regenerates naturally (i.e. without the assistance of human intervention) from existing seed banks, suckering or coppice growth
Rehabilitation	Means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria set out in relevant environmental approvals and, where relevant, includes remediation of contaminated land
Reinstatement	The process of bringing the construction earthen landscape back to the original profile of the surrounding environment, including the stabilisation of the site. This can include seeding with grasses to stabilise the site.
Remediation	To take action to repair or mitigate damage that may or will be, or that has been, caused to a MNES or an EVNT listed species Remediation, in reference to contaminated land, means: a) rehabilitate the land; or b) restore the land; or c) take other action to prevent or minimise serious environmental harm being caused by the hazardous contaminant contaminating the land
Revegetation	The use of direct seeding or tubestock to support an area achieving the pre-clearance native vegetation or regional ecosystem

11.2 Abbreviations

In this document, the following abbreviations apply:

Table 25: Abbreviations

Term/Abbreviation	Meaning
APIA	Australian Pipeline Industry Association
ATP	Authority to Prospect
CCA	Conduct and compensation agreement
CSG	Coal seam gas
DES	Department of Environment and Science
EA	Environmental Authority
EDL	Ecologically dominate layer
EMP	Environmental Management Plan
EMR	Environment Management Register
EMS	Environment Management System
EP Act	Environmental Protection Act 1994 (Queensland)
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)
ESA(s)	Category A, B and C Environmentally Sensitive Areas as mapped by DES and defined by DES
EVNT	A species listed as endangered, vulnerable or near threatened under the NC Act or threatened species under the EPBC Act.
GIS	Geographic Information System
GPS	Global Positioning System
GQAL	Good Quality Agricultural Land as defined by Planning Guidelines: the Identification of Good Quality Agricultural Land (Queensland)
HSE	Health, Safety and Environment
HSEMS	Health Safety Environment Management System
IECA	International Erosion Control Association
LNG	Liquefied Natural Gas
MNES	Matters of National Environmental Significance listed under the EPBC Act
NC Act	Nature Conservation Act 1992 (Queensland)
PE	Poly Ethylene Pipe
PL	Petroleum Lease
PLA	Petroleum Lease Application
PPL	Petroleum Pipeline Lease
RE	Regional Ecosystem

Term/Abbreviation	Meaning
RoW(s)	Right of Way(s)
SCL	Strategic Cropping Land
SEVT	Semi Evergreen Vine Thicket
TEC	Threatened Ecological Community listed under the EPBC Act

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13. Plan certification

I Rob Ully (Bachelor of Science & Watershed Management Dip.), am a suitably qualified person as defined as a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

I certify that this plan demonstrates the following:

- relevant material, including current published guidelines (where available) have been considered in the written document;
- the content of the written document is accurate and true; and
- the document meets the requirements of the relevant conditions of the Westside environmental authorities.

Signature:



Westside Corporation Pty Limited

DOCUMENT TYPE **MANAGEMENT PLAN**

DOCUMENT TITLE # Produced Water Management Plan - Petroleum Lease 94

DOCUMENT DETAILS

Dept. Origin	HSE
Document #	MSG-GN00-HS-PLN-002
Intranet Folder	Health, Safety, Environment & Risk
Used by	All Relevant Westside Personnel

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1. Introduction

This Produced Water Management Plan (PWMP / the Plan) provides a description of the PL 94 development (outlined in section 1.1) (the Project), and details on produced water quantities, storage, treatment and management.

1.1 Project Overview

The Project involves the construction, operation, rehabilitation of the following:

- 600 development wells (the PWMP covers Stage 1 and Stage 2 developments);
- Ancillary linear infrastructure including gas and water infrastructure, access tracks, power lines and communication lines;
- Gas compression facilities as required;
- Water management infrastructure; and
- Other ancillary activities and facilities to support gas field development.

Water will be produced from the Baralaba Coal Seams associated with gas production in accordance with this PWMP. Gas and water will be produced over the approximate 25-year life of the Project.

The Produced Water Management PLan has been prepared for the entire Project but recent updates have been made focusing on the final 350 well heads for PL94 which is being assessed by the Department of Climate Change, Energy, the Environment and Water.

The current Environmental Authority (EA) for the Project is a site specific Environmental Authority, Chapter 5A petroleum activity Permit Number: EPPG00783713. The Environmental Authority permits well stimulation techniques such as hydraulic fracturing. It is not Westside's preferred approach, but it may be used in vertical wells as part of the completion of a well to improve the gas flow rate. Such stimulation will be undertaken in accordance with the above EA and any associated regulations will be complied with.

1.1.1 Location

The Project is located in the Moura-Theodore district of the Banana Shire, Queensland. The area consists of the fields Dawson River, Nipan, Moura, Moura Central and Mungi. The field development occurs as 'pods' within an area extending approximately 36km north to south and up to 8km east to west. Moura is located within the PL94 tenure on the Western boundary and located 3.5km South of the northern PL94 boundary and 33km North of the Southern boundary. The development lies between the western boundary of various Mining Lease (MLs) held by Anglo Coal and the Dawson River. Access to the well fields utilises public roads and associated secondary roads which provide access to local properties. Figure 1 shows the Project location.

149°50'
150°
-24°30'
-24°40'
-24°50'
N

GLNG
Interconnect

PPL 166

PPL26 - PPL61
Interconnect Compound

Moura Office/Warehouse

Moura

PPL26

Mungi Laydown Yard

MR81 Moura M99
Booster Station

Moura Central
Compressor Station

Moura C
Booster

Nipan Booster

MERIDIAN SEAMGAS
PL94 AREA

Dawson River
Compressor Stati

Dawson River Water
Treatment Plant

Legend

Existing Facility and Infrastructure:

- Faclities
- Well pads
- PPL26 gas pipeline
- PPL166 gas pipeline
- Gas gathering pipeline

EPBC 2021/9217:

- PL94 Project Area

0 2 4 6 8 10 km

Data must not be used for direct marketing or be used in breach of the privacy laws.
(i) Westside Corporation Pty Ltd (WCL) accepts no responsibility for any loss or damage suffered however so arising to any person or corporation who may use or rely on this plan in contravention of the terms of this clause or clauses (ii) & (iii).
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Source: WCL; DNRME (QLD); Geoscience Australia; Bing Maps

Compiled:	M.Rodiger
Checked:	M.Rodiger
Drawn:	J.Payne
Date:	27/02/25
Datum:	GDA2020
Approved:	M.Rodiger

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FIGURE 1 - PROJECT AREA AND EXISTING PL94 INFRASTRUCTURE MAP

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Path: M:\02_Products\02_Meridian\Workspaces\ME_308\ME_308d\ME_308d.aprx\ME_308d

1.2 Objective of the Produced Water Management Plan

This Plan covers all activities associated with managing produced water once it is at surface. The plan outlines how produced water will be managed in accordance with the regulatory framework. In addition, the Plan sets the objectives to maximise the beneficial use of the produced water and identify any potential impacts that may require mitigating. Other objectives of the Plan include:

- Provide a document that sets out the Westside water management philosophy and approach;
- Demonstrate alignment with regulatory policies;
- Document the risks and mitigation measures in relation to produced water management;
- Provide clear information on the base data and management of the produced water including:
    - Source water quantity and quality;
    - Demand location and volume;
    - Available technologies;
    - Environmental receptors and constraints;
    - Address potential community concerns and regulatory requirements.

The Plan considers the management of produced water over the life of the Project. This Plan will be regularly reviewed to adapt to any changes in development or take advantage of advances in the management of produced water in the future.

2. Legislative Framework

This Plan has been prepared in accordance with the key policies and legislation for managing produced water at PL 94. Table 1 provides a summary of the policies and legislation considered in the development of the Plan.

Table 1– Summary of Legislation, Guidelines and Approval Conditions for CSG water Management

Legislation, policy or guideline
Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)
Environmental Protection Act 1994 (Qld) (EP Act)
Environmental Protection (Water and Wetland Biodiversity) Policy 2019
Coal Seam Gas Water Management Policy (EHP 2012)
Petroleum Act 1923 (Qld)
Petroleum and Gas (Production and Safety) Act 2004 (Qld) (P&G Act)
*Waste Reduction and Recycling Act 2011 (*Qld) (WRR Act)
End of Waste Guideline (Qld) (DES, 2016) • *End of Waste Code – Associated Water* • *End of Waste Code – Associated Water for Irrigation*
Water Act 2000 (Qld) (Water Act)
National Water Quality Management Strategy (NWQMS) (AG, 2018)
Australian and New Zealand Guidelines for Fresh and Marine Quality (ANZEC, 2000)
Queensland Water Quality Guidelines (QWQG) (EHP, 2013)
Code of Practice: For the construction and abandonment of petroleum wells and associated bores in Queensland (DNRME, 2019)
Australian Standard AS2885 – Pipelines Gas and Liquid Petroleum
Australian Pipelines and Gas Association Ltd (APGA) Code of Environmental Practice (2017)

3. Water Resource

3.1.1 Produced Water Production

The by-product of gas production of a CSG field is produced water. Gas and water are held in the coal matrix by hydrostatic pressure. To release the gas molecules from the coal matrix the coals need to be de-pressured. Depressurisation is done by pumping the water out of the coal seam, which then allows the gas to desorb from the coals and flow to the surface.

Groundwater is extracted until hydrostatic pressure is reduced to achieve consistent gas flow. Generally water extraction in a well has a steep production curve to a peak, where gas flows are achieved and then the water production sharply declines.

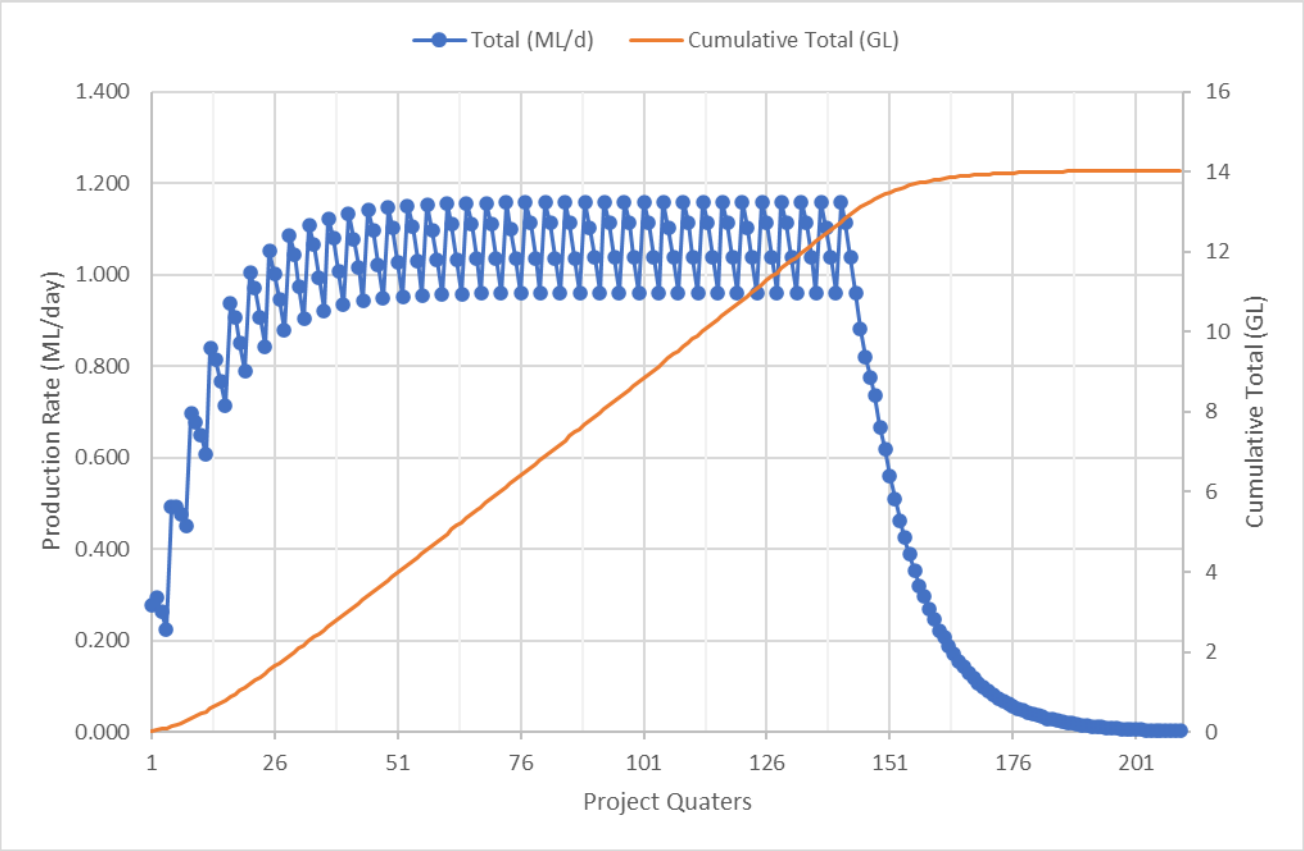
The produced water production characteristics from a gas field can be forecast using established techniques and field data. The forecast (often termed the water production curve) provides the rate and total volume of produced water extracted over a gas field area.

The PL94 field is a relatively mature gas field and the produced water data acquired during the operation of PL94 has been used to predict the volumes of produced water that will be extracted over the life of the Project.

The current water production rate is ~ 480 m3/d across the PL94 field. This baseline flow will be consistent through 2022 until drilling operations increase after a reduction in 2020. **Figure 2** provides the water profile curve for the life of the Project. The peak water production is predicted to occur in Year 17, with a peak rate of ~2.6 ML/day. The estimated cumulative water production volume is also presented in **Figure 2**. The total groundwater that will be abstracted for the duration of the Project is estimated at ~32.4 GL. The water profile of each well peaks quickly and drop offs quickly making the profile flat ranging between 2.2 and 2.6ML per year for the majority of the Project.

> The water profile will be updated as the Project progresses to ensure the water management scenarios are fit for purpose.

Figure 2 – Produced water production for PL94



3.1.2 Produced Water Quality

The quality of produced water from the proposed wells will be a function of the underlying formations. Groundwater quality of the Baralaba Coal Measures collected over a number of years shows there is a wide range of water quality within the coal seams. It also shows water quality to be a Na/Mg - Cl dominated saline water type. Accordingly, produced water from these coal measures is high in salinity (see **Table 2**).

Table 2 - Groundwater Quality in the Baralaba Coal Measures[1]

Parameter	Unit	Range
pH	Range	7.3 – 8.8
EC	µS/cm	5010 – 15 400
TDS	mg/L	2000 – 14 000
SO_4	mg/L	<1 – 690

[1] Data collected for the PL94 UWIR dated 11 June 2019 and UWIR annual reports.

Parameter	Unit	Range
Ca	mg/L	6.7 – 505
Cl	mg/L	1743 – 6231
Mg	mg/L	1.5 – 216
Na	mg/L	1163 – 4400
K	mg/L	9.5 – 150
CO3	mg/L	1.4 – 165
HCO3	mg/L	771 – 3258
Total alkalinity	mg/L	580 – 980

3.2 Current Produced Water Management

The current water management program at Westside has a mix of beneficial use applications, storage and water treatment. The current produced water management program is suitable for the volumes of water that are currently produced. Figure 3 provides an overview of the water management infrastructure for the Moura field as well as tank capacity and indicative flows.

Figure 4 provides an overview of the water management infrastructure for the Dawson River and Nipan fields as well as tank capacity. The current water management program relies on tank storage and beneficial uses for the treated, raw and retentate water. The end use of the water has several scenarios:

- Water produced in the Moura field is aggregated in the Above Ground Storage Tanks (AGST) and used for beneficial uses.
- Water from the Dawson River and Nipan Fields is aggregated at the Dawson River AGST and treated at the Dawson water treatment plant. The permeate is stored in tanks for beneficial use. The retentate water is returned to the AGST. Water produced in excess of the plant capacity is beneficially used.

The current beneficial uses include:

- Stock water for local landholders (Westside currently has one beneficial use agreement with local a local landholder)
- drilling activities;
- dust suppression; and
- construction activities.

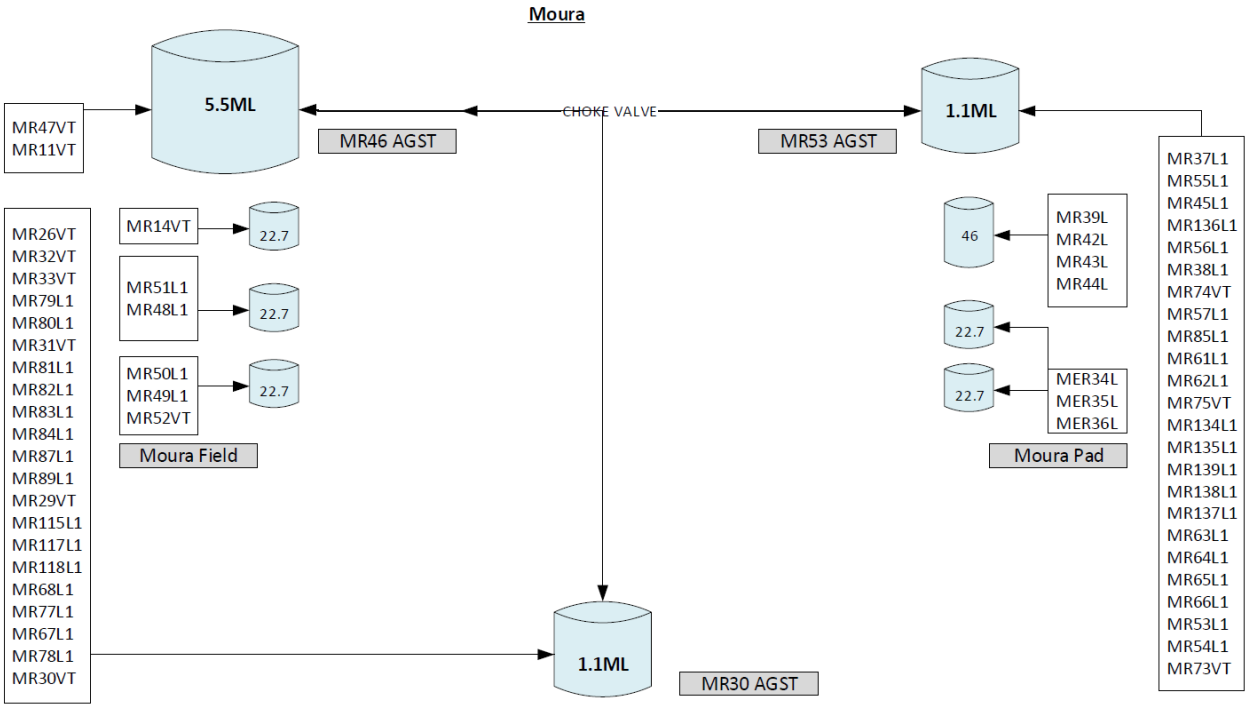


Figure 3– Moura Field Water Network

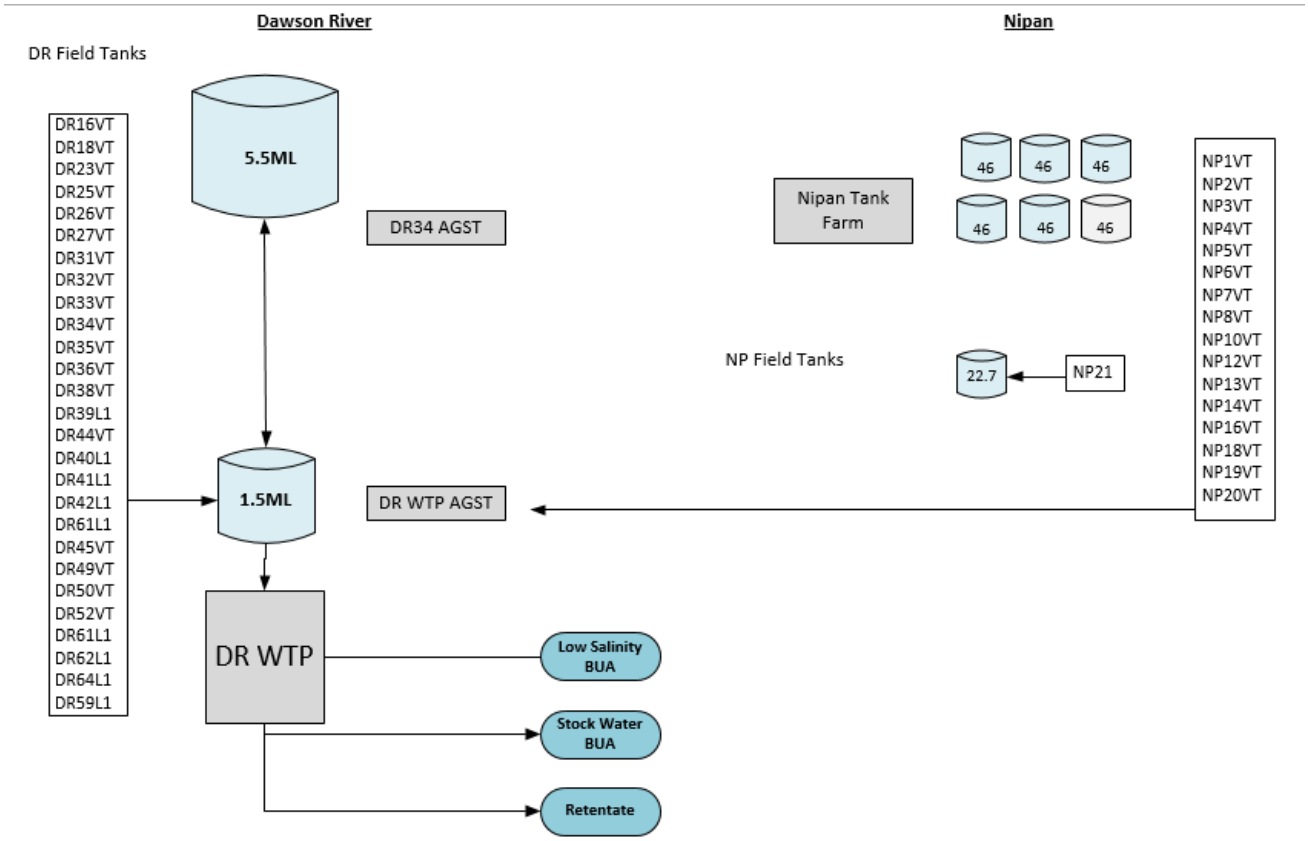


Figure 4– Dawson River and Nipan Field Water Network

3.2.1 Produced Water Management – Water Treatment

The existing Dawson Water Treatment Plant (WTP) receives water from the Dawson and Nipan sections of the gas fields. Currently, approximately 250kL per day is received at the plant. Figure 5 provides an overview of the Dawson River WTP.

The water is received in a 1.5 ML AGST. The water in this tank is dosed with a flocculation and leaves the tank via a clarifying weir. The water is then ozonated and pumped through a hydrocyclone, disc filter, sand filter and bag filter. The filtered water is stored in a balance tank. From the balance tank the water can be pumped either through an ion exchange media (IEX) filtration chain or a reverse osmosis (RO) system. There is additional filtration (sand and granulated activated carbon filter, bag filter and cartridge filters) prior to the water being pumped through the RO membranes.

The Dawson WTP produces 3 types of treated water: low salinity (1,500 µS/cm EC limit), stock BUA water (5,000 mg/L TDS limit) and retentate water (ranges from 10,000 - 20,000 uS/cm). The low salinity is mainly RO water with a shandy of ion exchange (IEX) resin treated water to re-ionise. The stock BUA water is mostly IEX filtered water with a small RO water shandy to reduce salinity. The retentate water is the brine from the

RO units and backwash from the hydrocyclone and sand filters. Water quality tests are performed and recorded daily with portable water quality meters. Laboratory tests are conducted monthly.

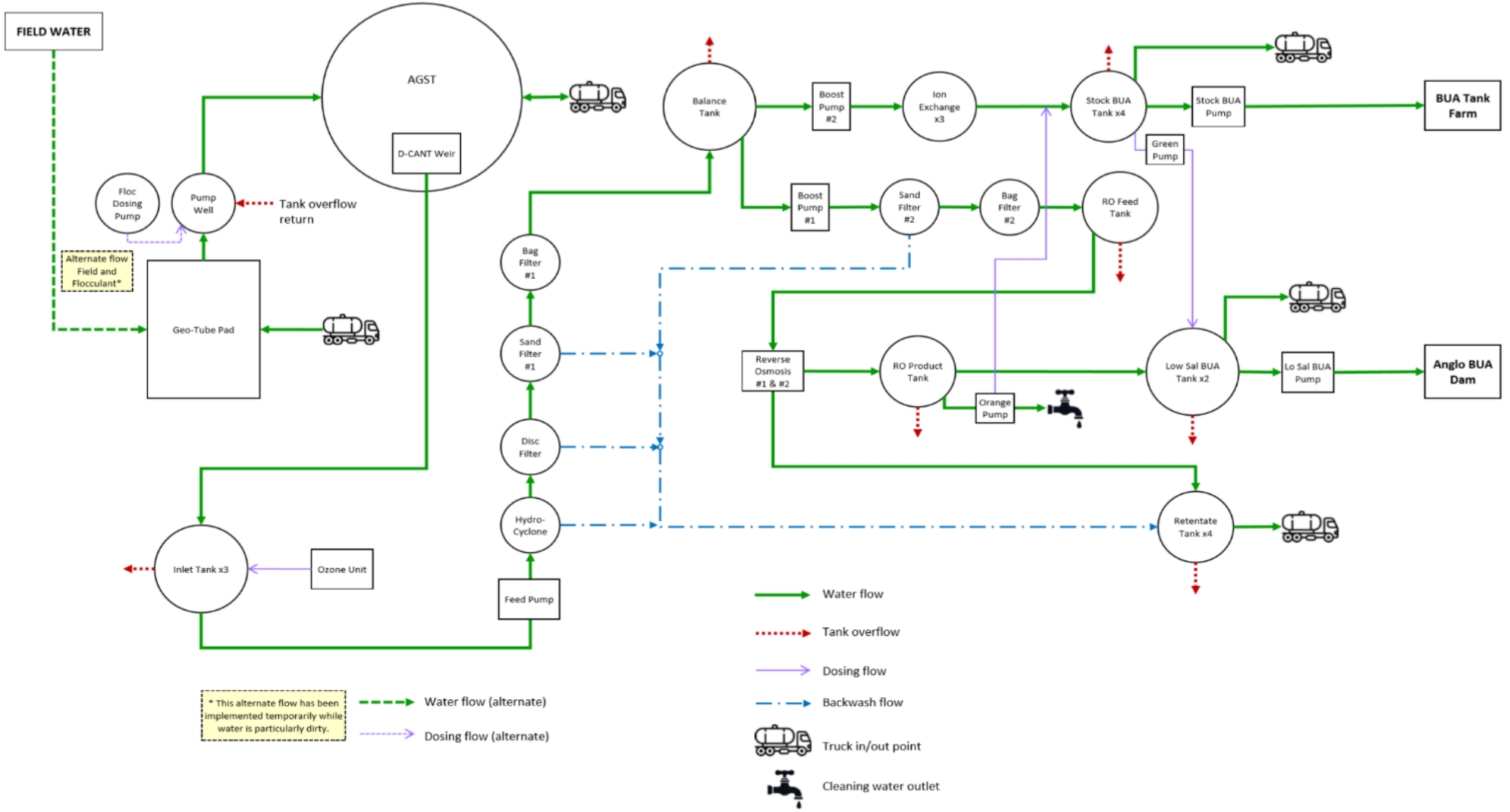


Figure 5 – WTP Overview

3.2.2 Produced Water Management – Raw Water Beneficial Use

Westside maximises the beneficial use of raw produced water as the priority. The water is beneficially used for stock water, construction, drilling and completions and dust suppression.

Westside has a number of wells in the Dawson River Field that meet the water quality requirements under the EOWC for Associated Water to supply produced water for stock water. Westside's priority is to supply all produced water that meets the stock water quality parameters to landowners.

Westside uses produced water in its drilling and completions processes and in construction when needed for compaction.

The Moura-Theodore area can become very dry and dust can be generated by Westside's activities. Westside is proactive in ensuring dust is minimised and does not impact on the community's amenities. Below are the Environmental Authority (EA) conditions for PL 94 that specify how produced water can be used:

(B7) Under PL94 EA produced water may be re-used in:
a) drilling and well hole activities; or
b) stimulation activities.

(B8) Produced water may be used for dust suppression provided the following criteria are met:
a) the amount applied does not exceed the amount required to effectively suppress dust; and
b) the application:
i. does not cause on-site ponding or runoff
ii. is not applied outside the area being suppressed
iii. does not harm vegetation surrounding the area being dust suppressed; and
iv. does not cause visible salting.

(B9) Produced water may be used for construction purposes provided the use:
a) does not result in negative impacts on the composition and structure of soil or subsoils
b) is not directly or indirectly released to waters
c) does not result in runoff from the construction site; and
d) does not harm vegetation surrounding the construction site.

3.2.3 Produced Water Management – Treated Water Beneficial Use

The Dawson WTP produces two treatment streams, the first is stock water quality water and the second is low salinity water. The stock water quality meets the ANZECC water quality guidelines as per the requirements under the End of Waste Codes – Associated Water. The low salinity water meets the requirements for irrigation water under the End of Waste Code – Associated Water for Irrigation.

Westside has a BUA for stock water in place to take the low salinity water and the stock water quality water from the permeate produced from the water treatment plant. The stock water quality water is delivered via a pipeline to a set of water tanks on the landowner's property.

Water quality tests are completed daily at the water treatment facility to ensure that the water supplied meets the specification requirements of the End of Waste Code – Associated Water (ANZECC water quality guidelines for stock water). Water quality results are uploaded on the operational dashboard Kanepi for review by the Operations team.

3.2.4 Produced Water Management – Retentate/Brine Management

Due to the limited processing and low recovery of the water treatment facility to meet the stock water quality guidelines, the retentate produced is approximately 5,000 - 10,000 uS/cm. The retentate is classified as CSG water as it meets the definition of CSG water, which has a EC of less than 12,000 uS/cm. The water treatment facility produces approximately 70 m3/d of retentate.

The retentate is currently stored in a tank where it can be loaded out for:

- dust suppression, where it meets the definition of CSG water,
- if it does not meet the definition of CSG water it is blended to meet CSG water quality,
- Recirculated through the system,
- or loaded out for disposal.

4. Future Produced Water Management Strategy

Westside has plans to fully develop the PL94 tenure, which will require a water management strategy to support the increased development. The *Coal Seam Gas Water Management Policy 2012* (EHP, 2012) contemplates that developments change over time including the volumes produced from each well, and therefore the solutions will need to be adaptive. To achieve the outcomes of the regulatory framework and the best end use for the water, this Plan considers a number of viable water management options.

This Plan follows the prioritisation hierarchy documented in the *Coal Seam Gas Water Management Policy*:

- Priority 1 – Beneficial Use
  Produced water is used for a purpose that is beneficial to one or more of the following: the environment, existing or new water users and existing or new water dependant industries
- Priority 2 – Disposal
  After feasible beneficial use options have been considered, treating and disposing produced water in a way that firstly avoids, and then minimises and mitigates impacts on environmental values.

4.1 Water Management Infrastructure

With the existing development on PL 94 there is a backbone of water infrastructure in place to be developed upon and expanded. The future development will require additional capacity, transport, storage and

management of the incremental increases of produced water over time. The overarching design of the produced water management is pictured in Figure 6.

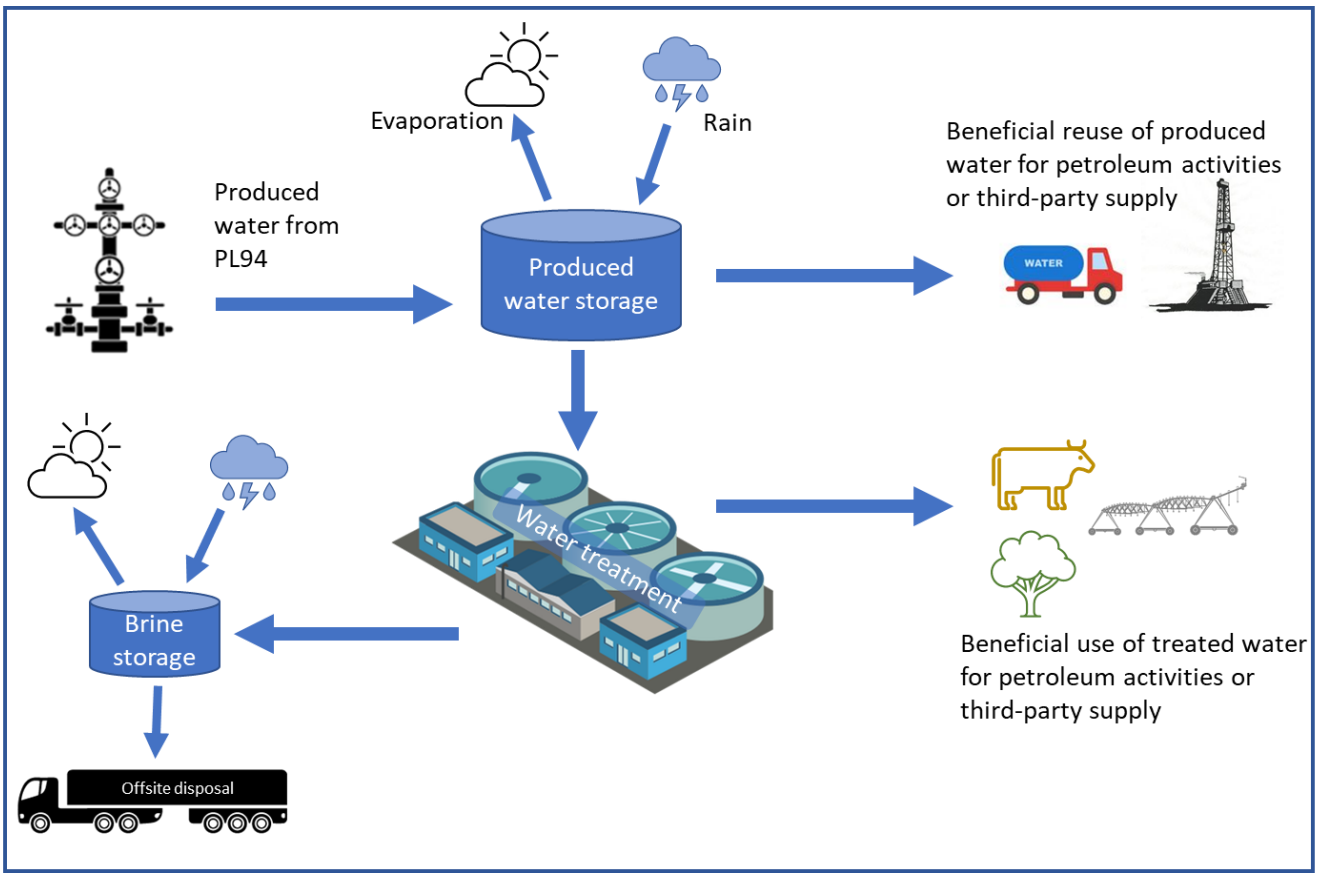


Figure 6 – Overview of the Proposed Produced Water Management

The current produced water management infrastructure is depicted in Figure 3 for the Moura field and Figure 4 for the Dawson River and Nipan fields. The future water management will include an increase in:

- produced water storage;
- water gathering network;
- increased produced water treatment facilities; and
- increase beneficial uses.

The increases in water infrastructure utilise a water balance incorporating the water production forecasts, potential storage surface areas, site rainfall and evaporation and the provision of water for beneficial reuse to develop the field infrastructure to manage the produced water.

4.1.1 Rainfall and Evaporation

Understanding the rainfall and evaporation data for the area is essential for determining the water balance.

Climate monitoring data collected by BOM is available from the Moura Post Office (Station No. 039071) located in the northern area of PL94. The climate of the surrounding region is subtropical, with warm to hot summers and mild winters. According to Enviropacific Services' Due Diligence Investigation Report (6

September 2010), the mean annual rainfall over the catchment varies between 600mm to 750mm. The average annual rainfall at the Moura Post Office Station since 1980 is 685mm, of which the majority falls in the warmer months of the year (November to February).

Mean daily pan evaporation in the summer season reaches 8mm in December and 3mm in June. Average daily evaporation of 5.8mm/day (2117mm/year) exceeds mean rainfall throughout the year, the highest moisture deficit occurring during summer. In order to place recent rainfall years into a historical context, the CRD, a summation of the monthly departures of rainfall from the long-term average monthly rainfall, was calculated as follows:

CRDn = CRDn-1 + (Rn – Rav)
Where:
CRDn = CRD for a given month
CRDn-1 = CRD for a preceding month
Rav = long-term average rainfall for a given month
Rn = actual rainfall for given month

The CRD graph for the period 1980 to present is shown in Figure 7 using data from the period 1980-2020. A rising trend in the CRD plot indicates periods of above average rainfall, whilst a falling slope indicates periods when rainfall is below average. The CRD shown on the figure below indicates that the area experienced a period of generally below average rainfall from 1990 until 2009. Above average rainfall has been recorded from 2009 to 2012 followed by average – slightly below average rainfall to present. Rainfall data from the Moura station is not available from the BOM after August 2016 and so this data was produced using patched data from SILO.

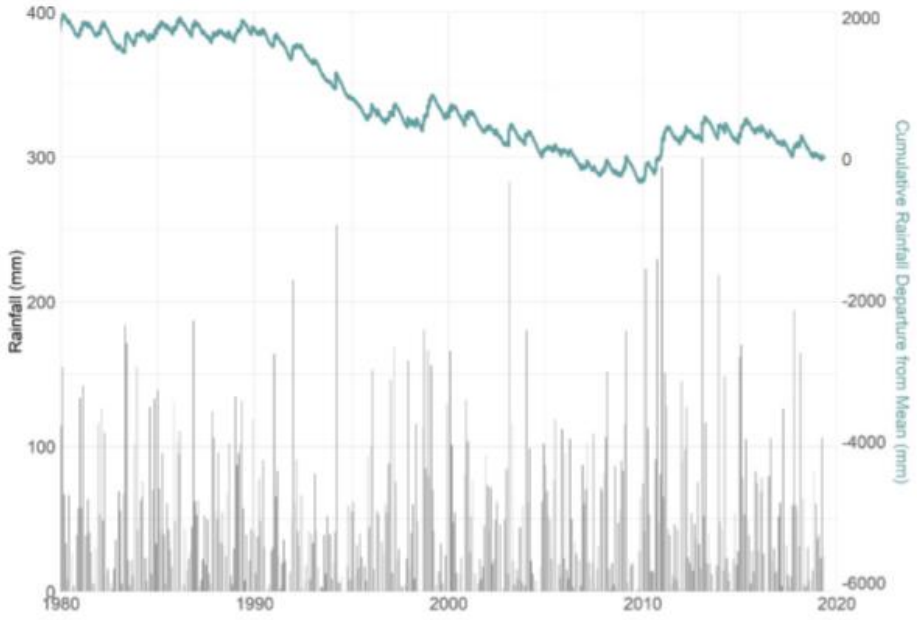


Figure 7 - CRD graph for the Moura area from 1980 to 2020

4.1.2 Produced Water Storage

Water storage is integral to the operations of PL94, as water storages are required to balance the produced water across the PL94 fields. Water storages are used for produced water, treated water and brine. These water storages can come in multiple types of structures including above ground tanks or purpose built earthen dams.

Any produced water earthen storage facility will be assessed and operated in accordance with the Queensland Government's *Manual for assessing consequence categories and hydraulic performance of structures*, and structures which are dams or levees constructed as part of environmentally relevant activities.

During operations of the water storages, adequate freeboard will be in place to manage the variations in water production, beneficial use availability and to manage wet weather.

Currently PL94 has 20ML of produced water storage. The increase in water production as a result of increased drilling activities will require further storage facilities over the life of the Project. Based on the current production profile, rain and evaporation rates and the irrigation scheme proposed for the Project, it is estimated that an additional 5.5ML tank will be required at the water treatment plant as a feedwater tank to the water treatment facility. It is envisioned that all of the PL94 water will be gathered to the Dawson River Field, where it will be either provided as stock water to landholders or treated and delivered for irrigation. The gathering system and management of the produced water will limit the amount of produced water storage required.

4.1.2.1 *Beneficial use storage*

Produced water from PL94 can be used for beneficial uses and is the priority for Westside. The beneficial uses for PL94 include:

- Construction –
  - Drilling and Completions
  - Civils
- Operations –
  - Dust suppression
- Stock water supply (Dawson River and Nipan Fields are the only fields that meet the EOWC – Associated Water without treatment)

Produced water for construction and operation activities will be taken directly from the above ground storage tanks.

Stock water supply is provided to landowners directly from wells that meet the EOWC – Associated Water for stock water. The produced water goes into a tank so that it can be tested in accordance with the EOWC – Associated Water and then it is transferred to landowner tanks.

4.1.1 Production Well and Water Gathering Network

Production wells will be drilled and constructed in accordance with the *`Code of practice for the construction and abandonment of petroleum wells and associated bores in Queensland'* (DNRME, 2019).

To transport the produced water from the production wells to the water facilities, Westside will utilise new and existing gathering infrastructure. Gathering lines are low pressure networks that are buried to a depth that enables unchanged grazing or farming operations.

Gas gathering lines will be designed and constructed to comply with:

- *Australian Standard AS2885 – Pipelines Gas and Liquid Petroleum*
- *Code of Practice: For the construction and abandonment of petroleum wells and associated bores in Queensland* (DNRME, 201)
- *Australian Pipelines and Gas Association Ltd (APGA) Code of Environmental Practice* (2017)

4.1.2 Produced Water Treatment and Beneficial Uses

The future water treatment plant will replace the existing plant or alternatively incorporate the existing plant into the new system.

The proposed new water treatment plant will be able to treat up to 1.5ML/d of produced water and will utilise RO desalination technology to recover 85-90% of the water processed through the facility. The treatment process is presented in Figure 8 and comprises:

- Feed water tank
- Filtration
- Reverse Osmosis
- Brine storage facility
- Produced water tank
- Pumps and irrigation.

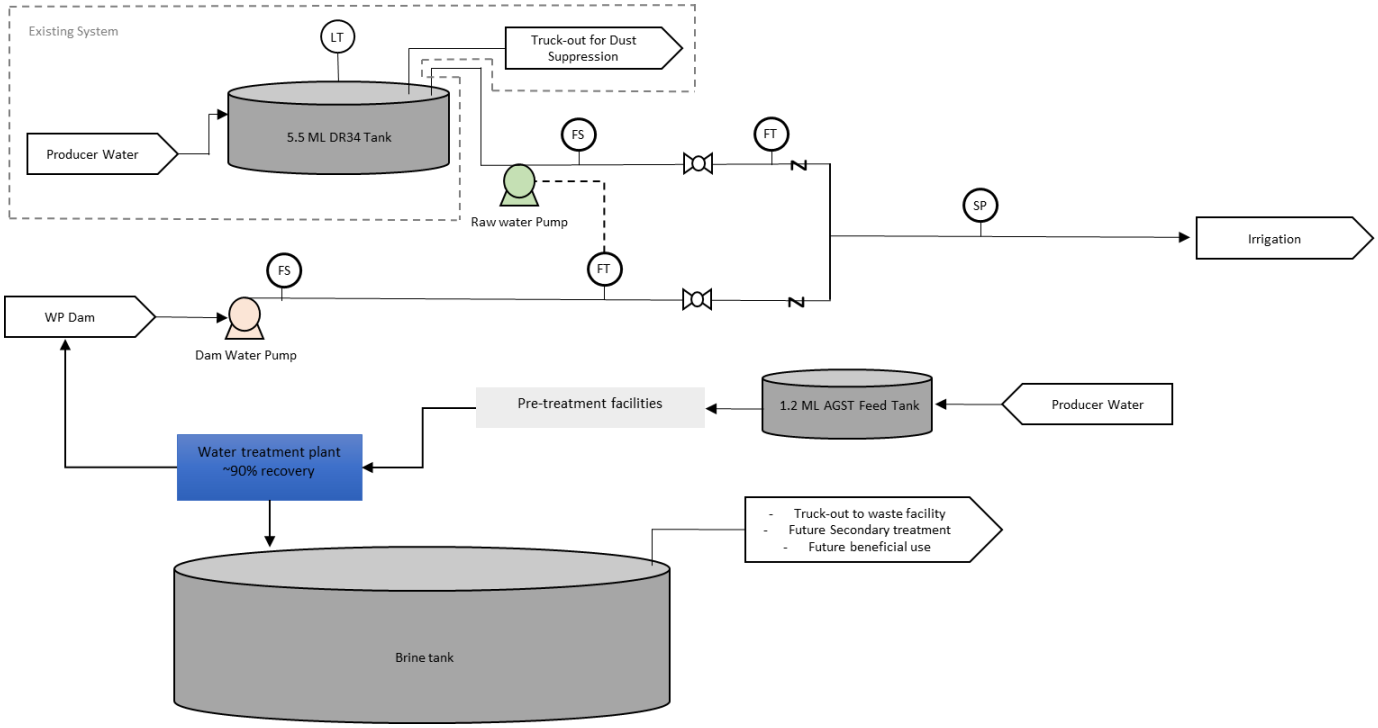


Figure 8 - Water Treatment Plant - simplified process flow diagram

4.1.2.1 *Feed Tank*

Produced water from PL94 is either directed to the 1.2ML feed pond or the 5.5ML DR34 field tank. The feed tank provides a temporary storage prior to the pre-treatment phase of the plant. The feed tank has a clarifying weir and allows for the settlement of course suspended sediments and oxygenate the produced water. As the development progresses, an additional 5.5ML tank is planned to be added to the front of the process to enable additional capacity.

4.1.2.2 *Filtration and disinfection*

On entry to the water treatment plant from the feed tank, produced water is dosed with a monochloramine disinfectant to reduce its propensity to cause biofouling of the subsequent treatment equipment (monochloramine disinfectant is commonly used in domestic water treatment) then transferred to filtration units.

The produced water is passed through a coarse filter then a finer filter to remove any particles or suspended sediments that did not settle out within the feed pond and to remove any biological organisms that may have been introduced during this temporary storage period.

4.1.2.3 *Reverse Osmosis*

For the PL94 Project area, RO desalination has been selected as the primary treatment method. RO desalination is a proven technology in Australian CSG applications when all key selection variables are objectively considered. Where high-quality treated water is required, RO desalination has, to date, has been the preferred technology as the most cost-effective and practical treatment process once all regulatory

requirements, practical operability, and commercial considerations have been evaluated. As new treatment technologies emerge, they will be assessed by Westside and considered for any future water treatment requirements, or for retrofitting to existing assets, if proven viable.

RO desalination uses hydraulic pressure to overcome osmotic pressure to draw water through the RO membrane. Most dissolved salts and other trace elements are rejected by the membrane thus generating two (2) separate product streams: treated produced water (permeate) and saline reject (brine). The future WTP's RO recovery rate is planned to achieve 85-95% utilising secondary RO to recover additional treated water from the saline reject produced by the primary RO units. Prior to RO desalination the filtered water will undergo pH adjustment (if required), dosing with a commercially available biocide and anti-scalent, and be de-chlorinated with sodium bisulphite to protect the RO membranes.

4.1.2.4 *Permeate water conditioning*

Prior to the supply of permeate water, the pH of the permeate water is adjusted to ensure its suitability for beneficial use and that residual disinfectant is removed. Blending in a small proportion of filtrate to increase buffering capacity and conditioning using calcium and magnesium may be undertaken to meet specific water quality limits for the end use, e.g. agricultural use.

4.1.2.5 *Waste*

Wastes generated by the water treatment plant consist of filtered solids and other chemical cleaning solutions from the process and Brine.

Wastes that are suitable for recycling will be directed to the Feed Pond for treatment. Other wastes will be directed to the brine tank.

4.1.2.6 *Permeate water use*

4.1.2.6.1. Water to Landholder – Irrigation Scheme

Utilising the application process under the End of Waste Framework, irrigation water will be provided to a landholder. A Resource Monitoring Management Plan has been developed for the End of Waste Application for the provision of irrigation water, which will be approved prior to irrigation.

Figure 8 provides an overview of the irrigation scheme. Produced water is delivered to the feed tank for treatment at the water treatment plant. The water delivered to the feed tank are from the Nipan, Mungi, Hillview, Pretty Plains, Ridgedale and Meridian fields which have higher salinity and lower volumes. Water from the Dawson River field will be delivered to the 5.5ML DR34 tank. The Dawson River Field water has higher volumes and lower salinity.

The permeate water from the water treatment plant will be delivered to the Waddington Park dam under the End of Waste Code - Associated Water for Irrigation as it will be under 950 uS/cm. The permeate water mixed with the dam water will then be blended with the produced water stored in DR34 to produce a 2000

uS/cm irrigation water quality to be used by the landholder. The irrigation will be undertaken under in compliance with an approved Resource Monitoring Management Plan under the End of Waste Framework.

4.1.2.6.1. Water to Project activities

As described in Section 3.2.2, where water quality is compatible with the requirements of the particular project activity and the End of Waste Codes, untreated produced water will be preferentially used to support Project activities. In circumstances where a better quality of water is required, treated produced water will be used in accordance with the End of Waste Codes. Project activities that could use treated produced water include:

- General construction activities such as:
  - Well drilling, workovers and completions, hydraulic fracture stimulation;
  - Hydro-testing of produced water gathering network;
  - Facility construction;
- Dust suppression; and
- Landscaping and revegetation.

4.1.1 Brine and Salt Management Scheme

The prioritisation hierarchy within the Coal Seam Gas Water Management Policy also provides guidance for managing brine waste, which comprises of:

- Priority 1 – Brine or salt residues are treated to create usable products wherever feasible.
- Priority 2- After assessing the feasibility of treating brine or solid salt residue to create useable and saleable products, disposing of the brine and salt residues in accordance with strict standards that protect the environment.

The preferred brine and salt management scheme comprises storage of brine in purpose built tanks, utilising solar evaporation for the concentration of brine, followed by thermal crystallisation to produce a solid salt product suitable for containment in a Regulated Waste Facility (RWF) on or off tenure.

A conceptual overview of the scheme's key processes includes:

- Storage and solar evaporation of brine in brine tanks – brine produced by the water treatment plant is transferred into brine tanks located in close proximity to the water treatment plant for storage. Evaporation of water from the brine increases its salinity until crystallisation commences (at circa 250 g/kg of brine).
- Brine crystallisation to solid salt – The crystallisation process is anticipated to be a thermal process, with solid salts transferred to a beneficial use or to an existing regulated facility or purpose built RWF.
- Salt management options include:
  - Investigation of beneficial uses for the crystalised salt in the region include agricultural uses like salt licks.
  - Transfer to an existing RWF that accepts salts.

- Salt encapsulation within a purpose built RWF on the PL94 tenure. The RWF will be designed and operated in accordance with applicable legislation and guidelines. A RWF will utilise proven technologies that are commercially available and represent an evidence-based method of safely containing and storing waste.

Brine and salt management options will continue to be investigated the as the development progresses.

5. Groundwater

5.1 Groundwater Chemistry

The following groundwater chemistry observations have been made for the local hydrochemistry of PL94:

- The groundwater data from Alluvium bores vary between sodium-chloride and sodium-bicarbonate dominated. Salinity levels from the alluvium groundwater data indicate that the water quality is predominantly fresh.
- Moolayember Formation water quality data shows it is similar to the alluvium, the Moolayember Formation varies between sodium-chloride and sodium-bicarbonate dominated. TDS concentrations indicate that the water quality is fresh to brackish.
- The Clematis Group water quality indicate that the water is fresh. The limited groundwater data prevents the identification of the dominant ionic constituents of the water.
- The water quality results indicate that the Rewan Group groundwater is sodium-chloride dominated, and is saline.
- Water quality data of the Baralaba Coal Measures indicate that the groundwater is sodium-chloride dominated, with a quality ranging from fresh to saline (average TDS = ~10,800 mg/L). These results are comparable to the produced water quality from the current operations.

5.2 Groundwater Recharge

Recharge in the PL94 occurs as diffuse recharge with rainfall infiltration occurring at outcropping aquifers. Estimates of long-term average recharge rates have been made by OGIA as part of the 2016 UWIR (OGIA 2016b) using chloride mass balance recharge estimation method. For the units outcropping within the vicinity of the Project Area, the following recharge rates were estimated by OGIA:

- Alluvium – 6.8 mm/year
- Moolayember Formation (outcrops to southwest) – 2.5 mm/year
- Clematis Group (outcrops to southwest) – 26.9 mm/year
- Rewan Group (outcrops to south-southwest and within Project Area) – 1.2 mm/year
- Baralaba Coal Measures (outcrops to east) – 5.0 mm/year
- Older Permian Units (outcrops to east) – 6.8 mm/year

Recharge into the alluvium associated with the Dawson River is anticipated to occur during high flow periods, following significant rainfall events, although insufficient data is available to quantify the recharge. Recharge from the alluvium into the units underlying may also occur.

5.3 Groundwater-Surface Water Interactions

Groundwater-surface water interaction within the Project Area may occur as a result of two key processes:

- Recharge of aquifers as leakage from watercourses; and
- Discharge of groundwater to watercourses as baseflow.

Recharge to groundwater systems from watercourses may occur across the Project Area, however this only occurs when there are conditions of sufficient saturation in the alluvium and associated hydraulic head to allow water to infiltrate into the underlying aquifers. This is likely for the majority of the ephemeral watercourses across the Project Area where flow is only observed during and following rainfall events. The exception to this is the Dawson River where surface water flow is perennial.

Alluvial aquifers deposited by fluvial processes in river channels or floodplains are found along the Dawson River, and associated tributaries. Based on the information from the surface water flow gauges, and groundwater level data from the alluvium, there is limited potential for baseflow from the groundwater system to contribute to the Dawson River within the vicinity of the Project Area. This is supported by the comparison between groundwater levels in the alluvium monitoring bore (13030385) immediately upstream of the surface water gauging station on the Dawson River at Woodleigh (130317B). Perennial surface water flow in the Dawson River, through the Project Area, is a result of groundwater baseflow contribution up-catchment of the Project Area.

Groundwater levels recorded in monitoring bore 13030385, over the duration of the surface water gauging records that correlated with the groundwater level monitoring records (October 1985 to May 2012), indicate that groundwater levels gradually rose from 120.62 mAHD to 126.2 mAHD throughout the recorded period. In comparison, the recorded river elevation at the Dawson River at Woodleigh gauging station fluctuated from 126.254 mAHD to 144.509 mAHD, with a median of 126.808 mAHD. This indicates that the river levels were always higher than the recorded groundwater levels in the alluvium.

As a result, the elevation of the Dawson River at Woodleigh is higher than the groundwater level at 13030385, and considering that the monitoring bore is approximately 10 km upstream in the Dawson River alluvial channel this is limited connection between groundwater and surface water within the vicinity of the Project Area.

5.3.1 Spring Complexes and Groundwater Dependant Ecosystems

The majority of spring complexes are located over 50 km south of the Project Area, while other spring complexes are located over 30 km to the southwest of the Project Area. There will be no impacts to surrounding spring complexes as a result of the Project.

Potential terrestrial GDEs have been mapped in the vicinity of the Project Area. Typically, these mapped areas of TGDEs are located adjacent to watercourses (e.g. Dawson River), which are reliant on groundwater within the alluvium. Potential TGDEs are also mapped where Cenozoic sediments are present. Drawdown resulting from the proposed Project will be limited to the Rewan Group and will not propagate into the Cenozoic sediments and alluvium. Therefore, there will be no impacts to mapped potential terrestrial GDEs in the vicinity of the Project Area

6. Environmental Values

6.1.1 Environmental Values

The *Environmental Protection Act 1994* (Qld) (EP Act) defines an Environmental Value (EV) as:

- a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Under the EP Act, the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EP Policy) is established as subordinate legislation to achieve the object of the EP Act in relation to Queensland Waters. The purpose of the EP Policy is achieved by:

- identifying environmental values for waters and wetlands to be enhanced or protected;
- identifying management goals for water;
- stating water quality guidelines and water quality objectives to enhancing or protecting the environmental values of water;
- providing a framework for making consistent, equitable and informed decisions about waters; and,
- monitoring and reporting on the condition of waters.

The EP Policy provides defined EVs and water quality objectives (WQOs) for the Dawson River sub-basin under Schedule 1 of the policy. EVs for the Lower Dawson are shown in Table 3. The WQ1309 plan (State of Queensland 2013a, 13) that accompanies the policy, indicates that the Project Area is located within the Lower Dawson main channel – regulated reaches, as well as eastern tributaries. The WQ1310 plan (State of Queensland 2013b) details the groundwater zones and indicates the Project Area is located across three groundwater chemistry zones.

Table 3 - Environmental Values for the Dawson River Sub-Basin waters within the vicinity of the Project Atlas (DEHP 2011a)

Water	Environmental Values											
	Aquatic Ecosystem	Irrigation	Farm Supply / Use	Stock Water	Aquaculture	Human consumer	Primary recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural and spiritual values
Lower Dawson—Cracow, Theodore areas (WQ1309)												
Lower Dawson main channel – regulated reaches	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Eastern tributaries – developed areas	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater	✓	✓	✓	✓	✓		✓			✓		✓
Undeveloped areas	✓			✓		✓	✓	✓	✓	✓		✓

✓ means the EV is selected for protection. Blank indicates that the EV is not chosen for protection.

6.1.1.1 *Relevant EVs for local groundwater*

The regional EVs identified in Table 3 have been reassessed to determine their applicability to PL94. Table 4 provides a summary of the review and presents the EVs deemed applicable to PL94 groundwaters including justification for their inclusion / omission.

Table 4 - Summary Assessment of Environmental Values related to groundwater

Environmental Value	Applicable to PL94 / Justification	
Aquatic Ecosystem	✓	Quaternary alluvium is connected to the Dawson River and Kianga Creek. During gaining stream conditions groundwater quality may affect surface water quality. Concentrations for analytes defined in the WQOs are generally similar or less than measured groundwater baseline conditions.
Water supply for Irrigation	✓	Based on GWDB review and baseline bore assessment results, groundwater from bores screened within the Quaternary alluvium are used for irrigation purposes (crops and gardens). Groundwater from bores screened within other units is not used for irrigation purposes. With the exception of iron and manganese, concentrations for analytes defined in the WQOs are generally similar to or greater than measured groundwater baseline conditions.
Stock Watering	✓	Based on GWDB review and baseline bore assessment results, groundwater from bores screened within the Quaternary alluvium is used for stock watering purposes (primarily cattle). Groundwater from bores screened within other units is not used for stock watering purposes. Concentrations for analytes defined in the WQOs are generally similar to or greater than measured groundwater baseline conditions.
Aquaculture	×	No bores were identified as being utilised for aquaculture purposes
Primary Recreation	×	No bores were identified as being utilised for primary recreation purposes
Drinking Water	×	No bores were identified as being utilised for drinking water purposes
Cultural and Spiritual Values	✓	Quaternary alluvium is connected to Dawson River and Kianga Creek which may hold cultural and spiritual significance

6.1.2 Water quality objectives

The EP Policy also provides limited water quality objectives for underground aquatic ecosystem protection in Fitzroy Basin groundwaters. These WQOs provided in the policy are classified by groundwater depth and regional chemistry zone. Under the policy, groundwater at and surrounding the Project site will need to be compared to the WQO's relevant to Zones 28 and 34 of the Dawson Groundwaters of the Dawson River Sub-basin of the Fitzroy Basin water plan (WQ1310). WQOs for these zones are shown in Table 5 (aquatic ecosystem EVs) and Table 6 (human use EVs). In reference to the site hydrogeology it is deemed that the shallow WQOs (<30 m) are representative of the Quaternary alluvium, Tertiary sediment and Rewan Formation aquifer units with the deep WQOs (>30m) representative of the Permian coal measure aquifer units. It should be noted that where groundwaters interact with surface waters, groundwater quality should not compromise identified EVs and WQOs for those waters.

Table 5 - Fitzroy Basin Water Quality Objectives (aquatic ecosystem) according to water chemistry zone

Zone	Depth (± 30m)	Percentile	EC (µS/cm)	Hardness (mg/L	pH	Alkalinity (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	Cl (mg/L)	SO_4 (mg/L)	HCO_3 (mg/L)	NO_3 (mg/L)	SiO_2 (mg/L)	F (mg/L)	Fe (mg/L)	Mn (mg/L)	Zn (mg/L)	Cu (mg/L)	SAR	RAH (meq/L)	EH (mV)
28	Deep	20th	308	24	7.1	74	5	3	28	32	0	85	0	13	0.1	0.01	0.01	0.01	0.03	1.89	0.83	ID
28	Deep	50th	425	45	7.8	156	9	5	73	45	2	186	0.5	15	0.2	0.01	0.01	0.02	0.03	4.6	2.25	ID
28	Deep	80th	723	66	8.2	219	16	9	128	74	5	257	0.5	17	0.23	0.04	0.21	0.03	0.045	9.73	3.54	ID
28	Shallow	20th	300	22	7.1	73	4	3	28	42	0	85	0	15	0.114	0	0.01	0	0	2.2	0.19	ID
28	Shallow	50th	615	51	7.7	196	9	6	128	57	2	230	0.5	17	0.2	0.02	0.01	0.01	0.005	5.5	2.8	ID
28	Shallow	80th	1644	261	8.2	416	30	32	252	241	11	495	0.5	25	0.4	0.093	0.096	0.019	0.019	13.5	4.91	ID
34	Deep	20th	3419	359	7.4	156	46	35	480	753	25	188	0.01	16	0.02	0	0	0.01	0.017	10.5	0	ID
34	Deep	50th	6100	919	7.8	275	145	115	1100	1900	138	330	2.15	25	0.155	0.05	0.05	0.025	0.03	15.6	0.24	ID
34	Deep	80th	160000	3208	8.03	536	442	491	2565	5905	398	650	14.92	36	0.4	0.246	0.291	0.317	0.03	24.65	6.25	ID
34	Shallow	20th	498	163	7.1	154	18	27	135	171	12	187	0	21	0.1	0	0	0	0	4.37	0	ID
34	Shallow	50th	498	163	7.1	154	18	27	135	171	12	187	0	21	0.1	0	0	0	0	4.37	0	ID
34	Shallow	80th	2150	674	7.75	435	84	108	747	1309	140	536	0.95	36	0.28	0.03	0.01	0.015	0.015	10.85	0	ID

ID: Insufficient data to perform statistical summaries, or the parameter was not tested

Table 6 - Fitzroy Basin Groundwaters Water Quality Objectives according to human use environmental values

Environmental Value	Water Quality Objective (refer to specified codes and guidelines for full details)
Water Supply for irrigation	Australian and New Zealand Environment and Conservation Council (ANZECC, 2000) objectives for pathogens and metals are provided in Tables 8 and 9 of Dawson River Sub-basin Environmental Values and Water Quality Objectives (DEHP, 2011). For other indicators, such as salinity, sodicity and herbicides, see Australian Water Quality Guidelines (AWQG).
Farm water supply/use	Objectives as per AWQG.
Stock Watering	Objectives as per AWQG, including median faecal coliforms <100 organisms per 100 mL. WQOs for total dissolved solids and metals are provided in Tables 10 and 11, based on AWQG. For other objectives, such as cyanobacteria and pathogens, see AWQG.
Cultural and Spiritual Values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.

7. Risks, Potential Impacts and Management

Westside implements all produced water and brine management in accordance with the applicable legislation and Environmental Authority conditions to protect all relevant Environmental Values identified in the Project Area.

This section is an overview of the outcomes of the environmental risk assessment conducted to ensure the risks to Environmental Values from produced water are adequately controlled.

7.1 Risk assessment process

Westside is committed to the continual and effective management of risk to ensure that:

- Systems are in place to identify all risks to the extent that is reasonably practicable;
- The potential impacts of identified risks are understood and limits set to ensure their appropriate management;
- Responsibilities for risk management are delegated to appropriate persons;
- Assurance is provided as to the effectiveness of the risk management system and its associated risk controls; and
- Any material changes to risk levels are monitored and acted upon accordingly.

To achieve these aims, for all produced water management activities, Westside conducts a comprehensive risk assessment. Identified risks are evaluated considering existing controls and are assigned likelihood and consequence ratings which are then combined to derive a risk level on a five-point scale from 'Low' to 'Extreme'. 'Low' level risks and some 'Medium' level risks (of acceptably low severity), are considered to be appropriately mitigated by existing controls without the need for further treatment. For other risks, additional mitigation measures are considered and treatment plans prepared and approved. For 'Extreme' risks, a treatment plan is prepared and implemented immediately. All identified risks are registered in the Westside Risk Management System and are regularly reviewed at a frequency dependent on the risk level. 'Low' and 'Medium' risks are reviewed yearly, 'High' risks are reviewed twice a year and 'Severe' and 'Extreme' risks are reviewed once a month. A summary of risks associated with the operation of the produced water management scheme have been considered for the full lifetime of the PL94 Project and are provided in Section 7.2.

7.2 Summary of risks and controls

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
Produced water gathering network					
Uncontrolled release of produced water adversely impacts soil, surface water and/or groundwater EVs.	- Loss of pipeline integrity. - Release of produced water from low point drains.	- Gathering network designed in accordance with Australian Standards by suitably qualified engineers - Integrity of gathering network managed through implementation of the Integrity Management Plan including: - Right of way inspection prior to commencement of operation - Ongoing right of way surveillance tailored to specific gathering network. Components may include; monitoring of third-party activities within corridor, monitoring for evidence of soil erosion and conducting leakage surveys.	Serious	Unlikely	Low
Produced water storage					
Seepage of produced water through tank liner adversely impacts soil, surface water and/or groundwater EVs.	- Failure of Liner	- Operation of the produced water tanks, which includes: - Monitoring the sumps for the leak detection system of the primary and secondary liners. - Preventative maintenance of the tanks. - Tank level monitoring	Serious	Highly Unlikely	Low

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
		- External monitoring around the base of the tank for wet areas - Asset Integrity Management Plan - UWIR annual reporting			
Failure of tank or overflow with release of produced water adversely impacts soil, surface water and/or groundwater EVs.	-Poor construction and / or operation. - Extreme rainfall causes volume stored to exceed capacity	- Operation of the produced water tanks, which includes: - Monitoring the sumps for the leak detection system of the primary and secondary liners. - Preventative maintenance of the tanks. - Tank level monitoring - Operate at recommended manufactures freeboard - Ensure available freeboard is available prior to the wet season - Site water balance undertaken routinely to ensure capacity in the system. - CSG Water Storage Management Procedure (WCL-0000-HS-PRC-033) - Asset Integrity Management Plan - UWIR annual reporting	Moderate	Unlikely	Low
Drowning of Fauna	Entry of fauna into tanks	Tanks are all above ground structures with vertical walls	Minor	Highly Unlikely	Low

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
Use of untreated produced water					
Ponding and/or runoff of produced water adversely impacts soil, surface water and/or groundwater EVs.	-Poor practice during application of produced water. - produced water quality unsuitable for use.	- All requirements for use outlined in the relevant End of Waste Code will be met. - All requirements under the PL94 EA for dust suppression will be met. - Monitoring of the dust suppression applications. - Records will be kept for auditing purposes. - Application of produced water will not occur during rainfall events. - CSG Water Carting Procedure (WCL-0000-HS-PRC-035) - UWIR annual reporting	Moderate	Unlikely	Low
Vehicle incident/accident leads to spill of produced water and resultant adverse impact on soil, surface water and/or groundwater EVs.	- Driver error - Poor road condition - Poor weather - Poor vehicle condition - Collision with wildlife/stock	- All drivers to complete safe driver training. - Driver to inspect vehicle prior to use. - Toolbox meeting to discuss weather and truck movements for the day. - Driver to check with site superintendent during periods of wet weather to confirm roads are safe. - CSG Water Carting Procedure (WCL-0000-HS-PRC-035)	Minor	Unlikely	Low

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
Use of treated produced water for project activities					
Risks associated with using treated produced water for project activities are addressed by the untreated produced water use risks as the risk profile is lower.					
Use of treated produced water for water to Landholder Scheme					
Irrigation scheme of mixed treated and produced water adversely impacts soil, surface water and/or groundwater EVs.	- Off spec water supplied to the landholder - Landowner application rates are altered	- End of Waste Application – Resource Monitoring and Management Plan developed by a third party specialist and approved by the Department of Environment and Science. - Compliance with the Resource Monitoring and Management Plan. - Resource Monitoring and Management Plan obligations for the Landholder clearly defined in the agreement. - Monitoring and reporting against the Resource Monitoring and Management Plan kept for assurance purposes.	Minor	Unlikely	Low
Brine Storage					
Seepage of brine through tank liner adversely impacts soil, surface water and/or groundwater EVs	Failure tank liner	- Operation of the brine tanks, which includes: - Monitoring the sumps for the leak detection system of the primary and secondary liners. - Preventative maintenance of the tanks. - Tank level monitoring	Major	Highly Unlikely	Med

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
		- Operate at recommended manufactures freeboard - Ensure available freeboard is available prior to the wet season - Site water balance undertaken routinely to ensure capacity in the system. - CSG Water Storage Management Procedure (WCL-0000-HS-PRC-033) - Asset Integrity Management Plan - UWIR annual reporting			
Failure of tank or overflow with release of brine adversely impacts soil, surface water and/or groundwater EVs.	-Poor construction and / or operation. - Extreme rainfall causes volume stored to exceed capacity	- Operation of the brine tanks, which includes: - Monitoring the sumps for the leak detection system of the primary and secondary liners. - Preventative maintenance of the tanks. - Tank level monitoring - Operate at recommended manufactures freeboard - Ensure available freeboard is available prior to the wet season - Site water balance undertaken routinely to ensure capacity in the system. - CSG Water Storage Management Procedure (WCL-0000-HS-PRC-033); - Asset Integrity Management Plan - UWIR annual reporting	Moderate	Unlikely	Low

Risk	Potential Causes	Existing Controls	Residual Risk		
			Consequence	Likelihood	Risk Level
Secondary salinity (arising from windborne salt from brine ponds) adversely impacts terrestrial ecology, soils and/or surface water EVs	Wind-borne salt	- Tank locations considers prevailing wind-direction - Manage freeboard to minimise wind effects - Regular monitoring of surrounding vegetation will be undertaken as part of the monitoring identify any preliminary signs of salinity effects.	Minor	Unlikely	Low
Drowning of Fauna	Entry of fauna into tanks	Tanks are all above ground structures with vertical walls	Minor	Remote	Low

8. Management Criteria

In accordance with the EP Act and specific requirements of the PL94 EA, Westside has developed measurable criteria (termed management criteria) against which the effectiveness of produced water and brine management will be monitored. The management criteria have been developed in accordance with the DES factsheet *CSG water management: Measurable criteria*.

Table 7 shows the management criteria for this PWMP. Each component of the produced water and brine management strategies in implementation has been assigned a specific management criterion and together, these criteria account for the quantity and quality of all produced water used, treated, stored or disposed of in the Project Area.

Several management criteria also inherently address the management of waste (primarily retentate/brine) generated during the treatment of produced water. Each management criterion consists of:

- A management objective for protecting EVs from the potential impacts of the produced water management activity;
- A series of tasks that will ensure that the objective can be achieved;
- Specific indicators against which the performance of produced water management can be measured, assessed and audited in an objective and repeatable manner; and
- A target for produced water management.

The continued suitability of all management criteria and operational performance against each criterion will be regularly evaluated and reported once a year in the annual return for the EA. If it is found that a management criterion has not been met, the following activities will be undertaken: Investigate significance of failure to meet management criterion on EVs and identify likely cause/s; Where cause/s can be attributed to the activities of Westside, and where required in order to protect EVs, identify means to refine operating procedures in order to ensure that criterion is met in future; Where required in order to protect and maintain EVs, implement any recommended changes to operating procedures. The respective annual return will outline the results of the above activities, where required.

Table 7 – Produced water management criteria

Objective	EVs to protect	Task	Performance Indicator
Understanding produced water quality and quantity	Contaminated-free land Groundwater availability for other users. Soils for growth of native vegetation. Soils for crop and pasture growth. Treated produced water for stock watering. Treated produced water for aquatic ecosystem protection. Treated produced water for reuse in the petroleum activities.	UWIR annual reports Implement groundwater monitoring program Development and implement stimulation impact monitoring program (if activities commence)	Reports prepared annually
		Monitoring dam / tank water pre and post treatment	Monitoring carried out in accordance with EA conditions and results documented
		Use of flow meters	Flow data for volumes abstracted taken and documented.
Movement of produced water		Routine maintenance of all water gathering lines, pipelines and pump stations	No spills of produced water from water gathering lines, pipelines or pumping stations
Storage of untreated produced water		Annual inspections of dams by RPEQ Routine checks of all produced water storage dams and tanks Installation and routine maintenance of high-level alarms / telemetry for tanks	Annual report prepared in accordance with EHP's Manual (EM635) and EA conditions Recommendations from report implemented with 14 days. No overflows or leaks from tanks No evidence of contamination of surface waters High level alarms installed Any new aggregation or brine dams are designed constructed and operated in accordance with the EA and EHP's Manual (EM635).
Treatment of produced water		Maintain and operate water treatment plant Monitor capacities and treatment volumes as activities progress to prevent hydraulic overload	Treated produced water is fit for purpose / meets criteria for intended use Treated produced water meets plant manufacturer specifications Volumes treated are measured and recorded
Maximising reuse of produced water		Use of produced water for all drilling and well hole activities, construction, dust suppression and if carried out, stimulation activities. Investigate and secure third-party reuse of produced water	Apply produced water on soils using spray irrigation methods. Monitor soil where produced water has been applied Produced water for dust suppression to only occur when wind speeds are ≤ 5 km/hr to avoid wind-blown soils and surface water contamination Produced water for dust suppression to only occur as necessary Continued consultation with, and documentation of, regional stakeholders

Objective	EVs to protect	Task	Performance Indicator
Brine / solid salt residue management		Investigate treatment and/or reuse of solid brine as the first priority Dispose of brine/solid salt residues at approved facility	Documented evidence of reading studies or participating in research studies.

9. Monitoring

Monitoring is undertaken to ensure the effective performance of the produced water management in PL94.

Data from the monitoring programs is used to continually refine and improve the operation of the produced water management scheme.

The water types and locations being monitored are:

- Treated produced water:
  - Water supply to the Waddington Park Farm Dam
  - Water Supply point for irrigation at DR34
  - Water supply point for stock watering at the water treatment plant
- Untreated produced water for End of Waste Code applications (irrigation, stock watering):
  - Water treatment plant AGST
  - DR 39
  - DR59
  - MR30
  - MR54
  - MR46
  - DR34
  - DR31
  - NP24

All monitoring is to be conducted in accordance with the *Monitoring and Sampling Manual 2009* (DEHP 2013). All monitoring is to be undertaken by a suitably qualified person.

9.1 Produced and treated produced water quality monitoring program

The recording and reporting of water quality data is used to confirm that the water treatment plant is effectively treating produced water to a standard suitable (from an environmental and public health perspective) for beneficial uses. The program is based on the public health and environmental water quality monitoring requirements outlined in the PL94 EA, the End of Waste Codes, UWIR and Resource Monitoring Management Plan. The monitoring required is regularly reviewed and updated as approvals and agreements change and if new uses of produced water are authorised.

Table 8 provides the water quality parameters and frequency for the beneficial uses of the treated and untreated produced water.

Table 8 - Westside PL94 Water Quality Monitoring Parameters

Use		Agriculture Use				Project Activities
Guideline/Approval		EOWC Irrigation		EOWC Stock Watering		EOWC
Characteristic	Unit	Limit Level	Frequency	Limit Level	Frequency	Limit
Physical - Chemical						
EC	uS/cm	950	Fortnightly			No water quality requirements
pH		6.-8.5				
SAR		12 or less				
TDS	mg/L			4000 - 5000 (beef cattle)	Fortnightly	
Metals and Metalloids						
Aluminium	mg/L	20	Monthly monitoring of metals and metalloids of the same water source, then six-monthly	5	Monthly monitoring of metals and metalloids of the same water source, then six-monthly	No water quality requirements
Arsenic	mg/L	2		0.5		
Boron	mg/L	Refer to Table 9.2.18 of the ANZECC Guidelines		5		

Characteristic	Unit	Limit Level	monitoring after three consecutive laboratory results which are less than 50 per cent of the water quality parameters	Limit Level	monitoring after three consecutive laboratory results which are less than 50 per cent of the water quality parameters	Limit
Cadmium	mg/L	0.05		0.010		
Chromium	mg/L	1		1		
Cobalt	mg/L	0.1		1		
Copper	mg/L	5		1 (cattle)		
Fluoride	mg/L	2		2		
Iron	mg/L	10				
Lithium	mg/L	2.5				
Lead	mg/L	5		0.1		
Maganese	mg/L	10				
Mercury	mg/L	0.002		0.002		
Molybdenum	mg/L	0.05		0.15		
Nickel	mg/L	2		1		

Uranium	mg/L			0.2		
Zinc	mg/L	5		20		
Characteristic	Unit	Limit Level	Frequency	Limit Level	Frequency	Limit
Radiological						
Alpha Emitters	Bq/L			0.5	Parameters initially monitored monthly, and then six-monthly after three consecutive detects which are less than 50% of the listed limit. If not detected in the source water Annually.	
Betta Emitters	Bq/L			0.5 (excluding K-40)		
Radium 226	Bq/L			5		
Radium 228	Bq/L			2		
Uranium 238	Bq/L			0.2		

9.2 Tank monitoring

Westside implements a range of inspection, maintenance and monitoring procedures in order to monitor the potential for environmental impacts. A summary of these procedures is provided in Table 9.

Table 9 - Tank Storage Monitoring

Activity	Frequency	Reporting	Personnel
Monitoring			
Field Water Quality	Monthly	Kanepi	Operations Environment
Beneficial re-use water (End of waste requirements)	Monthly	Kanepi	Operations Environment
Inspections			
Tank level monitoring	Weekly	Kanepi	Operations
Seepage	Annual	Maintenance System	Operations
Sump pump test	Annual	Maintenance System	Operations
Maintenance			
Routine Maintenance schedule	Annual	Kanepi	Operations Engineer

9.3 Sample Analysis and Data Management

9.3.1 Sample Analysis and Interpretation

All laboratory analyses and tests must be carried out by a laboratory that has NATA certification for such analyses and tests, except as otherwise authorised by the administering authority.

For environmental compliance purposes (EA, Irrigation End of Waste Code, and Resource Monitoring and Management Plan), the dissolved value is reported upon. The interpretation methodology is illustrated in Figure 3.4.2 of the ANZECC Water Quality Guidelines (page 3.4.19; ANZECC and ARMCANZ 2000).

9.3.2 Data Management

The data generated by the online monitoring of water quality parameters within the water treatment plant is captured by a SCADA system. This data is automatically copied into the Kanepi database that is remote to the water treatment plant for long term storage of a minimum of five (5) years. Exceedances of water quality alarm levels associated with online monitoring at the water treatment plant are managed in accordance with Standard Operating Procedures and Critical Operating Procedures.

All laboratory results data collected in support of water management is stored in the Westside data management system. All monitoring results are kept for a minimum of five (5) years, and will be made available to the administering authority if requested, and as part of the produced water evaluation annually where required by a condition of the EA or EP Act.

9.3.3 Incident Response and Results Reporting

Westside prepares routine reports describing the results of the monitoring, preferably in spreadsheet format, on a monthly basis. Routine monitoring related to the EA will be summarised in the EA annual return. No routine reporting is required under the End of Waste Code – Associated Water for dust suppression, however monitoring will be documented in the Westside data management system.

An incident is defined as a validated exceedance of a water quality limit level. For water quality parameters, exceedances of water quality limit levels are reviewed, validated, responded to and, where required, notified and reported to the administering authority.

All incident response processes are recorded and closed out through the Westside Donesafe System.

10. Abbreviations

Abbreviation	
BUA	Beneficial Use Agreement
CSG	Coal Seam Gas
CSG WMP	Coal Seam Gas Water Management Plan
^{0}C	Degrees Celsius
dB(A)	Decibels measured on the ‘A’ frequency weighting network.

Abbreviation	
DNRME	Department of Natural Resources, Mines and Energy
DES	Department of Environment and Science
EA	Environmental Authority
EC	Electrical Conductivity
EP Act	Environmental Protection Act 1994
EP Policy	Environmental Protection (Water and Wetland Biodiversity) Policy 2019
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ERA	Environmentally Relevant Activity
ERE	Endangered Regional Ecosystem
ESA	Environmentally Sensitive Areas
EV	Environmental Values
FA	Financial Assurance
Ha	Hectares
km	Kilometre
L	Litres
m	Metres
Mg/L	Milligrams per Litre
ML	Mining Lease
NES	National Environmental Significance

Abbreviation	
PL	Petroleum Lease
PWMP	Produced Water Management Plan
RE	Regional Ecosystem
ROW	Right of Way
HSE	Safety, Health and Environmental
µg/L	Micrograms per Litre
µS/cm	Micrograms per Centimetre
WQOs	Water Quality Objectives