Westside Corporation Ltd

Mungi West / Mungi North

Underground Water Impact Report

Final

DX70002A02

October 2024

Klohn Crippen Berger

25 October 2024

Westside Corporation Ltd
Level 11, 175 Eagle Street
Brisbane, QLD
4000

Mark Rodiger
Senior Environmental Advisor

Dear Mr. Rodiger:

PL 1048/PL 1049 UWIR Update
Underground Water Impact Report
Final

KCB Australia Pty Ltd (KCB) is pleased to provide the Underground Water Impact Report of the PL 1048/PL 1049 (Mungi West and Mungi North) to Westside Corporation Pty Ltd. Should you have any queries regarding this document, please do not hesitate to contact the undersigned on +61 7 3004 0237 or cwaterhouse@klohn.com.

Yours truly,

KCB AUSTRALIA PTY LTD.

Carly Waterhouse
Senior Hydrogeologist Associate

AC/CW/XW:JJ

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1 INTRODUCTION

KCB Australia Pty Ltd (KCB) was commissioned by Westside Corporation Pty Ltd (Westside) to prepare an Underground Water Impact Report (UWIR) for the Mungi North and Mungi West Project (the Project) within Petroleum Lease (PL) PL 1048 and PL 1049. This report covers the UWIR January 2025 to January 2028 period.

1.1 Project Overview

Petroleum Lease (PL) PL 1048 and PL 1049 (the Project) is located to the northwest of Moura in the southeastern portion of the Bowen Basin (Figure 1.1). The Project lies within the Fitzroy Basin surface water catchments. Directly adjacent to the Project, to the east and southeast, is Anglo American's Dawson Mining Complex (Dawson): an open cut and historic underground mine that commenced operations in the 1960s producing a mixture of coking, soft coking and thermal coal.

Gas production activities for the Project commenced in January 2022. The Project involves the progressive development of gas infrastructure including the following activities:

- 400 wellheads comprising of vertical wells, lateral wells and multi – lateral wells;
- Ancillary linear infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;
- Water management infrastructure; and
- Other ancillary activities and facilities to support gas field development.

Westside is the operator of PL 1048 and PL 1049. The permits are held by:

- Westside Mungi Pty Ltd;
- Harcourt (Queensland) LLC; and
- Mitsui E&P Australia Pty Ltd.

1.2 Background to the UWIR

The *Petroleum and Gas (Production and Safety) Act 2004* entitles the holder of a PL to take or interfere with underground water (i.e., groundwater) as part of approved CSG operations. This entitlement is termed the PL holder's 'underground water rights'.

Groundwater that is taken or interfered with while exercising the underground water rights is termed 'associated water'. The holder of the PL is entitled to use associated water for any purpose. In order to exercise the underground water rights for the project - the PL holder must:

- Obtain an Environmental Authority (EA) under the *Environmental Protection Act 1994* (EP Act); and
- Comply with its reporting obligations under Chapter 3 of the *Water Act 2000* (Water Act). The administering authority for Chapter 3 of the Water Act is the Department of Environment, Science and Innovation (DESI).

- Comply with lease holder obligations under Chapter 3 of the Water Act including undertaking baseline assessments of the groundwater regime and water supply bores, preparing UWIRs to provide for ongoing assessment, reporting of groundwater take and (where necessary) entering into make good agreements with owners of affected water supply bores.

An initial UWIR (2021) was prepared and submitted to DESI by Westside. The initial UWIR was approved and took effect on 10th January 2022.

This report (UWIR 2024) is relevant for the next reporting period from January 2025 to January 2028.

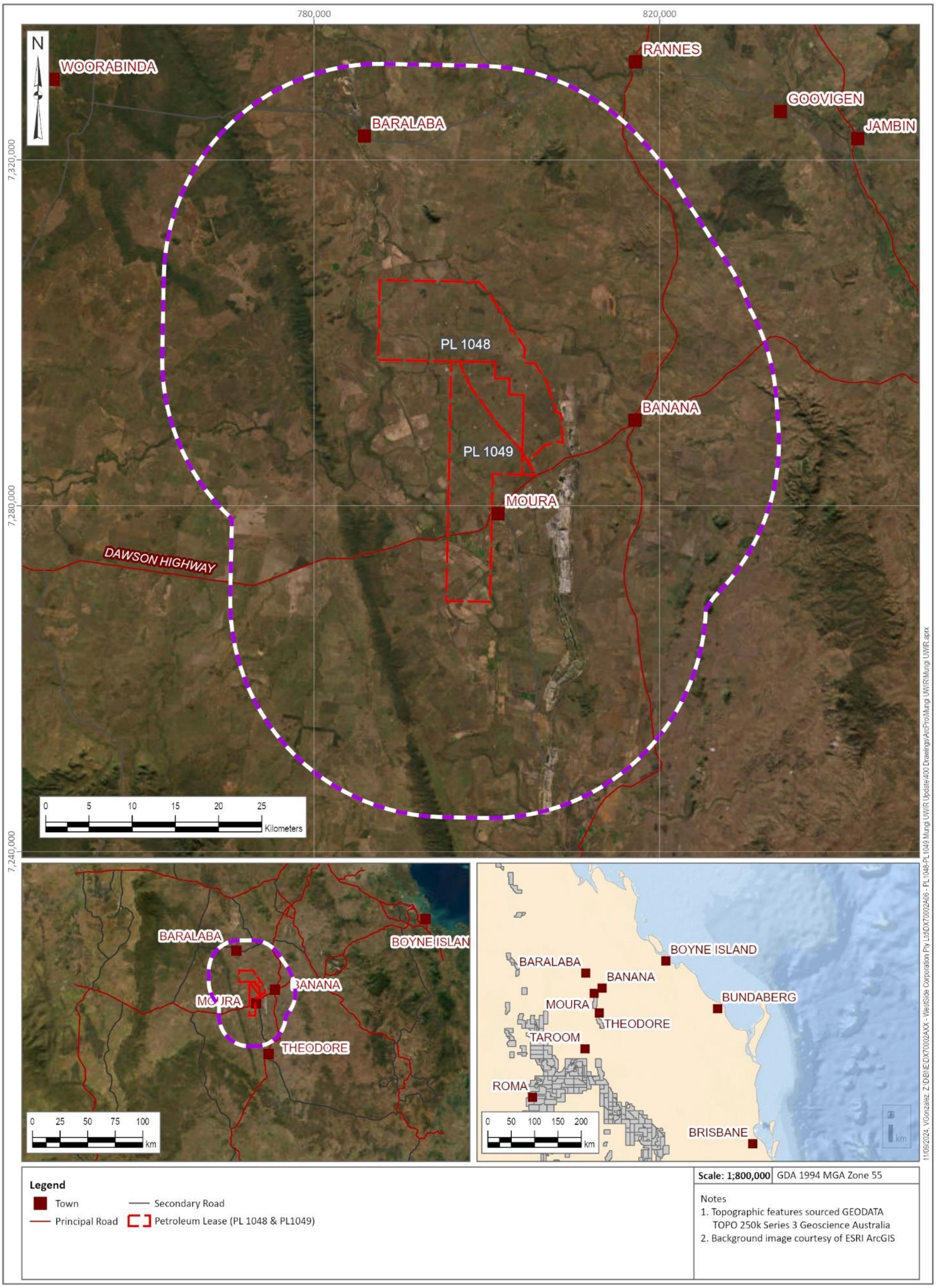

Figure 1.1 Project Location

1.3 UWIR Scope and Structure

The current UWIR (2021) addresses the initial three years of the Project from the date that Westside commenced to exercise its underground water rights on the Project site. The main purpose of the UWIR is to describe the groundwater take due to CSG development (and any associated impacts) over a three-year period (the UWIR period).

This updated UWIR (2024) addresses the next three years (three-year Anniversary) of the Project from the date that Westside exercises its underground water rights on the Project site. Westside's groundwater take on the Project site commenced in January 2022. The planned CSG activities during this UWIR period include CSG depressurisation in the southeast portion of PL 1048 and PL 1049.

This UWIR has been prepared in accordance with the requirements described in Section 376 of the Water Act and the DESI guideline: Underground water impact reports and final reports (the UWIR guideline), where relevant. The requirements of Section 376 of the Water Act are complimentary to the information requirements of the Section 126A and 227AA of the EP Act.

The specific scope of this UWIR includes:

- Presenting the relevant groundwater, geological and environmental information for the Project;
- Undertaking a review of the Queensland Government groundwater database and QSpatial database to confirm the current water bores registered within the Project, the immediate affected areas (IAA) and the long-term affected areas (LTAA);
- Presenting the conceptual understanding of the groundwater regime within the Project and its surrounds, based on historical groundwater studies and relevant public domain data;
- Updating and presenting the current conceptual understanding of the groundwater regime within the Project and its surrounds, based on historical groundwater studies and relevant public domain data;
- Simulation of the 3D numerical groundwater flow model to include the water production to date and updated production plans for the life of the Project;
- Using the numerical groundwater flow model to produce predictions of the Project groundwater effects during the UWIR period, including drawdown predictions and predictions of groundwater take for years 1, 2 and 3 of the UWIR period;
- Using water production “type curves” from comparable gas wells within the vicinity of the Project, produce water production volumes for years 1, 2 and 3 of the UWIR period;
- Assessing the groundwater impacts and developing feasible mitigation and management strategies in the event of potential adverse impacts being identified. Impacts assessed included:
    - Measured and future potential groundwater drawdown impacts on groundwater supply bores;

  - Potential groundwater drawdown impacts on the Dawson River and other surface water features;
  - Potential groundwater drawdown impacts on Groundwater Dependent Ecosystems (GDEs);
  - Potential cumulative drawdown impacts with adjacent resource activities, including existing coal seam gas and mining activities; and
  - Potential impacts on existing groundwater quality pre-mining as a result of the Project development.
- Confirming the existing approved EA groundwater monitoring program, the revised groundwater monitoring program, and management measures.

The structure of this UWIR has been prepared in accordance with that outlined in the Guideline: (Water Act 2000) Underground Water Impact Reports and Final Reports (DESI, 2024) (UWIR Guideline). This guideline specifies that a UWIR must contain information that has been outlined in each of the following parts of the guideline:

- Part A: Information about underground water extractions resulting from the exercise of underground water rights (Section 6);
- Part B: Information about aquifers affected, or likely to be affected (Section 7);
- Part C: Maps showing the area of the affected aquifer(s) where underground water levels are expected to decline (Section 8);
- Part D: An assessment of the impacts to the environmental values from the exercise of underground water rights (Section 9);
- Part E: A water monitoring strategy (Section 10);
- Part F: A spring impact management strategy (Section 11); and
- Part G: For a CMA, assignment of responsibilities to resource tenure holders (Section 12).

The relevant Water Act requirements for each part of the UWIR Guideline above are listed at the beginning of the relevant sections in this report. Westside's current EA for PL 1048 and PL 1049 (EA0002230) is also referenced with regards to the groundwater monitoring program which is currently implemented for the Project.

2 REGULATORY FRAMEWORK

2.1 Petroleum and Gas (Production and Safety) Act 2004

The *Petroleum and Gas (Production and Safety) Act 2004* is an Act relevant to exploring for, recovering and transporting by pipeline, petroleum and fuel gas, and ensuring the safe and efficient undertaking of those activities. The key purpose of this Act is to facilitate and regulate the undertaking of responsible petroleum activities and the development of a safe, efficient and viable petroleum and fuel gas industry.

This Act identifies underground water rights for petroleum tenures, and states that the holder of a petroleum tenure may take or interfere with underground water in the area of the tenure if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity for the tenure.

The Act prescribes mandatory compliance with the Queensland Department of Resources (DoR), formerly the Department of Natural Resources, Mines and Energy's (DNRME), '*Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 1'* (DNRME 2019). The purpose of this Code is to provide guidance that all petroleum wells, CSG wells and associated bores are constructed, maintained and abandoned to a minimum acceptable standard resulting in long-term well integrity, containment of petroleum and the protection of groundwater resources.

2.2 Water Act 2000

General Purpose of the Water Act

The Water Act is an Act to provide for the sustainable management of water and the management of impacts on underground water, among other purposes. This Act provides a framework for:

- The sustainable management of Queensland's water resources by establishing a system for the planning, allocation and use of water;
- The sustainable and secure water supply and demand management for designated regions;
- The management of impacts on underground water caused by the exercise of underground water rights by the resource sector; and
- The effective operation of water authorities.

This Act covers water in a watercourse, lake or spring, underground water (or groundwater), overland flow water, or water that has been collected in a dam.

Water Act and CSG Related Activities

The Water Act provides for the identification and management of potential impacts on underground water caused by the exercise of underground water rights by resource tenure holders, which are regulated under the *Petroleum and Gas (Production and Safety) Act 2004.* The Act also outlines the requirements for make good agreements, if required, associated with the impacts to underground water.

Chapter 3 of the Water Act has a stated purpose to provide for the management of impacts on underground water caused by the exercise of underground water rights by resource tenure holders, which includes petroleum tenure holders. To achieve the stated purpose, a regulatory framework is provided which requires:

- Resource tenure holders to monitor and assess the impacts of the exercise of underground water rights on water bores and to enter into make good agreements with the owners of the groundwater bores as necessary;
- The preparation of UWIR that establish underground water obligations, including obligations to monitor and manage impacts on aquifers and springs; and
- Manage the cumulative impacts of the activities of two or more resource tenure holders' underground water rights on underground water.

Under this regulatory framework, where there is an area of concentrated development, a cumulative management area (CMA) can be declared. The Project is located beyond the northern extents of the Surat CMA, which was declared in 2011. Of relevance to this Project, UWIRs have been previously compiled for:

- ATP 564 (now ATP 2027) - Harcourt Petroleum N.L. (CDM Smith 2016a);
- ATP 602 – Harcourt Petroleum N.L. (CDM Smith 2016b); and
- PL 94 – Westside (CDM Smith 2019).

Trigger Thresholds

Under Section 362 of the Water Act, a bore trigger threshold, for a consolidated aquifer, of 5 m applies (2 m for an unconsolidated aquifer). The 5 m threshold represents the maximum allowable groundwater level decline in a groundwater bore, due to petroleum tenure holder's activities, prior to triggering an investigation into the water level decline and potentially make good activities.

Under Section 379 of the Water Act , a spring trigger threshold for an aquifer applies. This includes vent springs / complexes and watercourse springs (i.e., gaining streams). This threshold value (0.2 m) represents the maximum allowable decline in the water level of an aquifer in connection with a spring, at the spring location, prior to triggering an investigation into the water level decline.

2.2.1 UWIR Requirements

Section 376 of the Water Act specifies the UWIR content requirements. Table 2.1 lists the specific content requirements and provides an explanation of where each requirement is addressed in this UWIR.

Table 2.1 UWIR Content Requirements

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
376(1)(a)	An underground water impact report must include each of the following — for the area to which the report relates: (i) the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights; and (ii) an estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report.	(i) Section 6.1 describes the groundwater produced (ii) Section 6.2 describes the estimated groundwater take over the UWIR period.
376(1)(b)	For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights: (i) a description of the aquifer; (ii) an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers; and (iii) an analysis of the trends in water level change for the aquifer because of the exercise of the rights mentioned in paragraph (a)(i); (iv) a map showing the area of the aquifer where the water level is predicted to decline, because of the taking of the quantities of water mentioned in paragraph (a), by more than the bore trigger threshold within 3 years after the consultation day for the report; and, (v) a map showing the area of the aquifer where the water level is predicted to decline, because of the exercise of relevant underground water rights, by more than the bore trigger threshold at any time.	(i) and (ii) Section 7 describes the groundwater regime in the relevant aquifers. (iii) Model results/analysis is described in Section 8 (iv) Section 8.2 provides discussion on the predicted groundwater level drawdown associated with the proposed CSG development during the UWIR period. (v) Section 8.2 provides discussion on the predicted groundwater level drawdown associated with the proposed CSG development at any time during the development.
376(1)(c)	A description of the methods and techniques used to obtain the information and predictions under paragraph (b).	Section 4 describes the UWIR methodology
376(1)(d)	A summary of information about all water bores in the area shown on a map mentioned in paragraph (b)(iv), including the number of bores, and the location and authorised use or purpose of each bore.	Section 9 describes the water bores identified from the DRDMW groundwater database.
376(1)(d,a)	A description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.	Section 9.2presents the assessment of the environmental values due to the CSG Development.
376(1)(d,b)	An assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights: i. during the period mentioned in paragraph (a)(ii); and, ii. over the projected life of the resource tenure.	Section 9.2presents an assessment of potential groundwater impacts due to CSG development.
376(1)(e)	A program for: i. conducting an annual review of the accuracy of each map prepared under paragraph (b)(iv) and (v); and, ii. giving the chief executive a summary of the outcome of each review, including a statement of	Section 12 describes the UWIR review and reporting process for the affected aquifers.

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
	whether there has been a material change in the information or predictions used to prepare the maps.	
376(1)(f)	A water monitoring strategy.	Section 10 describes the groundwater monitoring program.
376(1)(g)	A spring impact management strategy.	There are no springs within the Project site or its surrounds. Hence, a strategy for spring management is not required.
376(1)(h)	If the responsible entity is the office: i. a proposed responsible tenure holder for each report obligation mentioned in the report; and, ii. for each immediately affected area—the proposed responsible tenure holder or holders who must comply with any make good obligations for water bores within the immediately affected area.	Not applicable.
376(1)(i)	The information or matters prescribed under a regulation.	No other relevant information or matters have been prescribed under a regulation.
376(2)	However, if the underground water impact report does not show any predicted water level decline in any area of an affected aquifer by more than the bore trigger threshold during the period mentioned in subsection (1)(b)(iv) or at any time as mentioned in subsection (1)(b)(v), the report does not have to include the program mentioned in subsection (1)(e).	Section 12 describes the UWIR review and reporting process for the affected aquifers.

Section 378 of the Water Act lists the content requirements for the water monitoring strategy. Table 2.2 lists the specific content requirements and provides an explanation of where each requirement is addressed in this UWIR.

Table 2.2 UWIR Water Monitoring Strategy Content Requirements

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
378(1)	A responsible entity's water monitoring strategy must include the following for each immediately affected area and long-term affected area identified in its underground water impact report or final report: a) a strategy for monitoring— (i) the quantity of water produced or taken from the area because of the exercise of relevant underground water rights; and (ii) changes in the water level of, and the quality of water in, aquifers in the area because of the exercise of the rights; b) the rationale for the strategy; c) a timetable for implementing the strategy; d) a program for reporting to the office about the implementation of the strategy.	Section 10 describes the groundwater monitoring program.

Water Act Section No.	Water Act Section Content	UWIR Cross Reference
378(2)	The strategy for monitoring mentioned in subsection (1)(a) must include: a) the parameters to be measured; b) the locations for taking the measurements; and, c) the frequency of the measurements.	Section 10 describes the groundwater monitoring program.
378(3)	If the strategy is prepared for an underground water impact report, the strategy must also include a program for the responsible tenure holder or holders under the report to undertake a baseline assessment for each water bore that is: a) outside the area of a resource tenure; but b) within the area shown on the map prepared under section 376(b)(v).	Section 9 describes the water bores identified from the DRDMW groundwater database.
378(4)	If the strategy is prepared for a final report, the strategy must also include a statement about any matters under a previous strategy that have not yet been complied with.	Not applicable.

2.3 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is an Act with the objective to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This Act states that 'to carry out an environmentally relevant activity (ERA) an environmental authority (EA) is required'. A resource activity, specifically a petroleum activity, is defined as an ERA.

2.3.1 Environmental Authority EA0002230

Westside currently holds an Environmental Authority (EA) (EA0002230) authorising petroleum activity within PL 1048 and PL 1049. EA (EA0002230) authorises the construction and operation of up to 400 production wells and other ancillary activities to support gas field development across PL 1048 and PL 1049.

Under the EP Act, streamlined model conditions for petroleum activities have been developed for incorporation into EA's. These are provided in the Streamlined Model Conditions for Petroleum Activities Guideline (DESI 2016). The streamlined conditions are based on acceptable management approaches and constraints to protect environmental values.

3 PROJECT SETTING

3.1 Project Location and Land Use

The Project is located in Central Queensland and covers a total area of ~378 km^2, comprising PL 1048 and PL 1049. The southeastern extent of the Project is located less than 2 km from Moura, while the far western extent is located 8 km east of Banana.

Dominant land use within the vicinity of the Project is grazing native vegetation. Other land use types surrounding the Project include cropping, irrigated cropping, coal mining and production native forests. Figure 3.1 presents the mapped land use distribution within the vicinity of the Project.

The Project is situated directly north of an existing petroleum lease held by Westside entities and Mitsui E&P Australia Pty Ltd (PL 94). The Dawson Mine, operated by Anglo American Coal, is located to the east of the Project.

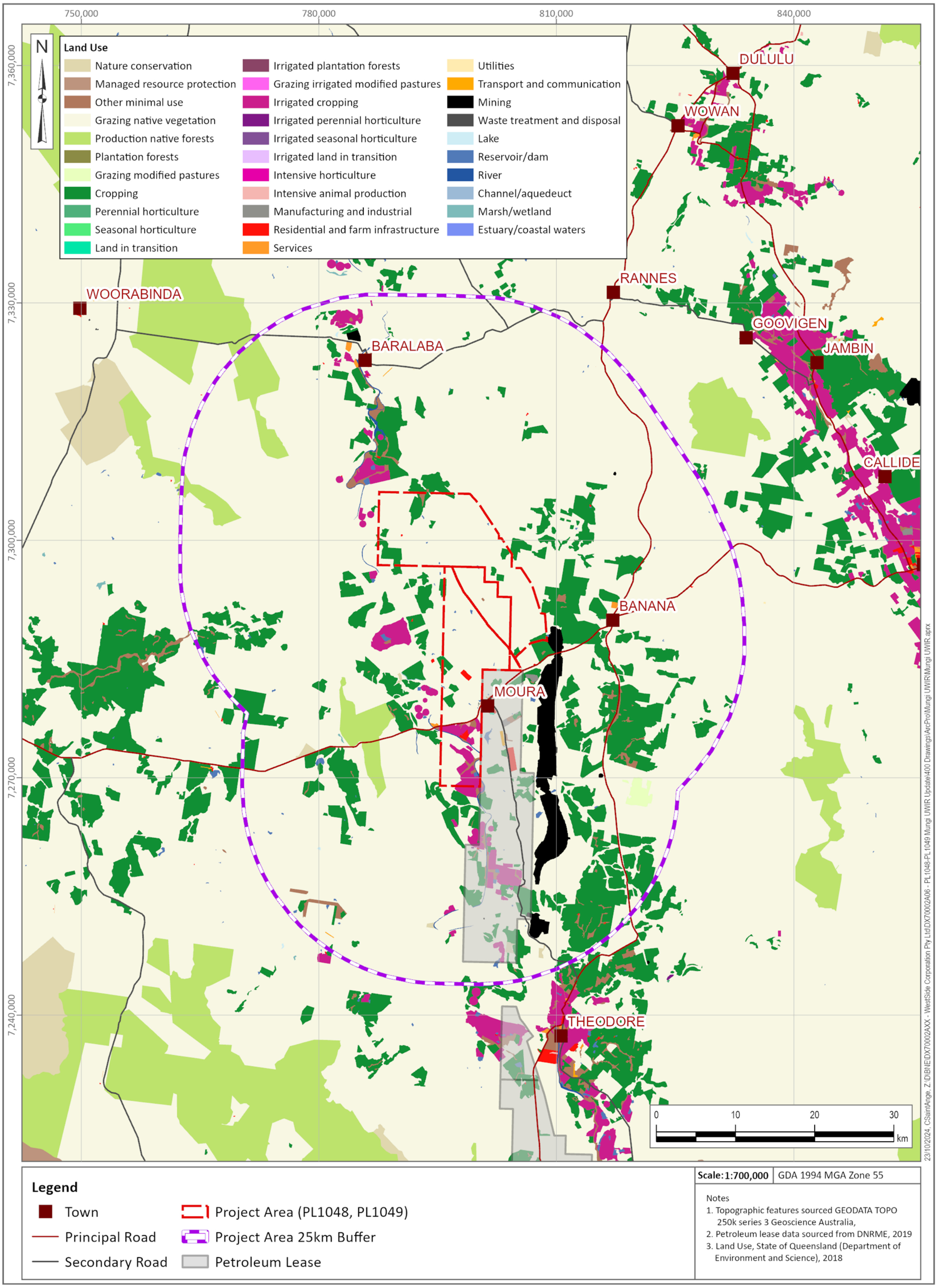

Figure 3.1 Project Development Area Current Land Use

3.2 Topography and Drainage

The Project area is generally undulating and is situated between two topographic highs. It is bordered by the Dawson Ranges and the Banana Ranges, located ~15 km west and ~30 km east of the Project respectively. Both of those topographic highs trend in a north-south direction (Figure 3.2).

The Project is located in the Lower Dawson Sub-Basin, part of the Fitzroy Basin (State of Queensland 2013). The Fitzroy River Basin is the second largest externally drained basin in Australia and the largest on the eastern coast of the continent. Covering an area of 150,000 km^2, the basin contains several significant tributaries, including the Nogoa, Comet, Mackenzie and Dawson Rivers. The basin discharges into the Coral Sea, east of Rockhampton.

The Dawson River drainage sub-basin is 565 km^2 (DESI 2019). The Lower Dawson catchment is bounded by the Shotover Ranges (URS 2014), ~120 km to the northwest of the Project. The catchment consists of an extensive network of watercourses that are ephemeral. The Dawson River is a perennial watercourse due to inflow from groundwater springs throughout the year (URS 2014), although there are sections of ephemeral flow (DNRME 2018).

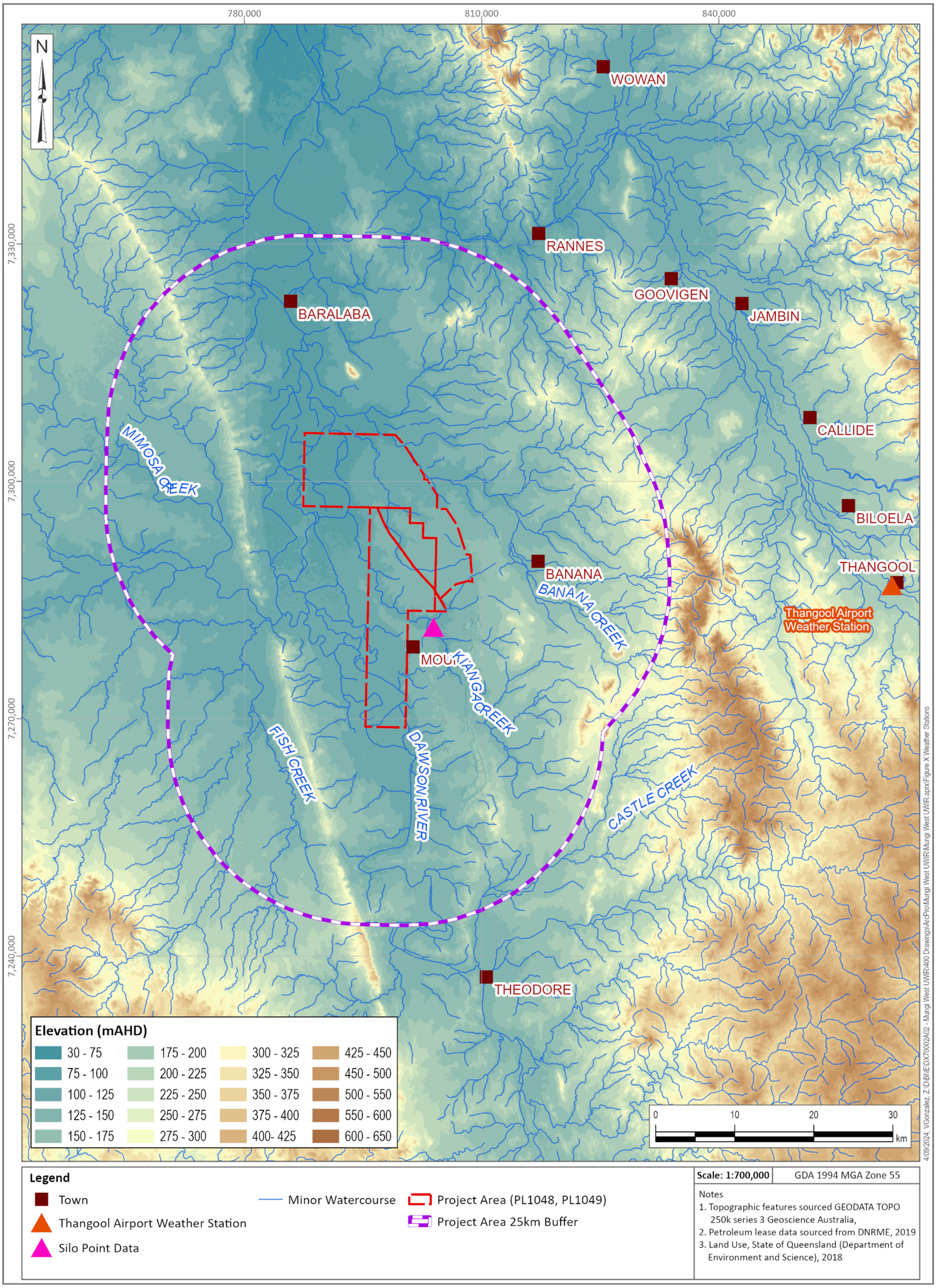

Figure 3.2 Project Site Topography and Drainage

3.3 Climate

The climate of the Project is classified as subtropical with a moderately dry winter, based on the modified Köppen classification system (BOM 2016). The closest open Bureau of Meteorology (BOM) weather station is located at Thangool Airport, approximately 55 km to the east of the Project. Due to the distance of the Thangool Airport weather station from the Project the SILO grid point data latitude -24.55, Longitude 150.00 (SILO, 2024) was used to assess the long-term rainfall trends of the Project.

Climate statistics sourced from the SILO grid point data located at latitude -24.55, Longitude 150.00 (SILO 2024) are presented in Table 3.1. The location of the SILO Grid point data and the closest BOM weather station are provided in Figure 3.2.

Table 3.1 Climate statistics for Site location Lat: -24.55, Long: 150.00 (SILO 2024)

Statistical Element	Site: -24.55, 150.00			
	Mean Minimum Temperature (°C)	Mean Maximum. Temperature (°C)	Mean Monthly Rainfall (mm)	Mean Daily Evaporation (mm)
Period of Record	January 1975 - August 2024			
Jan	21.0	34.2	75.2	7.4
Feb	20.7	33.4	81.5	6.7
Mar	19.1	32.3	60.4	6.1
Apr	15.3	29.7	32.5	4.9
May	11.5	26.2	33.6	3.6
Jun	8.0	23.2	26.0	2.9
Jul	6.7	22.9	22.7	3.1
Aug	7.6	24.9	18.7	4.1
Sep	11.1	28.3	26.9	5.6
Oct	14.9	30.8	59.8	6.7
Nov	17.7	32.4	75.4	7.4
Dec	19.8	33.9	96.0	7.7
Annual	**14.4**	**29.3**	**608.6**	**5.5**

Mean maximum temperature ranges between 33.9°C in the summer months and 22.9°C in the winter months. Mean minimum temperature ranges between 21.0°C in the summer months and 6.7°C in the winter months. The highest rainfall occurs during December to February, with the lowest rainfall occurring between April to September.

Evaporation data shows a mean daily evaporation to range between 2.9 mm to 7.7 mm. The highest evaporation occurs during the summer months (November to January; 7.4 mm to 7.7 mm), while the lowest evaporation occurs during the winter months (May to August; 2.9 mm to 4.1 mm).

Figure 3.3 presents daily rainfall between 1975 and 2024 for the Site location - latitude -24.55, Longitude 150.00 rainfall station, and a cumulative rainfall excess / deficit (CRD) trend for the same period. CRD trends present a running deviation of long-term actual rainfall against the average. This provides seasonal-scale identification of trends (wet / dry) and longer term (e.g., decadal) deviation from average conditions. These trends result in a natural tempering of peaks for rainfall events, and therefore support the correlation of rainfall events to aquifer responses.

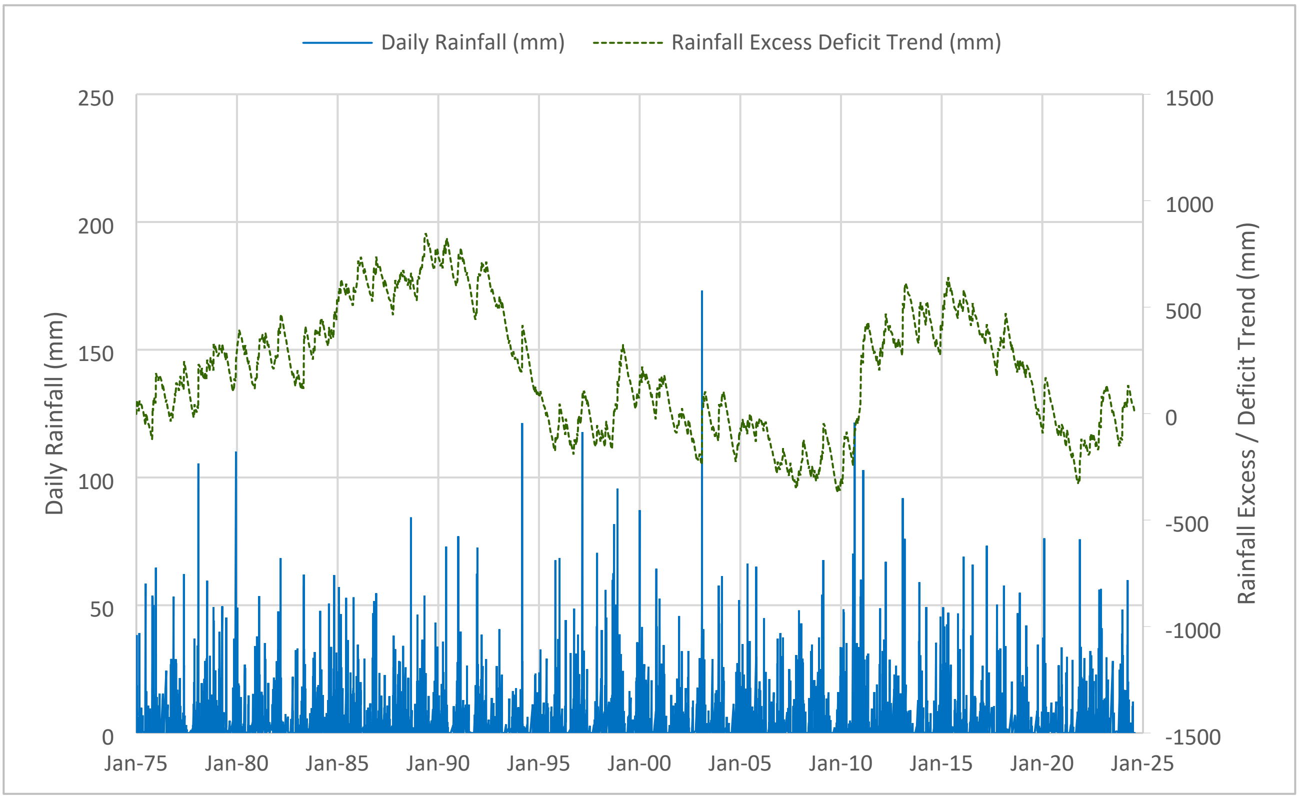

Figure 3.3 Daily Rainfall and Rainfall Excess / Deficit Trend (Site -2.55,150.00) (BOM 2021a)

Observations from the rainfall / CRD trend include:

- The overall rainfall trend is characterised by the cyclic nature of the wet and dry seasons, with annual fluctuations of ~80 mm evident across the record.
- Large rainfall events were recorded in 1994, 2003 and 2010 where more than 120 mm was recorded in a day. The highest rainfall was recorded in 2003 at 173.2 mm.
- The overall CRD trend reflects a decreasing trend of 20 years between 1990 and 2010.
- The CRD increased in 2011 and remained stable (with minor seasonal fluctuations) until 2018.
- The CRD decreased again through to 2021 prior to resuming an increasing.

4 ASSESSMENT METHODOLOGY

This section describes the UWIR methodology, including the desktop study of relevant groundwater bores, geological and environmental information, and groundwater monitoring data. It also provides an overview of the numerical groundwater modelling method. A detailed description of the numerical groundwater modelling method is provided in Section 8.1.2.

4.1 Information and Data Sources

A preliminary desktop assessment utilised data and information provided by Westside, the DRDMW Office of Groundwater Impact Assessment (OGIA) and publicly available reports and data. Primary data and information utilised in this assessment includes:

Datasets:

- Registered bore data from the DRDMW Groundwater Database (GWDB) (DRDMW 2024).
- Queensland Spring Register, published by the Queensland Herbarium (Queensland Herbarium 2018).
- Potential Groundwater Dependent Ecosystem (GDE) mapping published by the DESI (DESI 2024b).
- The Queensland Spatial Catalogue (QSpatial), via Queensland Globe – comprising records of petroleum and coal seam gas (CSG) exploration, production and monitoring wells.
- Groundwater monitoring records (levels and quality) provided by Westside.
- Geological model from Westside of the Project site localised geological regime.
- Regional geological layers and associated hydraulic parameters from OGIA.

Reports:

- Greater Meridian Field Groundwater Assessment (KCB 2020).
- Updated Geology and Geological Model for the Surat Cumulative Management Area (OGIA 2019a).
- Meridian Gas Project – PL 94 Underground Water Impact Report (CDM Smith 2019).
- Underground Water Investigation Report for ATP769 Paranui Pilot Project (AGE 2018).
- Meridian Gas Project – PL 94 Underground Water Impact Report (CDM Smith 2016c).
- Underground Water Impact Report Mungi West / Mungi North (KCB 2021).
- PL 1048 & PL 1049 - Annual Groundwater Monitoring Report (Arris, 2023).
- PL 94 - Annual Groundwater Monitoring Report (Arris, 2023).

4.2 Assessment Methodology

This assessment has been completed to assess potential impacts on the groundwater system from the proposed CSG development of PL 1048 and PL 1049 for the UWIR period (Immediately Affected Areas (IAA)) and for the proposed overall development (Long-Term Affected Areas (LTAA)). This report includes the reporting period from 2025 to 2028.

All relevant data (as identified in Section 4.1) was collated and analysed to develop a conceptual understanding of the groundwater regime, including the key geology, groundwater flow and groundwater quality characteristics. This conceptualisation served as the basis for the development and simulation of the numerical groundwater model, which was used to undertake the prediction of potential impacts to the groundwater regime. Details of the numerical groundwater model are provided in the following section.

4.2.1 Numerical Groundwater Modelling

The groundwater model developed for the Initial UWIR was updated with the current CSG schedule to predict the future groundwater response for this UWIR period.

The 3D numerical groundwater flow model was updated to predict the extents of depressurisation and the associated impacts on the groundwater regime and the surrounding environment. The groundwater model for the project uses the MODFLOW-USG platform. MODFLOW is the most widely used groundwater modelling software in Australia and is considered to be the industry standard. A detailed description of the groundwater model is provided in Section 8.1.2.

The model was used to predict the groundwater response to the project, including changes in groundwater levels as a result of the CSG bores and the proposed development. The groundwater model allowed the impacts of the existing approved CSG operations and adjacent Dawson Mining complex to be distinguished from those of the Project.

The groundwater model has specifically been used to predict the magnitude and extent of groundwater depressurisation; and these predictions have been used to identify the IAA and LTAA for the UWIR. Those predictions have also been used to assess the impacts of the Project on groundwater users and the sensitive environmental features.

5 REGIONAL GEOLOGY AND HYDROGEOLOGY

5.1 Geological Setting

The regional geology of the Project comprises sediments from the early Permian to middle Triassic age Bowen Basin. The Bowen Basin is an elongated, north-south trending basin extending over 160,000 km^2 from Central Queensland to the New South Wales border. Deposition is predominantly within two south–southeast trending troughs, the Taroom Trough to the east and the Denison Trough to the west, which are separated by the Comet Ridge (OGIA 2019b). The Project is located on the southeastern portion of the Bowen Basin, on the northeastern limb of the Taroom Trough and lies to the west of the Auburn Arch (OGIA 2019a).

Regionally, the Bowen Basin, comprises thick successions of shallow marine and non-marine sediments and volcanics, deposited in a foreland basin in the Late Permian (R. Korsch and Totterdell 2009b). The southern Queensland and northernmost New South Wales portion of the basin is overlain by up to 2.5 km of Early Jurassic to Early Cretaceous Surat Basin sedimentary sequences (R. Korsch and Totterdell 2009b). In the vicinity of PL 1048 and PL 1049, sediments from the Surat Basin have been eroded and the Bowen Basin units reside under Cenozoic cover.

Prior to the formation of the Bowen Basin, the basement rocks derived from magmatic origin were deposited during the Carboniferous – early Permian. The volcanic arc known as the Connor – Auburn Province is a linear magmatic belt comprising two sub-provinces: The Auburn to the south and Connor to the north. The sub-provinces are separated by the Gogango Thrust zone which comprises strongly deformed Permian sediments (P. M. Green et al. 1997; Withnall and Cranfield 2013). A change in geochemical patterns and bimodal volcanism suggests a period of extensional tectonics, lending to the initiation of deposition within the Bowen Basin (Withnall and Cranfield 2013). The Camboon Volcanics overlies Carboniferous volcanics along the western edge of the Auburn Arch and form the basal unit of the Taroom Trough (P. Green et al. 1997).

The Bowen Basin began as an extensive north-south trending back-arc basin to the west of the continental Camboon Volcanic Arc (Connor – Auburn Province) (P. M. Green et al. 1997). The period of extension on the western margin of the Bowen Basin produced a series of half-grabens, such as the Denison Trough, in which fluvial and lacustrine sediments were deposited in (Dickins and Malone 1973). In the east of the Bowen Basin: volcanics were also deposited during that time, whilst a thick succession of coals and non-marine sediments were deposited in the west of the Bowen Basin (Geoscience Australia 2019a; P. M. Green et al. 1997)

Sedimentation in the Bowen Basin ceased in Middle to Late Triassic by the Goondiwindi event which caused regional compression and significant extension and thrust faults in the Bowen Basin strata. This was followed by widespread erosion prior to the deposition of the Surat Basin sediments (OGIA 2019a).

A large intracratonic sag developed following the extended period of erosion and shallow platform basins including the Surat Basin, amongst others, formed as a result. Sedimentation in the Surat Basin was predominately focused within the Mimosa Syncline, which unconformably overlies the Permian strata deposited in the Taroom Trough.

Sedimentation occurred between the Triassic to Middle Cretaceous, which coincided with a compressional event, causing the uplift and erosion of the Bowen and Surat Basins and their related volcanic arcs (P. M. Green et al. 1997).

Cenozoic sedimentary deposits overlay the Bowen Basin units regionally, formed through subsidence-related faulting and erosion in conjunction with fluvial sedimentary depositional processes (R. J. Korsch et al. 2009). Crustal thinning caused by extensional tectonic events resulted in magma upwelling and intermittent volcanism, expressed as basaltic lava flows as well as interbedded tuff and volcanolithic fragments within the Cenozoic sedimentary sequences (R. Korsch and Totterdell 2009a).

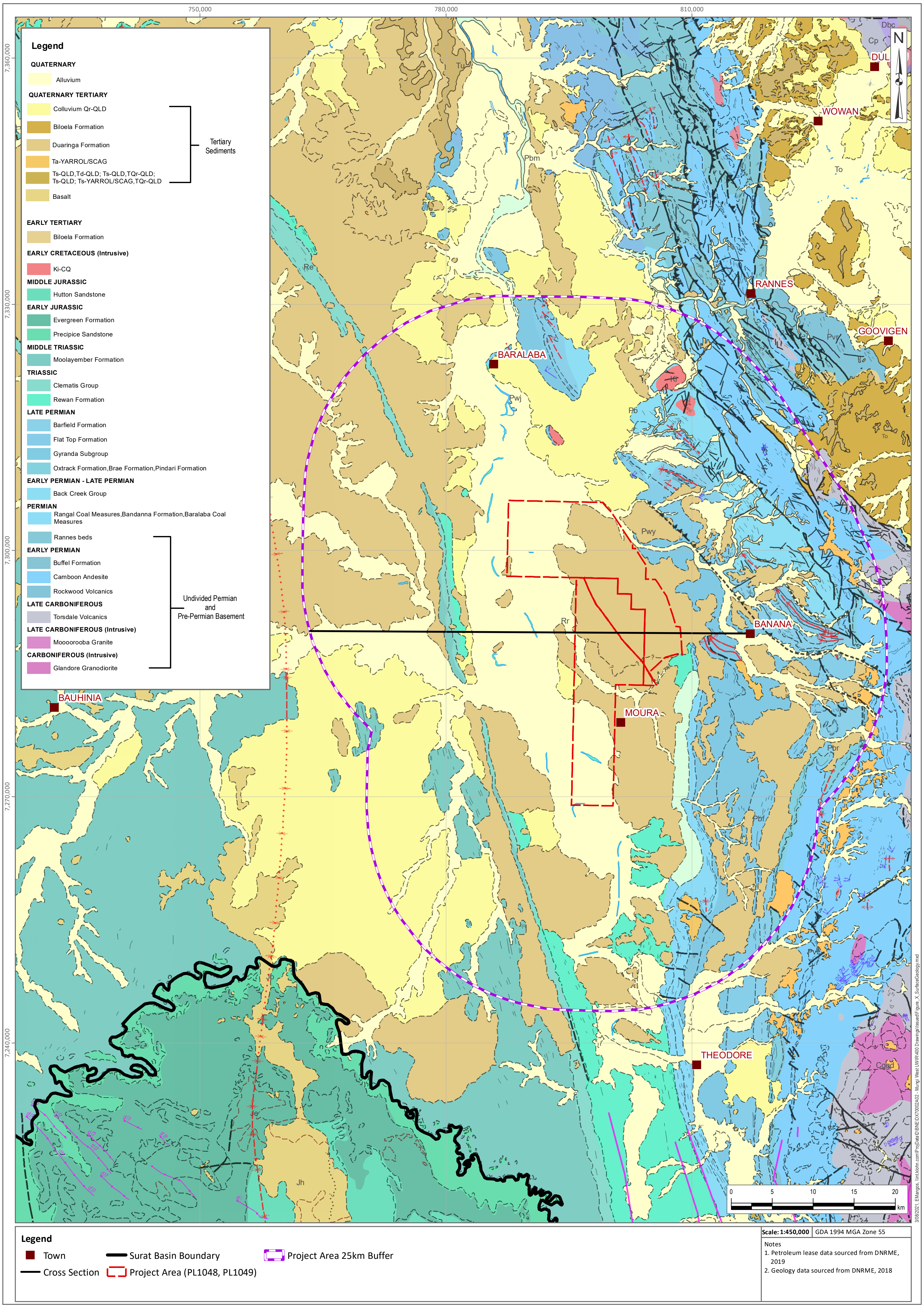

Figure 5.1 Surface Geology within the Vicinity of the Project Site

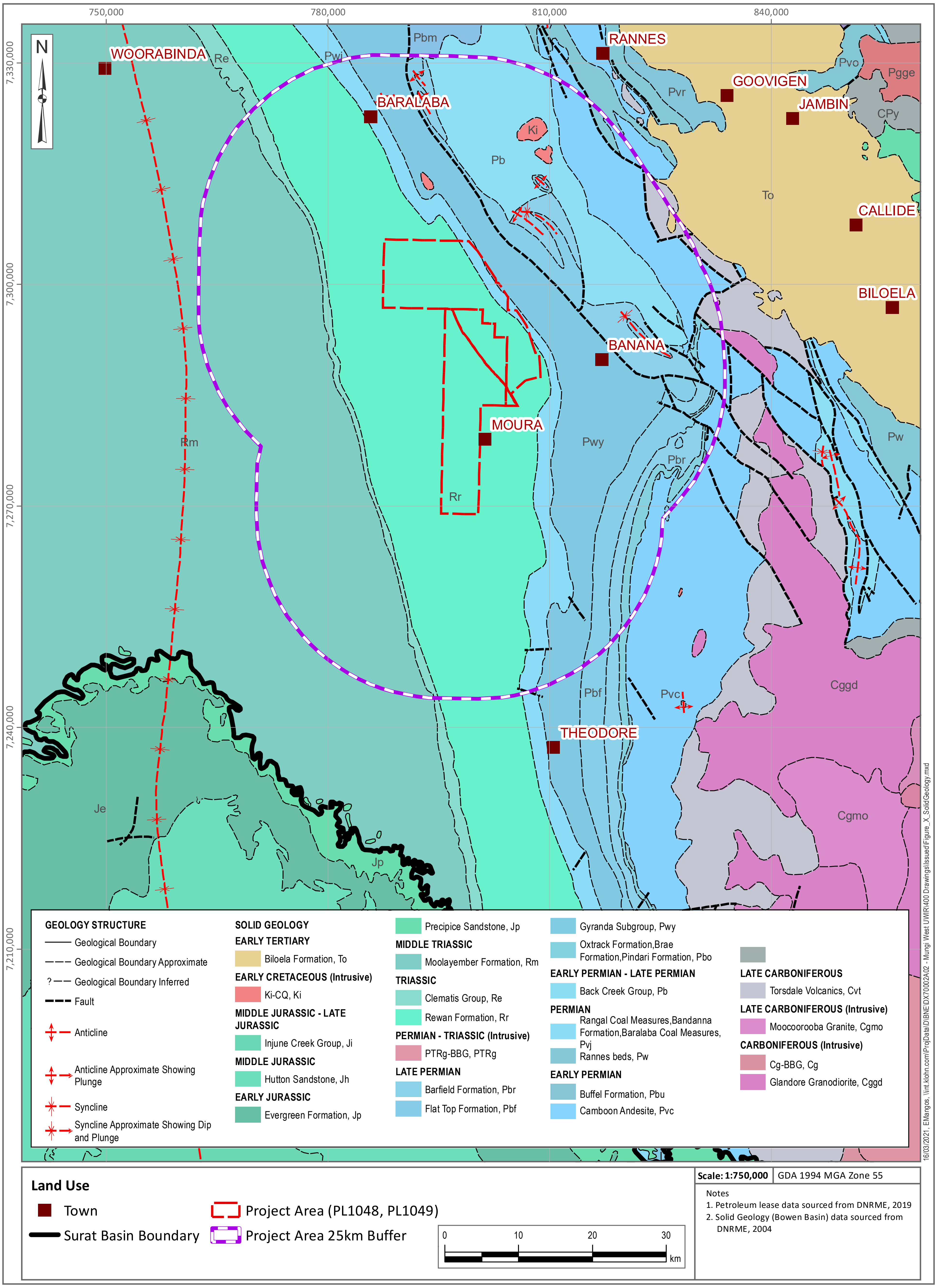

Figure 5.2 Solid Geology within the Vicinity of the Project Site

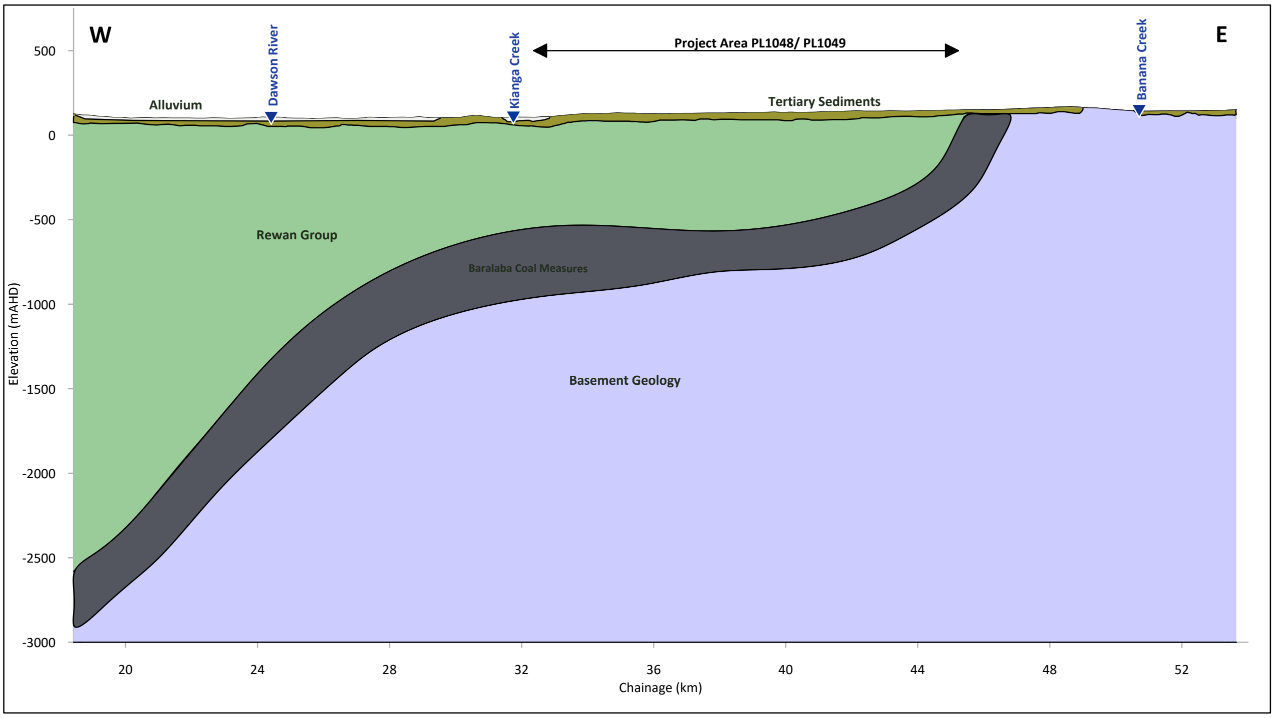

Figure 5.3 West – East Conceptual Geological Cross-Section across the Project

5.1.1 Structural Elements

The Project is located at the northeastern boundary of the Taroom Trough, on the eastern limb of the Mimosa Syncline. The Project is located west of the Auburn Arch which is intersected by a series of northeasterly faults (in Dickins and Malone 1973).

Regionally, the Bowen Basin has experienced a mixture of thrust faults, volcanic activity, extensional fault systems and reactivation of structures which creates a structurally complex basin (OGIA 2019a).

The main structural feature located in the southern part of the Bowen Basin is the Mimosa Syncline, located ~45 km west of the Project. The axis of the Mimosa Syncline follows that of the Taroom Trough and developed and filled with sediment in the Triassic. (Dickins and Malone 1973). To the northeast of the Project site, discontinuous northwest – southeast trending faults occur. Phases of deformation occurred throughout history resulting in the reactivation of historic structures as well as the creation of new structural elements. During the Middle Cretaceous, a compressional event caused the uplift and erosion of the Bowen and Surat Basin and their associated volcanic arcs (Elliott 1994 in (P. Green et al. 1997). Further deformation occurred during the Late Cretaceous and Tertiary as a result of epeirogenic movements as well as larger divergent plate motion related to the break-up of Gondwana (Exon 1976; P. Green et al. 1997).

Further discussion related to the structural elements directly within the Project is included in Section 7.1.

5.2 Regional Hydrostratigraphy

Stratigraphic units of relevance to the project include:

- Quaternary alluvial deposits located along the Dawson River and major tributaries;
- Surficial Cenozoic deposits;
- Jurassic sediments of the Boxvale Member, Evergreen Formation and Precipice Sandstone;
- Early to Middle Triassic sediments of the Clematis Group and Moolayember Formation;
- Early Triassic sediments of the Rewan Group;
- Late Permian sediments of the Baralaba Coal Measures; and
- Early Permian basement geology.

5.2.1 Quaternary

Alluvium

The Quaternary alluvium deposits comprise unconsolidated alluvium associated with existing river and creek systems located within the Project. Major alluvium deposits occur within and to the west of the Project and correspond with the location of the Dawson River, which crosses the Project in the south of PL 1049. Smaller alluvial deposits associated with Kianga Creek cross the Project through PL 1049 (Figure 5.1). Other alluvial deposits extend from the northeast and east of the Project and correspond with the location of Banana Creek.

The alluvium consists of fine to coarse grained gravels and channel sands interbedded with clays. The formation overlies Tertiary deposits, Cenozoic-age sediments and Triassic to Permian units. The alluvium varies in thickness and lateral extent.

5.2.2 Tertiary Sediments

The alluvium deposits are underlain by Tertiary-Quaternary colluvium consisting of clay, silt, sands, and gravel (DNRME 2018). This colluvium unit is not observed within the Project; however, it does dominate the surface geology 25 km west of the Project near the Dawson Ranges.

The Tertiary aged Duaringa Formation unconformably overlies the Permian units of the Bowen Basin and is the majority of the surface geology throughout the Project. This unit comprises mudstone, sandstone, conglomerate, siltstone, shale, lignite and basalt (Murray and Cranfield 1989).

Published geological mapping have identified lithological similarities between the Tertiary-Quaternary colluvium and the Duaringa Formation; with the contacts between these units being frequently indistinguishable. These units are therefore considered to form a single unit and are hereafter referred to as the Tertiary sediments.

5.2.3 Jurassic Deposits

Jurassic deposits are related to the Surat Basin and unconformably overlie the Permian strata of the Bowen Basin. The Jurassic units comprise Boxvale Sandstone Member, Evergreen Formation and the Precipice Sandstone. The units are located to the southeast of the Project, where the Surat Basin overlaps the Bowen Basin.

Boxvale Sandstone Member

The Upper Jurassic unit in the vicinity of the Project is known as the Boxvale Sandstone Member, comprising fine to coarse grained quartzose sandstone with carbonaceous siltstone, shale and coal interbeds. The sediments are interpreted to be deposited in shallow non-marine environment where sand was reworked and sorted, with periods of sea inundation. The Boxvale Sandstone Member lies conformably on the Evergreen Formation.

Evergreen Formation

The Evergreen Formation comprises chemically weathered sandstone overlain by carbonaceous mudstone, siltstone and minor coal (Geoscience Australia 2019). The lower part of the formation was likely laid down in an estuarine or lacustrine setting, with periodic marine inundation.

Precipice Sandstone

The Precipice Sandstone is the oldest unit within the Jurassic Sequence situated in the Project. It was formed by folding and subsequent erosion of pre-existing units (such as the Clematis Sandstone) during the late Triassic; creating the unconformity between the Triassic and Jurassic sequences (Martin et al. 2018).

The Precipice Sandstone consists of quartz sandstone with common cross-bedding and cut and fill structures; attributed to deposition in a fluviatile environment (La Croix et al. 2020). Evidence of marine influence throughout sedimentation has been reported (Martin et al. 2018). Deposits are laterally extensive across the Bowen Basin, indicating vast distances of sediment transport (Martin et al. 2018) . The unit is considered a major aquifer (OGIA 2019b) and outcrops to the west of the Dawson Ridge southeast of the Project.

5.2.4 Triassic Deposits

The Triassic sequence can be subdivided into three recognisable units; the Moolayember Formation, the Clematis Sandstone and the Rewan Group.

Moolayember Formation

The Middle to Upper Triassic Moolayember Formation is the youngest unit in the Bowen Basin and comprises interbedded mudstones, lithic, medium to coarse grained sandstone, carbonaceous shales, siltstones, and conglomerates (Green 1997).

The lower part of the Moolayember Formation was deposited in a lacustrine depositional environment that grades upwards into an alluvial plain with alluvial fans on the eastern margin (Golin and Smyth 1986). The thickness of this formation varies from 200 m on the Springsure Shelf to nearly 1,500 m in the centre of the Taroom Trough (Radke et al. 2000). The Moolayember Format(OGIA 2019b). The formation outcrops to the southeast of the Project.

Clematis Group

The Lower to Middle Triassic Clematis Group (formally, Clematis Sandstone) comprises medium to coarse – grained, cross-bedded, quartzose to sub-labile and micaceous sandstone; siltstone and thin beds of mudstone, deposited in fluvial environment. The Clematis Group includes two geological formations within the Denison Trough: the Expedition Sandstone (a quartzose sandstone, conglomerate, siltstone and mudstone package) and the Glenidal Formation (thinly bedded, very fine to medium-grained sandstone with common siltstones and mudstones), which overlies the Early Triassic Rewan Group (Brakel et al. 2009). The Expedition Sandstone is equivalent to the Showgrounds Sandstone in the Taroom Trough (Hoffmann, Green, and Gray 1997).

The Clematis Group forms the Dawson Range which outcrops to the west of the Project.

The Clematis Group is considered to be a major aquifer of the Great Artesian Basin (GAB). The Clematis Group is separated from the Baralaba Formation (targets for CSG production) by a thick sequence of the Rewan Group aquitard.

Rewan Group

The Rewan Group is described as containing thick-bedded, fine to medium-grained, commonly micaceous, and feldspathic sandstones. However, near the top of the unit, thin, medium-coarse grained, poorly sorted sandstones were observed (Olgers et al. 1966). Overall, the Rewan Group is dominated by reddish-brown to greenish-grey siltstones and mudstones. The Rewan Group forms an aquitard between the overlying Alluvium and Tertiary sediments and the underlying Baralaba Coal Measures. This is similar to observations recorded in the Paranui 10 well, drilled within Westside's existing PCA196 license, west of PL 94. In this well, the Rewan Group was described as containing mostly greenish-grey siltstone with thin beds of fine to medium-grained quartz-lithic sandstone Figure 5.4. Sandstones were observed to have low to medium visible porosity and low permeability. 60 - 70-degree fractures were present through the lower part of the section with multiple healed and carbonate-filled fractures.

Figure 5.4 Drillcore from Paranui 10 Well showing Rewan Group Core

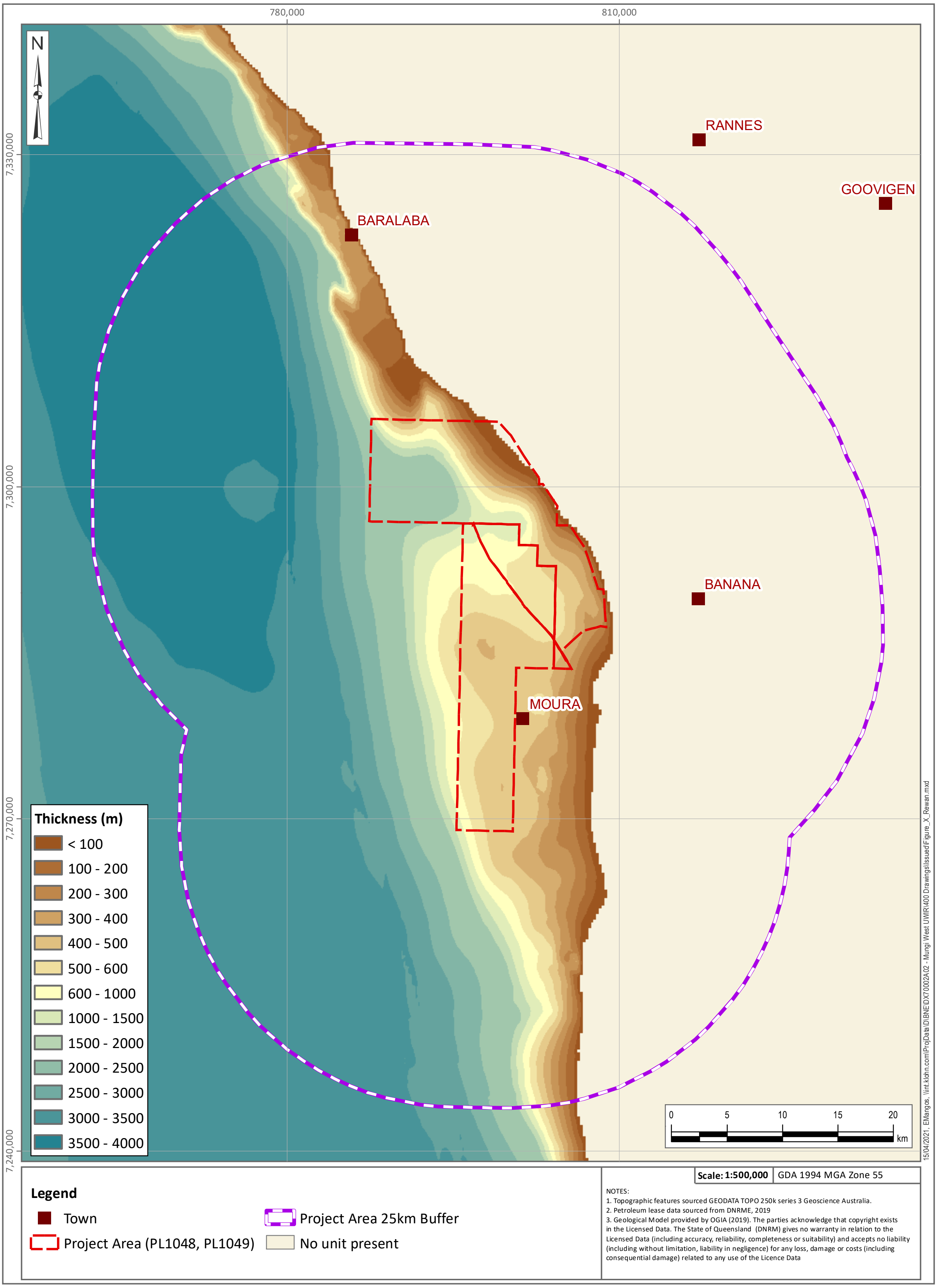

Figure 5.5 Rewan Group Isopach (sourced from OGIA 2019b)

5.2.5 Permian Units

Baralaba Coal Measures

The Late Permian Baralaba Coal Measures is part of a larger group known as the Blackwater Group. The Baralaba Coal Measures forms part of the upper units, comprising economical coal seams interbedded with calcareous mudstone, siltstone and shales (CDM, 2019). The Baralaba Coal Measures were deposited in paludal and lacustrine environments. Whilst the lower part comprises carbonaceous shale, limestones, coal and sandstone, laid down during the transition from marine to freshwater sedimentation. The Baralaba Coal Measures correlates with the Bandanna Formation located in the southwestern Bowen Basin and the Rangal Coal Measures located in southeastern Bowen Basin and northern Bowen Basin (Ayaz et al. 2016).

The Baralaba Coal Measures comprises the target coal seams, which are interbedded with sandstone, siltstone and shales that occur as interburden or overburden relative to the coal seams. The fine-grained shale and siltstone are observed as having low permeability and are interpreted to function as aquitards. In comparison, the target coal seams generally have a higher permeability.

The Baralaba Coal Measures outcrop to the east of the Project and dips to the west / northwest (CDM, 2019). The Baralaba Coal Measures are considered as an interbedded aquitard (OGIA 2019b).

Kaloola Member

The Kaloola Member (equivalent to the Burngrove Formation) comprises mudstone, siltstone, sandstone, conglomerate and minor coal (Geoscience Australia 2019) and is the basal sub-unit of the Baralaba Coal Measures.

The Kaloola Member outcrops to the east of the Project, immediately east of the Dawson Mine. This unit is considered an interbedded aquitard.

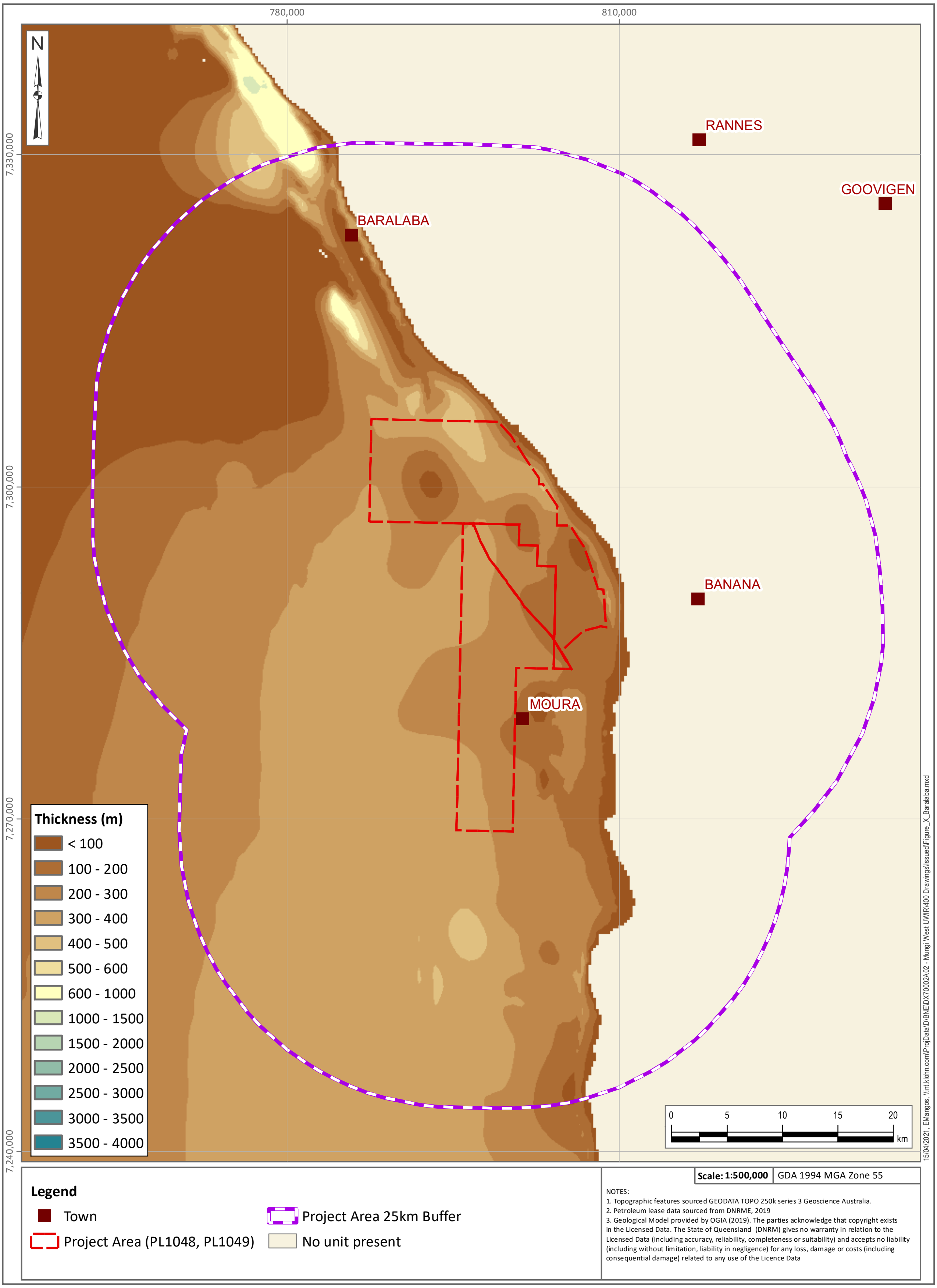

Figure 5.6 Baralaba Coal Measures Isopach (sourced from OGIA 2019b)

5.2.6 Undivided Permian – Carboniferous Units

The basement geology, interpreted for the Project, encompasses Upper Permian, Lower Permian and Upper Devonian-age units, broadly identified as any stratigraphic unit underlying the Baralaba Coal Measures. This group includes the Gyranda Subgroup, Back Creek Group and Camboon Volcanics. The units have been combined for the purpose of the geological model and the relevance to the Project and purpose of the hydrogeological model as designed by KCB.

Generally, the Back Creek Group comprises sandstone, siltstone and carbonaceous shale, which unconformably overlie the Camboon Volcanics. Units of the Back Creek Group; Flat Top, Barfield Formation and Oxtrack Formations (OGIA 2019a); outcrop to the east of the Project. The Camboon Volcanics comprise basaltic to andesitic composition volcanic rocks that outcrop to the east of the Project.

In general, the basement geology is not considered as an aquifer due to confinement beneath the Rewan Group and the Baralaba Coal Measure. The "Undivided Permian Group" forms the base of the geological model.

6 PART A : UNDERGROUND WATER EXTRACTION

6.1 Quantity of Water Produced to Date

Underground water rights have been exercised at the project. Current operations require the dewatering of groundwater from the underground coal seams to depressurise the coal for gas release.

Over the period of 10th January 2023 to 9th January 2024, a total of 7304 KL of water was produced across the two fields (Mungi North and Mungi West) (Arris, 2023). The produced water volumes reached a peak in May 2023 and decreased steadily since. The total volumes produced, 7,304 KL are slightly lower than the modelled volumes produced presented in the UWIR (7.99ML in 2023 – Year 2) (Arris, 2023).

The total volume of water produced from the Mungi North wells from January 2022 to July 2024 is 2281 KL (Figure 6.1). The total volume of water produced from the Mungi West wells from January 2022 and July 2024 is 6516 KL (Figure 6.1). The total amount of water produced from January 2022 to July 2024 is 8797 KL (Provided by Westside 2024).

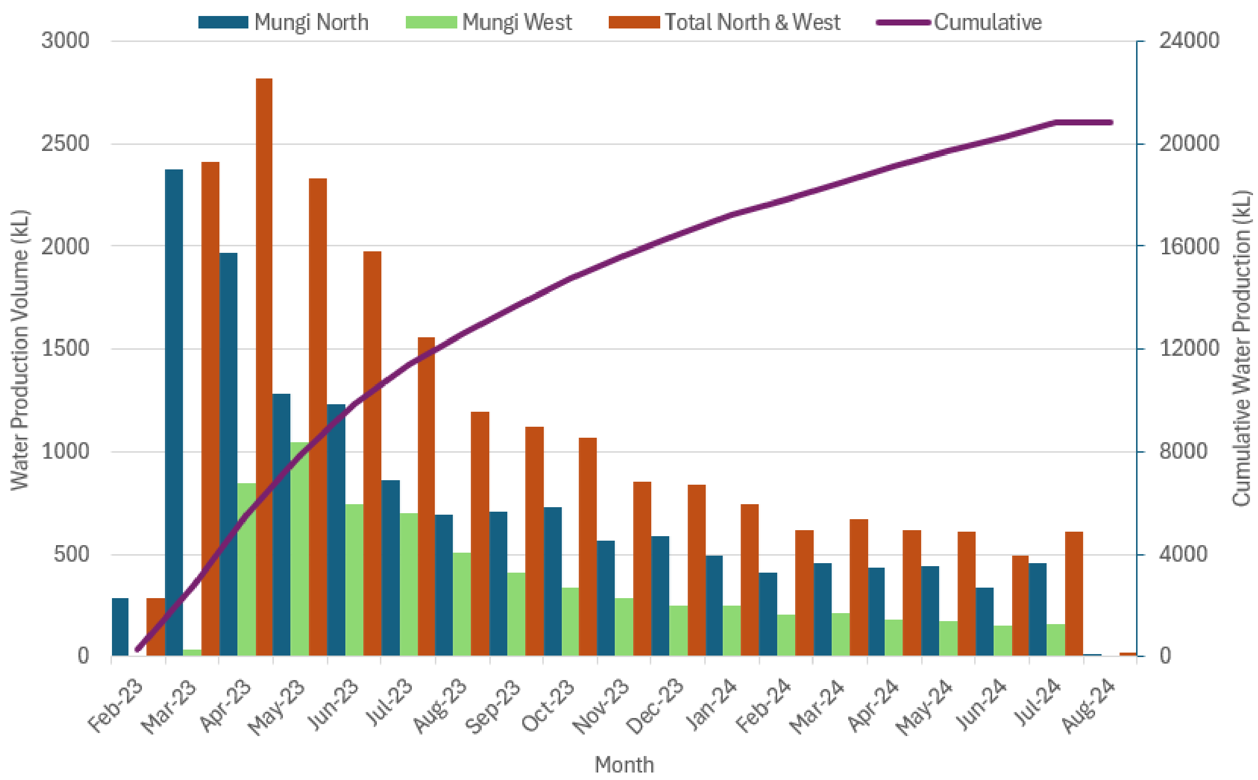

Figure 6.1 Current Water Production Summary – Mungi North and West

6.2 Quantity of Water to be Produced in the Next Three Years

Produced water volumes and rates for the Project are predicted using a stochastic reservoir modelling tool which produces probabilistic distributions applied to several key reservoir parameters (i.e., permeability, porosity, and net coal). The model predictions generate production profiles (type curves) for wells across the CSG field. The production profiles are used in field development planning to provide a water forecast. Type curves are updated during the life of the project as more information (e.g. further and refined key reservoir parameters) becomes available.

Figure 6.2 displays the predicted water production rate for the Project. Peak water production is predicted to occur in 2042, at a rate of ~1.65 ML/month. The estimated cumulative water production volume is also presented in Figure 6.2. The total volume of groundwater that will be abstracted for the duration of the Project is estimated to be ~510 ML.

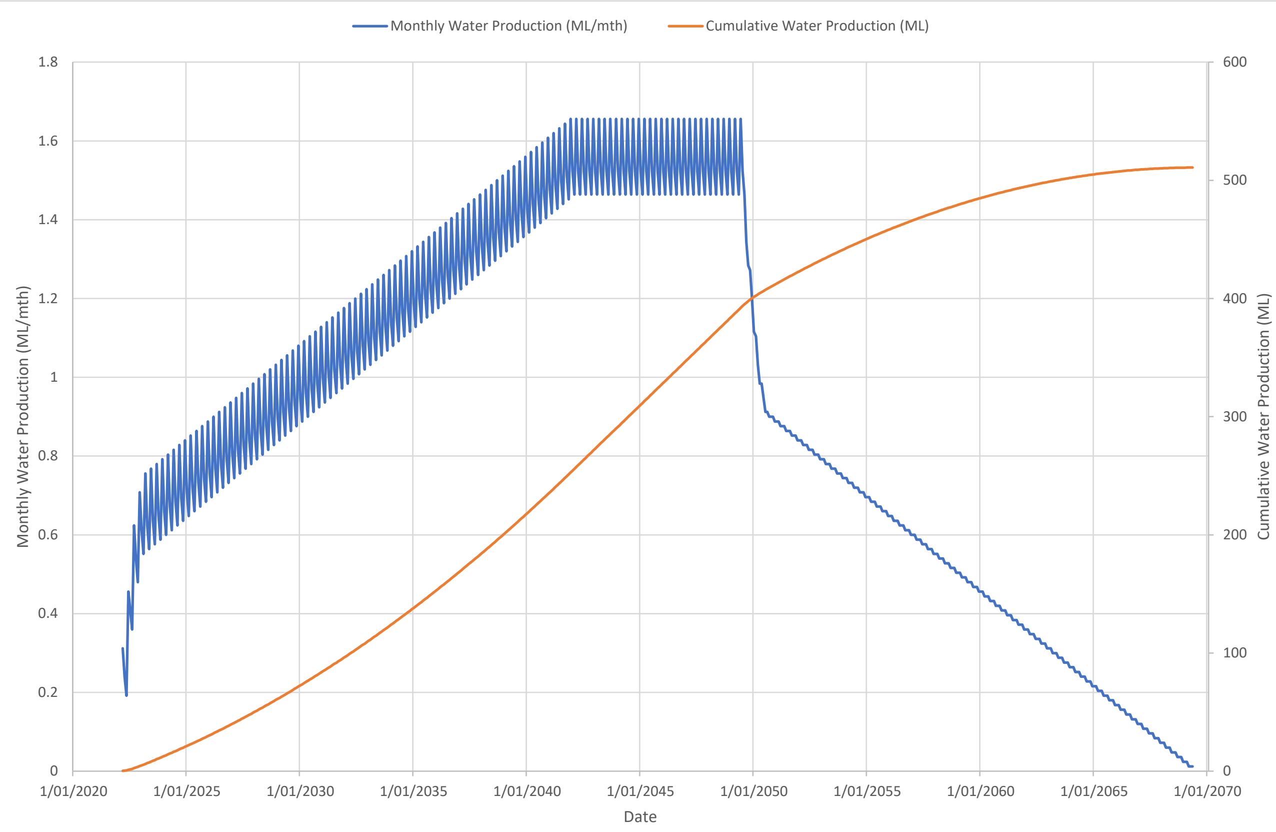

Figure 6.2 Predicted Water Production Rate and Cumulative Volume for the Project

Table 6.1 provides the annual groundwater take for Years 1, 2, and 3 of the UWIR period (Jan 2025 to Jan 2028). The gradual increase from 9.10 ML in Year 1 to 10.25 ML in year 3 is a result of the cumulative nature of additional wells coming online throughout the period, resulting in increased groundwater take annually over the UWIR period. The predicted groundwater take represents the theoretical volume of groundwater that could be removed from the groundwater regime.

Table 6.1 Predicted Volume of Groundwater take during the UWIR Period

Year of UWIR Period	Predicted Water Production Volume (ML)
1	9.10
2	9.67
3	10.25
Total for UWIR Period	**28.92**

6.2.1 Coal Seam Gas Development Activities

The Project has commenced with three gas wells (MN017VT, MO001L12 and MO002L2) which commenced production on PL 1048 and two gas wells (MW001L12 and MW002L12) which commenced production on PL 1049. In this UWIR, the CSG wells will continue to be commissioned from east to west, from the shallowest point of the target coal seam to the deepest. Over the first year of the UWIR period (Jan 2025 to Jan 2026) it is planned for two pads and four wellheads to be commissioned. In year two and year three (Jan 2026 to Jan 2028) a total of eight pads each with four wellheads at each pad is anticipated to be commissioned.

Associated water produced as part of the is managed by Westside using established off-site facilities that have been commissioned as part of adjacent operations (located on PL 94). Water management infrastructure is established on the Project site (e.g. holding tanks, gathering lines) will be for the purposes of transferring the water to established management facilities.

7 PART B: AQUIFER INFORMATION AND UNDERGROUND WATER FLOW

7.1 Local Hydrogeology

The Project is directly underlain by Quaternary alluvium associated with the Dawson River and the broader deposits of Tertiary sediments. Beneath the Quaternary and Tertiary surficial geology, the unconformably underlying Triassic (Moolyamber Formation, Clematis Group, Rewan Group) and Permian (Baralaba Coal Measures, Kaloola Member, Back Creek Group) sedimentary units are gently dipping towards the west in the vicinity of the Project. As a result of the dipping units, the Rewan Group outcrops within and to the east of the Project, while the Baralaba Coal Measures outcrop to the east of the Project, in the vicinity of the Dawson Mining complex Figure 5.2.

As discussed previously, the mapped alluvium in the Project is associated predominantly with the Dawson River, Kianga Creek, Banana Creek, and associated contributing water courses. A review of available data from the GWDB 'stratigraphy table' (DNRME 2019a) indicates the alluvium associated with these systems is up to ~20 m thick.

Isopachs for the Rewan Group and Baralaba Formation are presented in Figure 5.5 and Figure 5.6, respectively. The Rewan Group aquitard is present across the Project but does not extend east of the tenure due to formation outcropping in that area. The Rewan Group thickness beneath the Project increases east to west from <100 m in the east to ~2,500 m in the northwest corner. The Baralaba Coal Measures are <100 m to 500 m thick beneath the Project. Individual coal seams within the coal measure are reported to be up to 6 m thick.

7.1.1 Local Structure

The Project is located on the eastern limb of the Mimosa Syncline, the central axis of which is located ~30 km west of the Project. A series of compressional events to the east of the Project resulted in multiple northwest-southeast trending faults. Historical reports note reverse faulting in the Moura area (Chong 1968). Between those major disturbance zones, minor normal faults have been identified in bore holes (Taylor 1971).

2D seismic were acquired across PL 94 (directly south of the Project) to support CSG development activities (KCB 2020). Observations from seismic surveys show few large-scale faults interpreted within the Baralaba Coal Measures and even fewer which extend into the overlying Rewan Group. No faults extending more than 30 m were observed above the youngest target coal seam of the Baralaba Coal Measures, illustrating that faults do not extend to the top of Rewan Group and adjacent to overlying surficial hydrostratigraphic units. The seismic character of the Rewan Group is generally low reflectivity which supports the mudstone/siltstone dominant lithologies identified from the drill core obtained from within the vicinity of the Project.

7.2 Aquifer / Aquitard Hydraulic Properties

OGIA (2019b) present a range of hydraulic conductivity values, which have been estimated from core, drill stem tests (DSTs) and pumping tests. The data was compiled as part of the 2016 UWIR (OGIA 2016a). Table 7.1 presents a range of hydraulic conductivities estimated from core DSTs and pumping tests (OGIA 2016b).

Table 7.1 Horizontal Hydraulic Conductivity Ranges (after OGIA 2016b)

Source	Statistic	Hydrostratigraphic Unit Hydraulic Conductivity (m/day)					
		Alluvium	Moolayember Formation	Clematis Group	Rewan Group	Lower Permian	Basement
Core	10th Percentile		2.90×10^{-6}	2.0×10^{-6}	5.4×10^{-7}	3.2×10^{-6}	8.5×10^{-7}
	Median		1.44×10^{-4}	1.6×10^{-4}	4.0×10^{-5}	1.4×10^{-5}	3.3×10^{-4}
	90th Percentile		7.21×10^{-2}	0.2	0.1	2.2×10^{-4}	0.4
DST	10th Percentile		9.18×10^{-5}	6.7×10^{-5}	1.7×10^{-5}	8.3×10^{-5}	7.2×10^{-4}
	Median		1.52×10^{-3}	2.3×10^{-3}	4.2×10^{-4}	1.2×10^{-4}	7.2×10^{-4}
	90th Percentile		2.13×10^{-1}	0.6	0.03	1.2×10^{-3}	7.2×10^{-4}
Pumping Test	10th Percentile	2.44	2.16×10^{-2}	0.1	-	-	-
	Median	1.63×10^{1}	4.32×10^{-1}	0.4	-	-	-
	90th Percentile	1.16×10^{2}	5.33	15.2	-	-	-

Data reproduced from OGIA (2016a). Converted from millidarcies using the reported conversion factor of 1.27×10^{-3}.

DST and pumping tests have been referenced in the Hydrogeological Conceptualisation Report for the Surat Cumulative Management Area (OGIA 2016a) that are within the vicinity of the Project, and across different hydrostratigraphic units. A summary of these tests is provided as follows:

- Moolayember Formation
  - DST – two tests; 1.27×10^{-2} to 1.27 m/day
  - Pumping test – two tests; 1.27×10^{-2} to 0.127 m/day
- Clematis Group
  - DST – two tests; 1.27×10^{-2} to 0.127 m/day
- Rewan Group
  - DST – six tests; 1.27×10^{-5} to 1.27×10^{-3} m/day

Site-specific data is also available for the Baralaba Coal Measure, from 83 DSTs undertaken in wells within the Project. A statistical summary of this data is presented in Table 7.2. Additional testing of the Baralaba Coal Measures permeability will be undertaken as CSG production wells are drilled.

Table 7.2 Site-Specific Baralaba Horizontal Hydraulic Conductivity Statistics

Statistic	Hydraulic Conductivity – Site-Specific DST (m/day)
10th Percentile	6.35×10^{-5}
90th Percentile	7.64×10^{-3}
Median	4.57×10^{-4}
Geomean	5.32×10^{-4}

7.3 Groundwater Recharge

Key processes of recharge include:

- Localised recharge occurs beneath drainage features including rivers, and free-draining unconsolidated sedimentary cover, such as alluvium.
- Diffuse recharge is the process by which rainfall infiltrates directly into outcropping hydrostratigraphic units. This is expected to occur within all outcrop areas and therefore this process applies to the largest spatial extent (Kellett et al. 2003).
- Preferential pathway flow arising from changes in permeability within aquifers and in overlying regolith, providing conduits for water to infiltrate. Zones of higher permeability may include fissures, faults, joints, tree roots and high-permeability beds within individual formations and along bedding planes (Kellett et al. 2003; Suckow et al. 2016). This mechanism is considered the dominant recharge process in the GAB (Kellett et al. 2003).

Recharge in the Project will occur 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, 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) – 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. Further discussion on groundwater surface water interaction in the Project is provided in Section 0.

7.4 Groundwater Level and Flow

A total of 79 groundwater bores are registered on the GWDB with water level readings in a 25 km radius of the Project (Figure 7.1). The majority of these bores are dedicated groundwater monitoring bores in the Alluvium. A significant number have been abandoned with 29 existing bores screened in the Alluvium.

The following section provides a summary of the available groundwater monitoring data. Table 7.3 presents the number of groundwater monitoring bores within a 25 km radius of the Project for each monitored hydrostratigraphic unit.

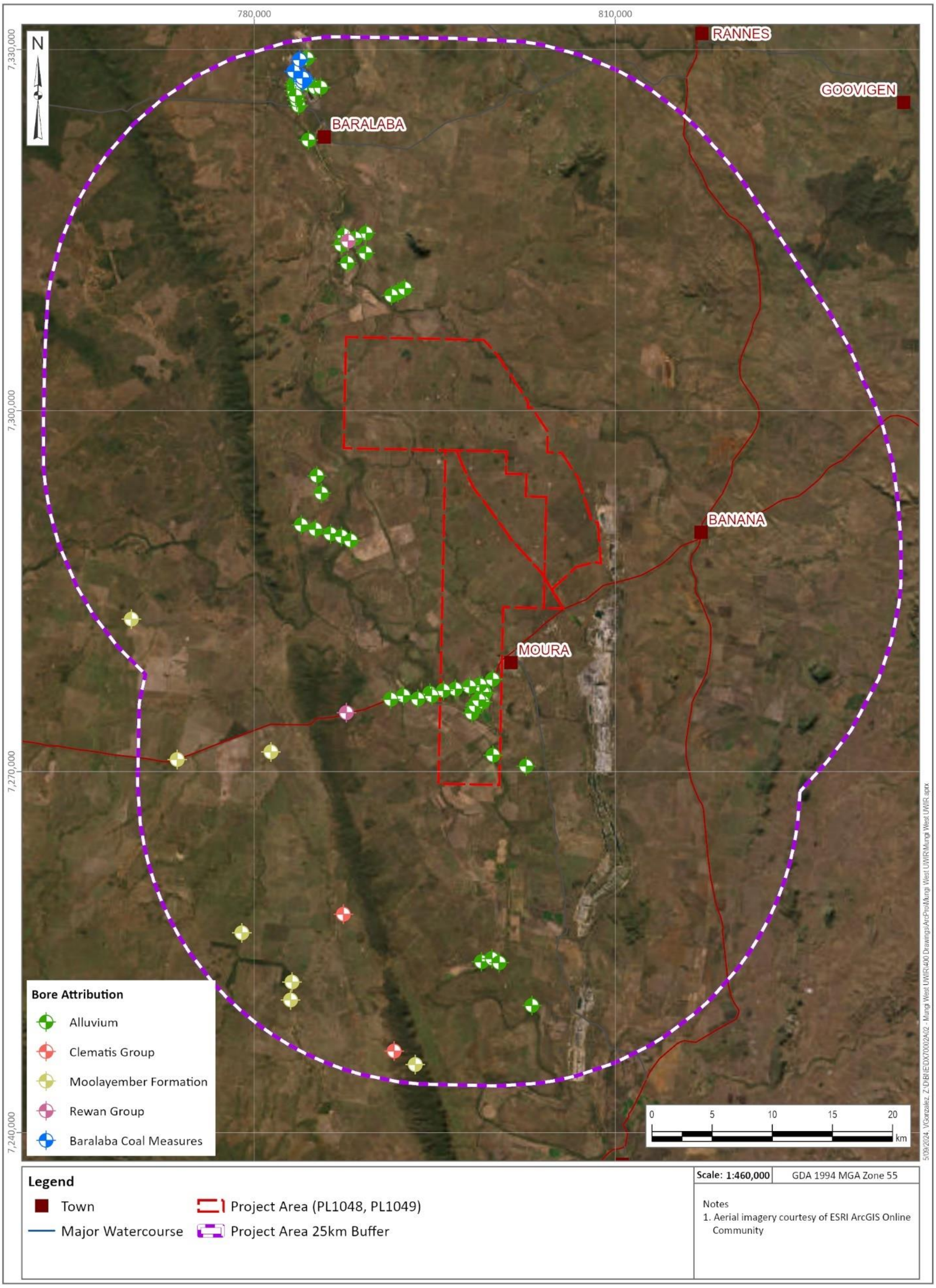

Figure 7.1 Location of Groundwater Bores with Groundwater Level Data in the Vicinity of the Project

Table 7.3 Summary of Existing Registered Groundwater Bores within 25 km of the Project with Groundwater Level Monitoring Records

Hydrostratigraphic Unit	No. of Bores
Alluvium	29
Moolayember Formation	7
Clematis Sandstone	2
Rewan Group	2
Baralaba Coal Measures	6

7.4.1 Alluvium

Across the Project, recharge to groundwater in the Alluvium and the Tertiary sediments is driven by regional diffuse recharge during rain events or localised recharge from watercourses during flood events.

The Alluvium shows a general decline in water level since 2017 (Figure 7.2). The static head in bore RN13030641 indicates a 1.79 m decline between 2017 and 2021 and RN1030636A shows a 1.2 m decline. This reflects the decline in rainfall between 2017 and 2021. The water level in bore RN13030641 shows an increase from 2021 to 2023 which is reflective of the increase in rainfall over this time. The groundwater level response in this bore follows the long-term rainfall excess/deficit curve.

There are no groundwater bores registered on the GWDB which are screened with in the Tertiary sediments. This indicates that the Tertiary Sediments represent a limited potential for a water resource.

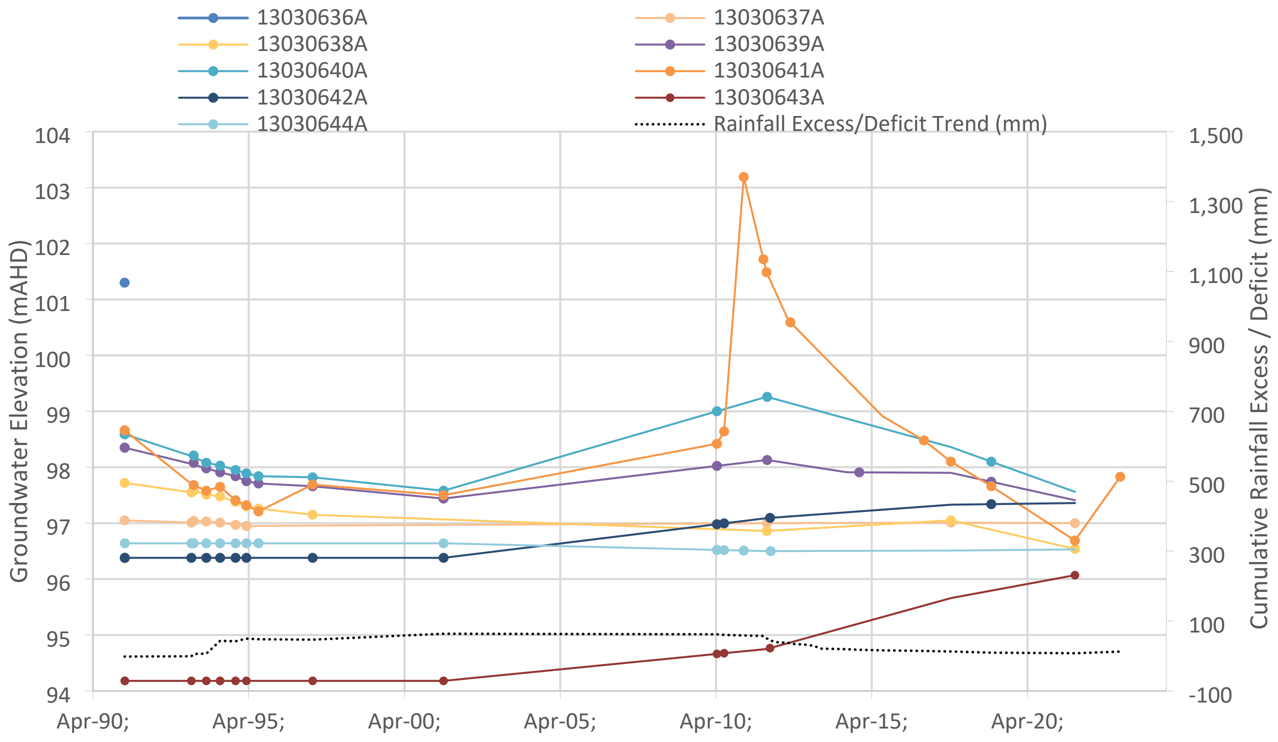

Figure 7.2 Alluvium Groundwater Elevation Hydrographs – Upstream Dawson River

7.4.2 Moolayember Formation

The limited data for the Moolayember Formation are combined on Figure 7.3. There are only two available bores (RN13030825A and 13030831A), with groundwater level measurements for the Moolayember Formation, located near the Project. The groundwater levels in the two bores have remained relatively stable over the time over the past 15 years and do not follow the long-term rainfall excess/deficit curve.

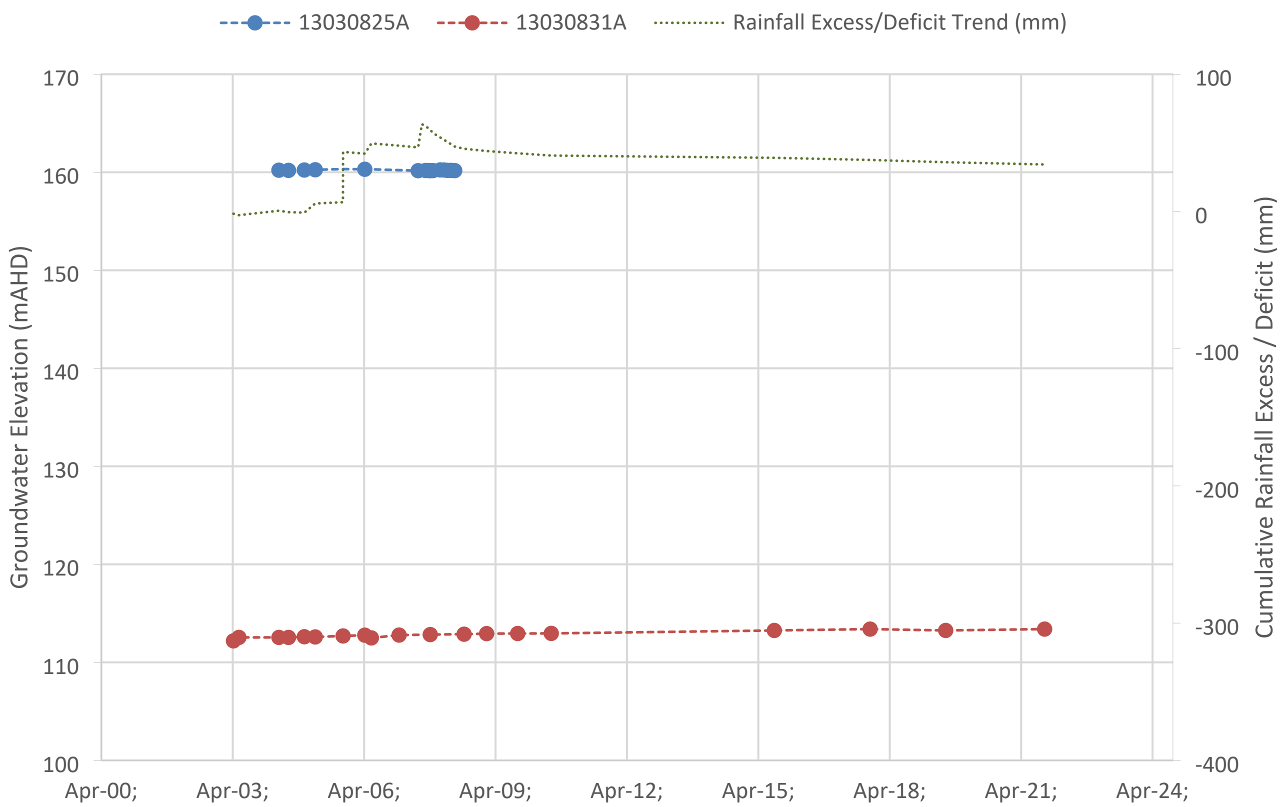

Figure 7.3 Moolayember Groundwater Elevation Hydrographs

7.4.3 Rewan Group

There is also limited data for the Rewan Group with only one bore screened in this aquifer (RN13030830A). The hydrograph of this bore is presented on Figure 7.3. The groundwater levels in this bore have remained relatively stable over time and do not follow the long-term rainfall excess/deficit curve.

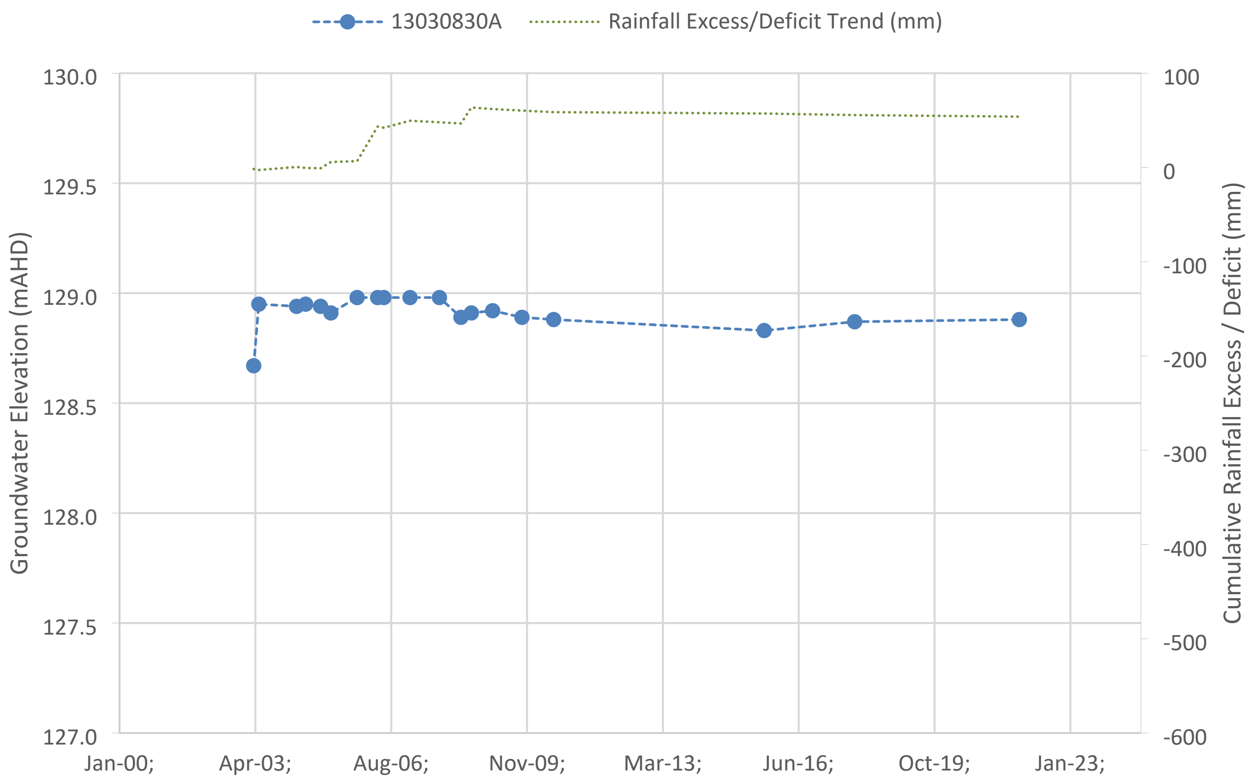

Figure 7.4 Rewan Group Groundwater Elevation Hydrographs

Two Westside monitoring bores, QNP (replaced by GW14) and Mungi are screened in the shallow aquifers of the Tertiary sediments and the Rewan Group. The Groundwater levels in the two bores have remained relatively stable from 2021 to 2024. The water levels in the bores indicate that gas and water extraction activities within the Baralaba Coal Seam aquifer are not having a noticeable impact on water levels within the overlying unconfined aquifers (Arris, 2023).

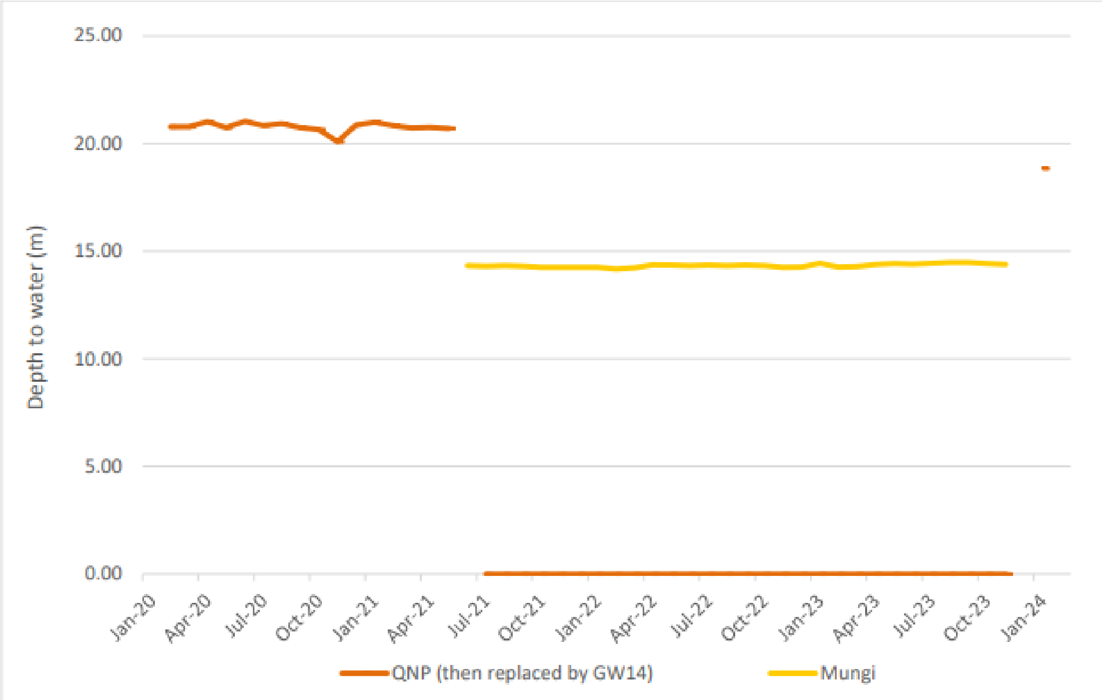

Figure 7.5 Westside bores Elevation Hydrographs (Arris, 2023)

7.4.4 Baralaba Coal Measures – Gas Field

Three westside gas wells (MN17V, MW001L and MW002L) are currently in operation within the Baralaba Coal Measures aquifer (PL 1048). Groundwater monitoring results show that Bore MN017VT has a water level variation between 450 mbgl and 520 mbgl. The groundwater levels for MN017VT are presented on Figure 7.6.

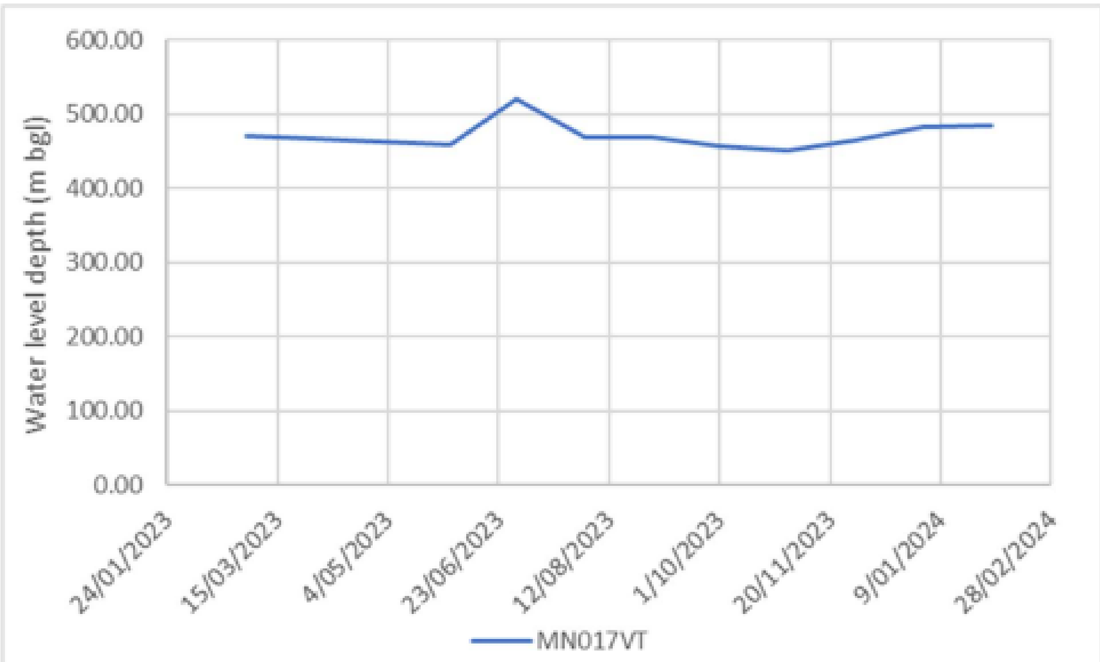

Figure 7.6 Gas Well MN017VT - Elevation Hydrographs (Arris, 2023)

Groundwater monitoring results show that MW001L showed an initial decrease in groundwater level from 220 mbgl to 560 mbgl as a response to initiating groundwater extraction. The groundwater level in this bore remained at 560 mbgl due to the continued water extraction. Bore MW002L also showed a groundwater level decrease from 208 mbgl to 482 mbgl as a response initiating groundwater extraction. Thie groundwater level in this bore ranges between 410 mbgl and 480 mbgl. The groundwater levels for MW001L AND MW002L are presented on Figure 7.7.

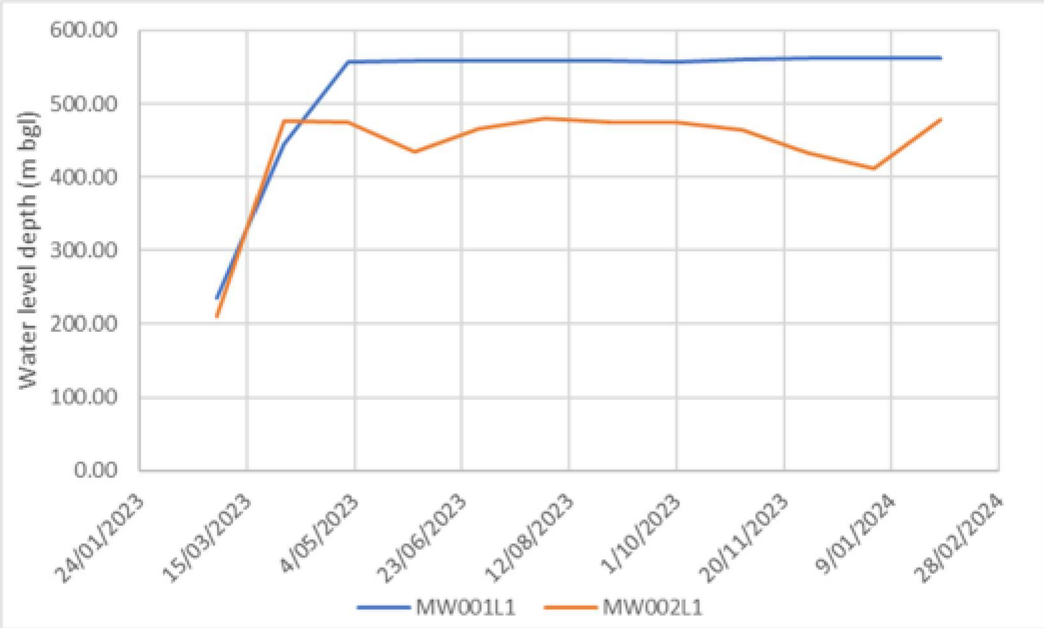

Figure 7.7 Gas Wells MW001L AND MW002L - Elevation Hydrographs (Arris, 2023)

7.5 Groundwater Chemistry

Groundwater chemistry within the Bowen Basin has been considered using information reported by OGIA (2019b) and data sourced from the GWDB. Table 7.4 presents a summary of regional groundwater chemistry from OGIA (2019b) for formations present within the Project.

Table 7.4 Surat CMA Groundwater Chemistry Summary (sourced from (OGIA 2019b))

Analyte	Percentile	Alluvium	Evergreen Formation	Precipice Sandstone	Moolayember Formation	Clematis Sandstone	Rewan Group	Undivided Permian Upper
Ca	25th	30	5	1.1	13.5	9.4	27.4	31.5
	50th	46	20	2.7	27	23.5	80.6	61.8
	75th	76.8	52	7	89.3	39	281	84.3
Mg	25th	22	1	0.3	4.9	5.3	51.3	36.3
	50th	40	8.7	1	21.5	14	71.8	52.2
	75th	80	22	1.7	81.3	39	200.9	85.1
Na	25th	100	33	31	118.8	31.5	252	143.3
	50th	205	87	45	384	76	706	372
	75th	500	356	75.3	1123.8	120	2326.3	628
K	25th	0.05	0.05	2	0.05	8	0.05	1.25
	50th	1	2	2	1.03	12	1	2.5
	75th	3	5	3	5.75	16	8.25	5.5
Alkalinity	25th	308	122	73.8	150	120	143.3	474.3
	50th	403	195	112	282	322.5	342	722
	75th	511.7	478	172	460.8	465	381.8	890.8
Cl	25th	84	25	10	98.5	34.3	272.5	137.3
	50th	250	54	16	444.5	50	1141	342.5
	75th	780	310	44.4	1654.8	68.5	4215	595.3
SO_4	25th	5	0.1	0.1	0.1	2	1	0.1
	50th	15	8.1	1	4.9	5.5	25.9	16
	75th	70	24.5	2	24	16.8	164.9	85
F	25th	0.1	0.1	0.1	0.1	0.1	0.16	0.22
	50th	0.2	0.2	0.2	0.3	0.17	0.3	0.35
	75th	0.3	0.42	0.5	0.59	0.23	0.45	0.62
TDS	25th	649	223.1	128.4	537.5	227.1	1138.7	1244.2
	50th	1064	411.1	184.1	1401.5	522.4	2648	1770.1
	75th	2016	1458.1	302.9	3657.1	745.4	7009	2342.4
pH	25th	7.6	7.2	7	7.5	7.1	7.4	7.9
	50th	7.9	7.6	7.3	7.9	7.8	7.4	8
	75th	8.2	8.2	8	8.2	8	7.6	8.1
SAR	25th	2.9	1.7	3	5	1.7	5.8	3.4
	50th	5.4	6.4	7.8	13.2	2.3	17	7.9
	75th	11.9	12.5	10.7	26.1	3.9	28.5	14.9

Further groundwater chemistry has been sourced from the GWDB, for bores within 25 km of the Project. The location of the bores with groundwater chemistry and the OGIA aquifer attribution (OGIA) is shown in Figure 7.8.

Water quality data from the registered groundwater bores within 25 km of the Project are screened in the Alluvium, Clematis Group, Moolayember Formation, the Rewan Group and the Baralaba Coal Measures. Water quality data from the Westside – Mungi annual groundwater monitoring bores screened in the Alluvium and Baralaba Coal Measures. Figure 7.8 shows the loca tion of the bores with water quality results. Figure 7.9 present Piper and Durov diagrams for the groundwater quality of the hydrostatic units of the registered groundwater bores and the Westside Mungi monitoring bores. The following observations are made for the local hydrochemistry:

- The pH range in the bores screened in the Alluvium ranges between 7.0 and 8.6. The pH range for the bores screened in the Clematis Group and the Moolayember Formation ranges between 7.6 and 8.2. The pH range for the bores screened in the Baralaba Coal Measures ranges between 7.5 and 8.5.
- The groundwater samples collected from the alluvium are dominantly magnesium chloride and magnesium sulfate dominated.
- The groundwater samples collected from the Baralaba Coal Measures, plot in the centre of the cation triangle, indicating that there is no distinct dominant cation. The groundwater samples on the diamond plot show that the groundwater ranges from sodium Chloride to Calcium Chloride dominated.

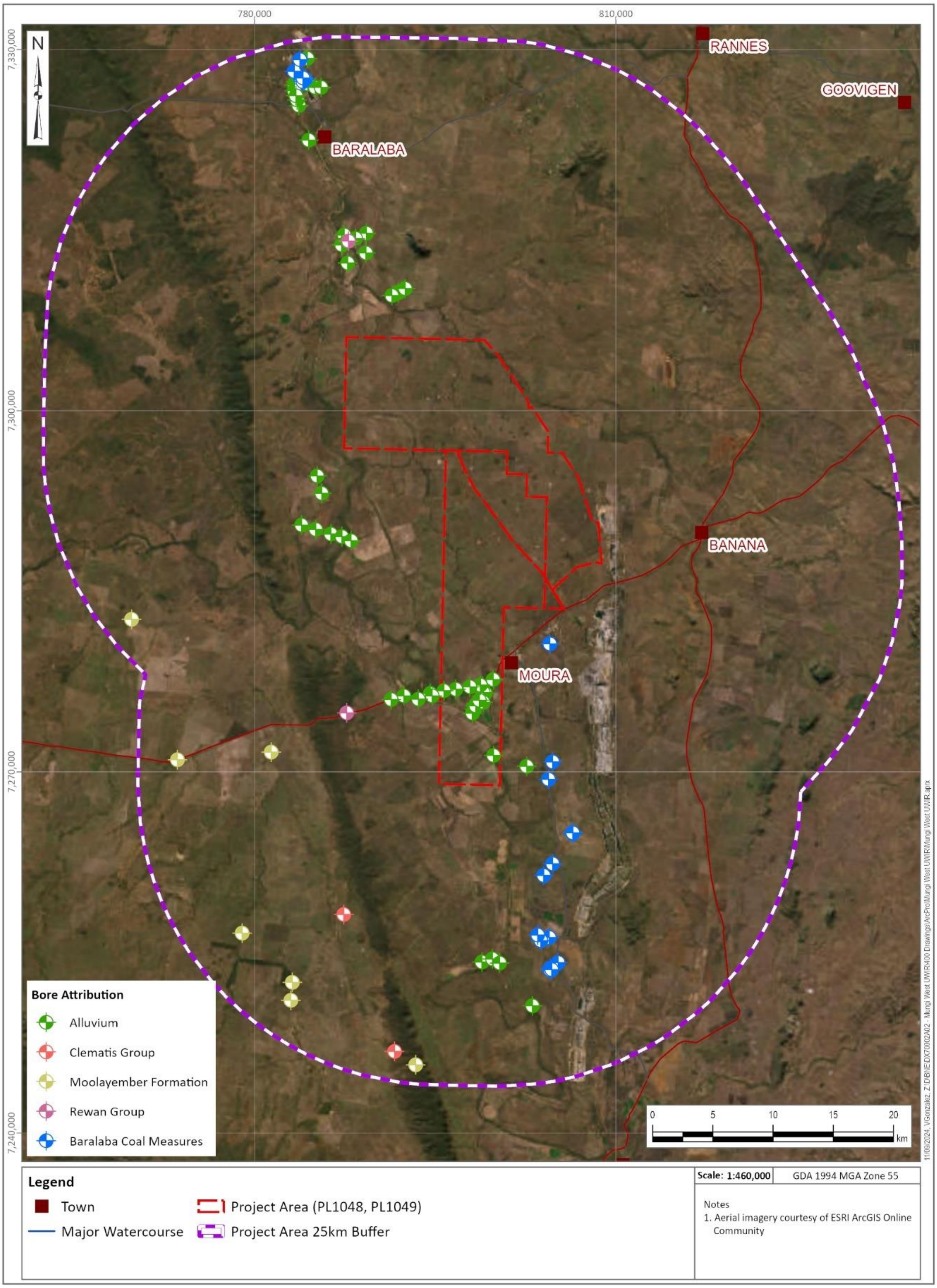

Figure 7.8 Current GWDB Bores with Chemistry Data within 25 km of the Project

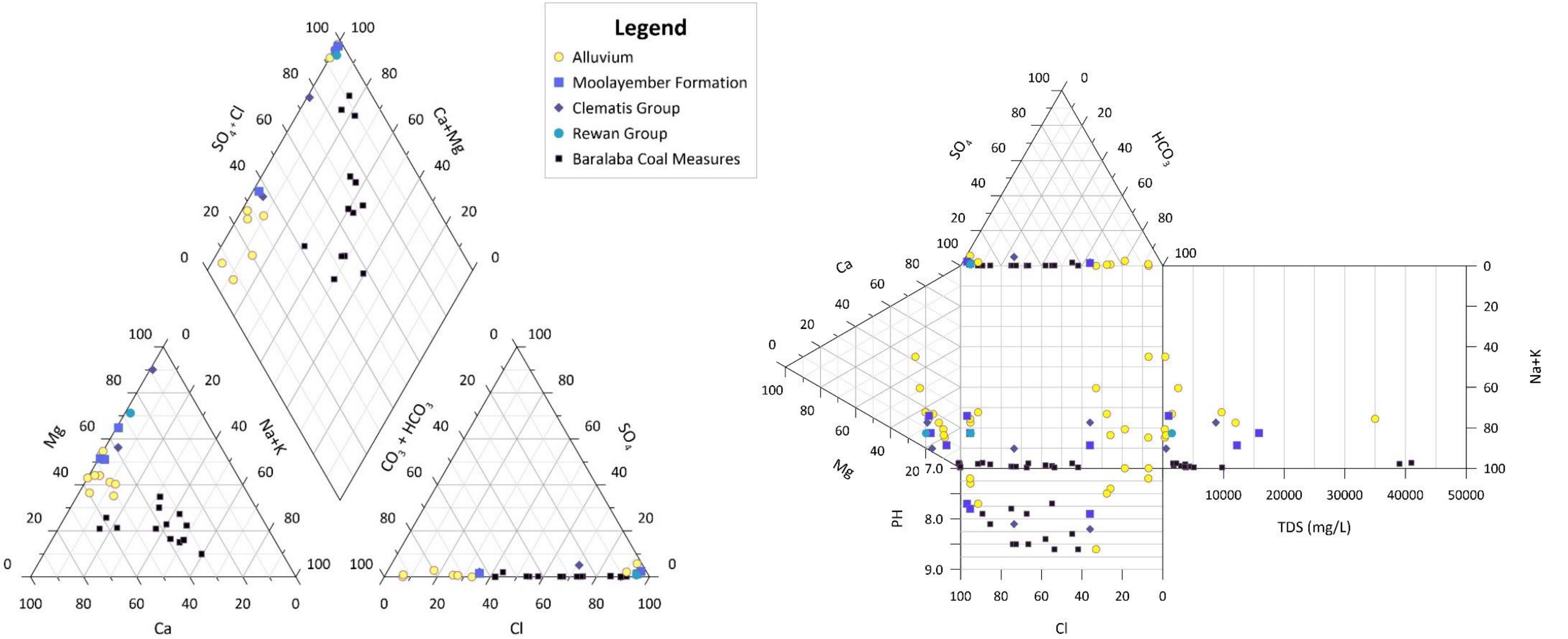

Figure 7.9 Piper and Durov Diagram – Alluvium, Clematis Group, Moolayember Formation, Rewan Group and Baralaba Coal Measures

8 PART C : PREDICTED WATER LEVEL DECLINES FOR AFFECTED AQUIFERS

8.1 Groundwater Model

8.1.1 Conceptual Model Summary

This section summarises the information of the previous section in terms of conceptual models for the hydrogeological systems and identifies the water dependent assets for consideration in the impact assessment. A summary of the conceptual model is as follows:

- The target for gas production for the Project is the Baralaba Coal Measures, which range from <100 m in the east of the tenure to more than 2,500 m in the west of the tenure (PL 1048 and PL 1049).
- Geology within the Project comprises Quaternary-aged alluvium associated with watercourses (predominately Dawson River), with Tertiary sediments covering the majority of the area beyond the extents of the alluvium adjacent to the creeks. The Rewan Group aquitard sub-crops directly beneath the Cenozoic cover within the Project, and to the south of the Project; and outcrops in areas where the Cenozoic cover has eroded away. The Baralaba Coal Measures underlie the Rewan Group and outcrop to the east of the Project. The outcrop of these coal measures coincides with the location of the Dawson Coal Mine Complex. Undivided Permian bedrock underlie the Baralaba Coal Measures and outcrop to the east of the Project.
- The Baralaba Coal Measures comprises the target coal seams, which are interbedded with sandstone, siltstone and shales that occur as interburden or overburden relative to the coal seams. The fine-grained shale and siltstone are observed as having low permeability and are interpreted to function as aquitards. In comparison, the target coal seams generally have a higher permeability.
- Localised faulting has been identified adjacent to the Project within Westside PL 94 and is associated with the Baralaba Coal Measures. However, detailed mapping of these fault structures has identified the faults to be limited to the coal measures and partially into the lower portions of the Rewan Group. The faults are not observed through the Rewan Group and into the overlying Cenozoic cover; and therefore, are not considered to be a conduit for groundwater flow or a concern for the proposed Project development.
- There is a significant thickness of the Rewan Group aquitard within the vicinity of the Project (up to ~500 m thickness in the south of the Project, to ~2,500 m in the cross of the Project) which separates the Clematis Sandstone and Cenozoic cover from the Baralaba Coal Measures.
- The watercourses within the Project are characteristically ephemeral and typically only flow during significant rainfall events. The exception to this is the Dawson River, which is interpreted to receive groundwater baseflow up-catchment of the Project.
- Potential terrestrial GDEs associated with the watercourses, if groundwater dependant (or at least in part), would likely be sourcing groundwater from the alluvium associated with the Dawson River and key associated tributaries.

- Spring complexes are present to the southwest, west, and northwest of the Project and are predominantly associated with the Precipice Sandstone, with a few associated with the Hutton Sandstone and the Clematis Sandstone. The mapped spring complexes are beyond the 25 km buffer of the Project and are not considered to be a concern for this Project development.
- The majority of the groundwater-source for water supply in the vicinity of the Project is predominately associated with the alluvium and Undivided Permian/Basement Rock.

8.1.2 Numerical Groundwater Model Summary

A calibrated groundwater flow model was previously developed for the initial Westside – Mungi UWIR (KCB, 2021). The domain for the previously developed groundwater model includes PL 1048 and PL 1049, and therefore was able to be adopted to undertake this assessment.

8.1.3 Model Design, Domain and Calibration

8.1.3.1 Model Code Selection

MODFLOW-USG is an "unstructured grid" version of MODFLOW that can use an irregular grid structure with arbitrary cell/node connections. This enables focused grid refinement to occur in areas where detail is important, without the need for continuation of grid refinement to the extremes of the model domain. It also facilitates implementation of pinching-out layers and/or layer discontinuities within the modelled domain. This can greatly reduce the number of grid cells within the model domain and thus greatly reduce model runtimes. In addition, MODFLOW-USG implements an "upstream weighting" formulation of the groundwater flow equation that allows cells to dewater and re-saturate easily.

For these reasons, MODFLOW-USG was selected for this assessment.

8.1.4 Model Processing and Discretisation

Algomesh was used to develop an unstructured grid based on Voronoi polygons and to calculate cell connectivities along with geometries of connected cell interfaces necessary for execution of the MODLOW-USG model. In doing so, grid mesh refinement was focused around:

1. The Quaternary alluvium;
2. Major surface water drainage lines; and
3. The development areas – CSG development and Dawson Mining Complex.

The grid cell mesh developed from these settings is shown in Figure 8.1. In representing the hydrostratigraphic units in the vicinity of the Project, a total of 11 model layers were used and these are discussed further Section 8.1.5. The model grid comprises 98,903 active cells.

The transient period used for model calibration consists of monthly time-steps with quarterly stress periods over the period October 1990 to June 2019 and a combination of quarterly and annual stress periods were used in the predictive runs to simulate operational development and post-development groundwater level recovery.

8.1.5 Model Layers

The hydrostratigraphy of the project was represented using 11 model layers. The uppermost surface is defined by project-specific LiDAR data, for the localised Project, combined with public domain SRTM data for the wider model domain. Table 8.1 presents the model layers and the primary geological units that are represented by each.

Table 8.1 Summary of Model Layers

Model Layer	Hydrogeological Unit	Geological Age
1	Alluvium	Quaternary
2	Tertiary Sediments	Quaternary-Tertiary
3	Tertiary Basalt	Tertiary
4	Boxvale Sandstone	Jurassic
5	Evergreen Formation	
6	Precipice Sandstone	
7	Moolayember Formation	Triassic
8	Clematis Group	
9	Rewan Group	
10	Baralaba Coal Measures	Permian
11	Undivided Basement Units	Permian and older

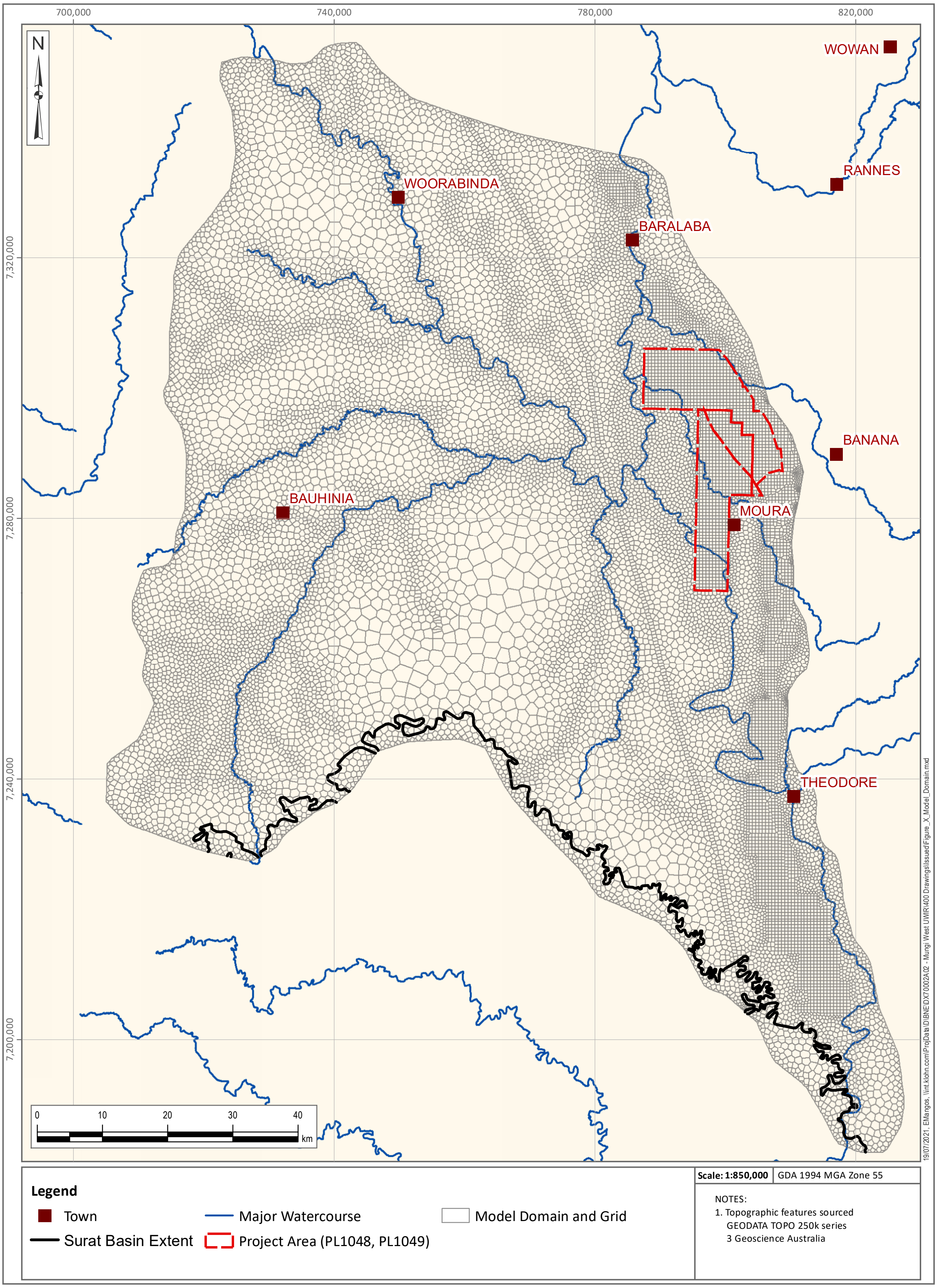

Figure 8.1 Groundwater Model Domain

8.1.5.1 Model Layer Assumptions

The previous (UWIR, 2021) model assumed that the simulation of the Baralaba Coal Measures as a single model layer was considered a conservative assumption and is appropriate for this assessment.

8.1.6 Model Boundary Conditions

Boundary conditions are necessary for solution of the 3D groundwater flow equation that is implemented by MODFLOW-USG. In the (UWIR, 2021) model a combination of constant head and constant flux boundary conditions was applied to specific layers in such a way that the general groundwater flow directions were maintained.

Rainfall recharge was applied in zones based on the extents of outcropping geological units, using the RCH package of MODFLOW. Recharge has been applied as the fraction of rainfall that passes through the unsaturated zone and arrives at the groundwater surface. Within the model recharge has been applied as a percentage of rainfall.

Evapotranspiration was implemented using the EVT package in MODFLOW. A uniform extinction depth has been applied across the domain and set at 1.5 m below the natural surface, below which evaporative losses from the groundwater surface are zero.

General head boundary cells (GHB package) were implemented around the perimeter of the model domain. These GHBs are applied to all layers where that layer is present at the boundary. The major water courses in the model domain are represented using the MODFLOW Streams package (STR7). Drain cells (DRN package) have been used to simulate existing open cut mining activities in the vicinity of the project. The existing and proposed CSG schedule was used to update the Drain cells (DRN package) in the model to simulate the coal seam gas extraction.

8.1.7 Model Calibration

The Mungi UWIR calibrated model (2021, KCB) was used for this updated (2025-2028) UWIR model. This current model was updated with the new CSG schedule and simulated.

8.2 Predicted Water Level Declines

Two predictive model scenarios were simulated to allow assessment of potential impacts to surrounding water resource as a result of the Project development. These scenarios comprised:

- Scenario A – Cumulative Scenario; which comprises existing CSG wells, coal mining activities associated with the adjacent Dawson Mine and the CSG wells associated with the proposed Project development.
- Scenario B – Current Conditions Scenario; which comprises the development activities identified in Scenario A, with the proposed Project development removed.

Groundwater level drawdown associated with the Project development is estimated based on the difference between the drawdown results from Scenario A and Scenario B, which provides a Project-only scenario. Scenario A provides the cumulative drawdown within the vicinity of the Project.

The predictive simulation was completed for the entire duration of the proposed Project development, with the predicted drawdowns abstracted from the model after three (3) years of development and at the completion of development to represent the drawdown for the IAA at the end of the UWIR period and the LTAA, respectively.

8.2.1 Scenario Results

Numerical modelling outputs for the scenarios detailed in the previous section have been used to assess the extent and magnitude of drawdown related to CSG production from the Project.

Drawdown as a result of the proposed Project development was observed in Layer 9 (Rewan Group), Layer 10 (Baralaba Coal Measures) and Layer 11 (Undivided Basement). There is no predicted drawdown in the surficial Cenozoic units (i.e. Quaternary alluvium, Tertiary sediments) above the Rewan Group. Predicted drawdown in Model Layers 9 to 11 (Rewan Group to Undivided Basement) for Project year 3 (IAA) are presented in Figure 8.2, Figure 8.3 and Figure 8.4 respectively. The maximum predicted drawdown from the entire model simulation period (LTAA) for Model Layers 9 to 11 (Rewan Group to Undivided Basement) are presented in Figure 8.5, Figure 8.6 and Figure 8.7 respectively. Drawdown associated with the proposed Project development was not predicted in layers 1 to 8, therefore, drawdown figures for those layers have not been presented in this report.

Key observations from the predicted drawdowns include:

- Predicted drawdown / depressurisation is limited to the Rewan Group, Baralaba Coal Measures, and Undivided Basement.
- There is no drawdown predicted for the hydrostratigraphic units above the Rewan Group.
- Predicted drawdown greater than 5 m (consolidated hydrostratigraphic unit bore trigger threshold) is predicted in the Rewan Group, Baralaba Coal Measures, and Undivided Basement for both IAA and LTAA drawdown predictions.

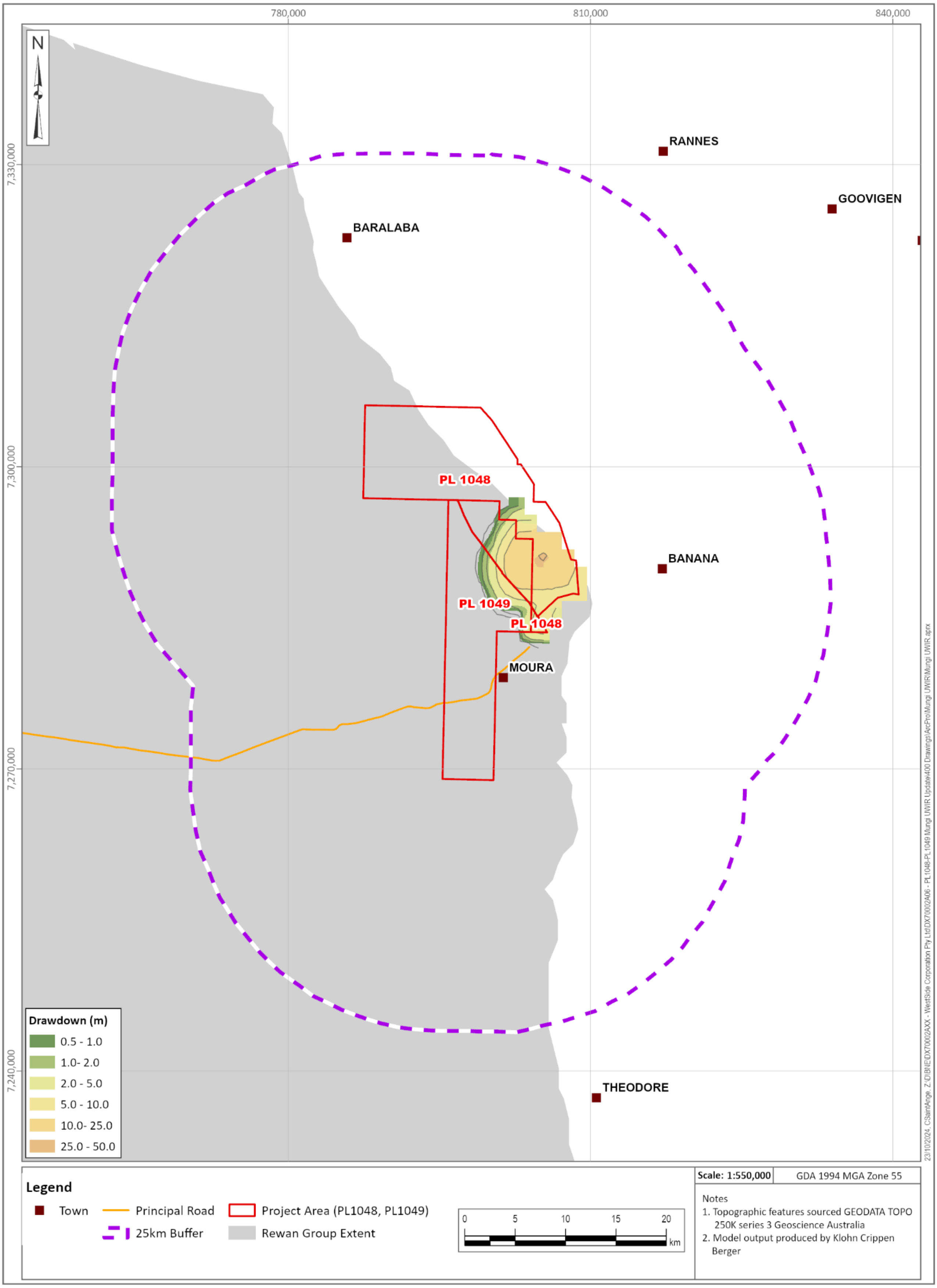

Figure 8.2 Project Year 3 Predicted Drawdown Model Layer 9 – Rewan Group

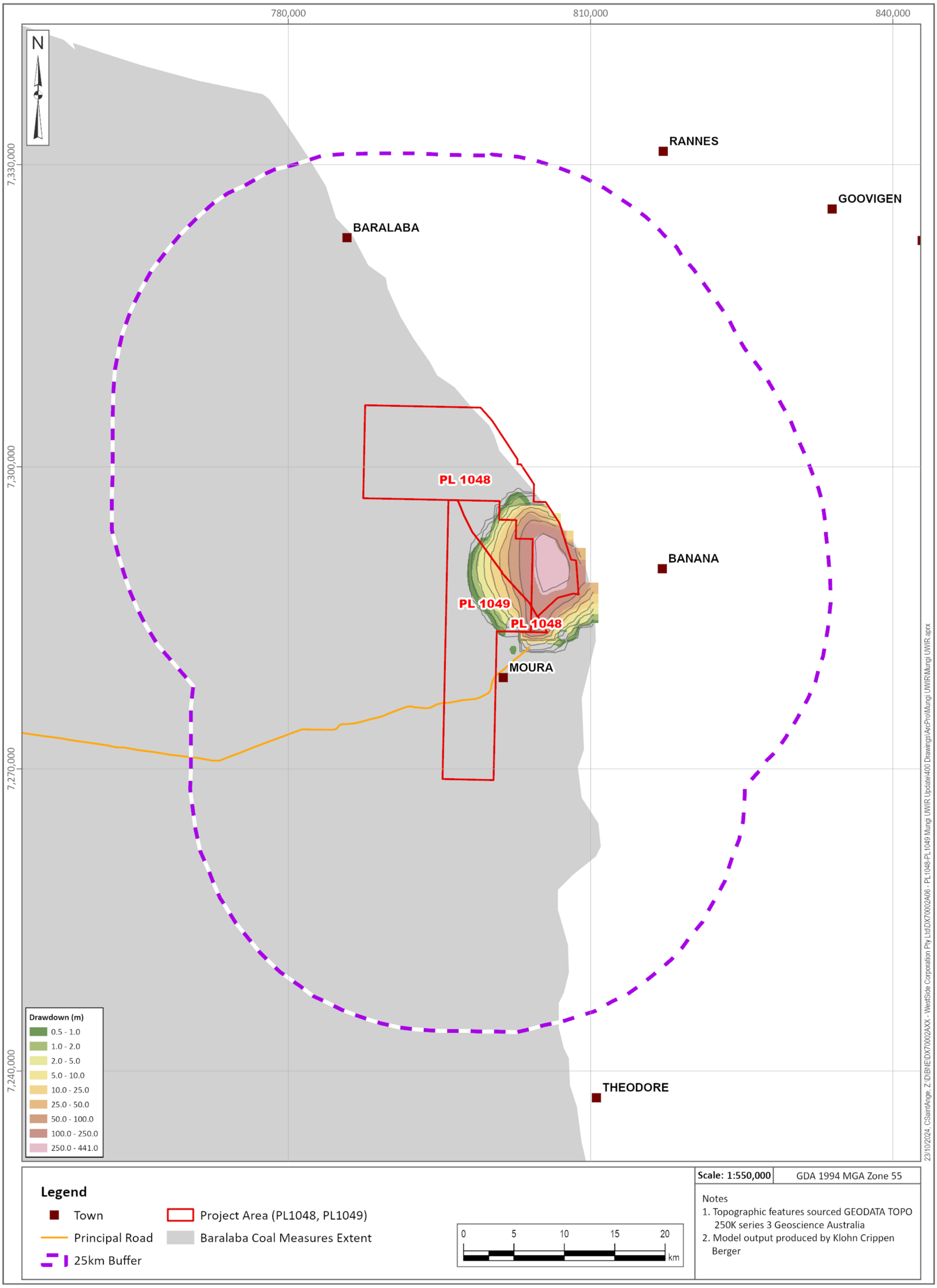

Figure 8.3 Project Year 3 Predicted Drawdown Model Layer 10 – Baralaba Coal Measures

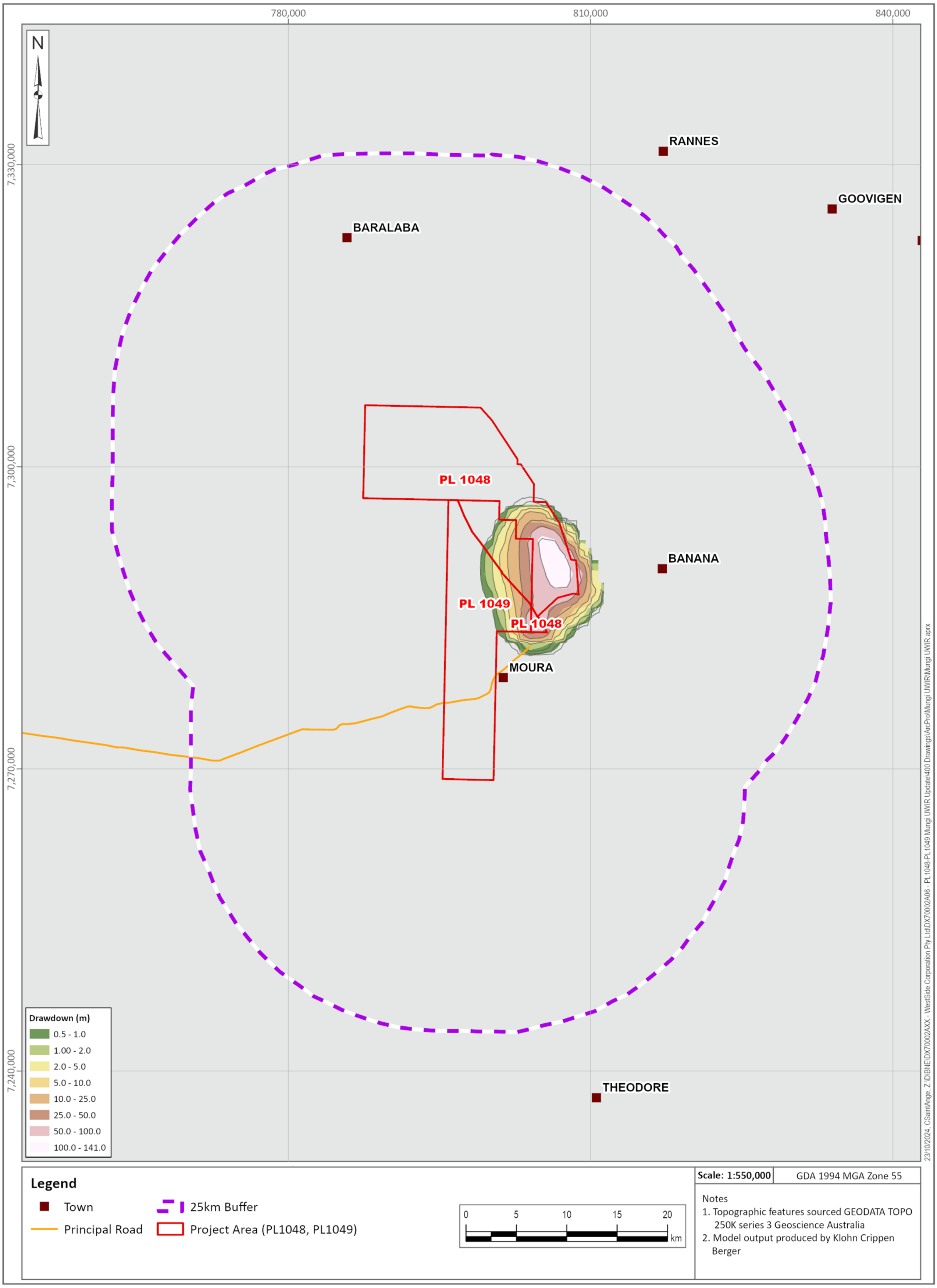

Figure 8.4 Project Year 3 Predicted Drawdown Model Layer 11 – Undivided Basement

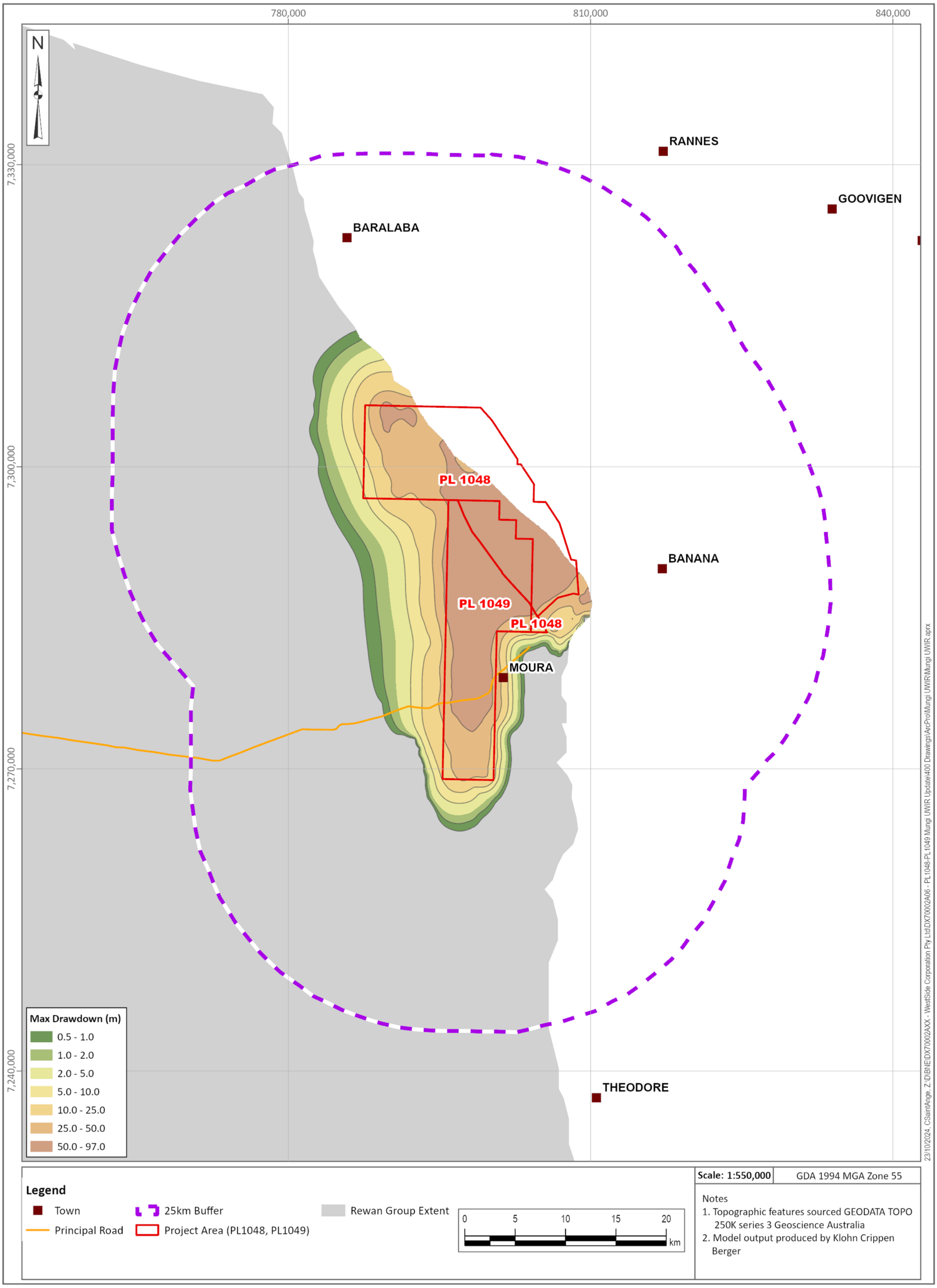

Figure 8.5 Maximum Predicted Drawdown Model Layer 9 – Rewan Group

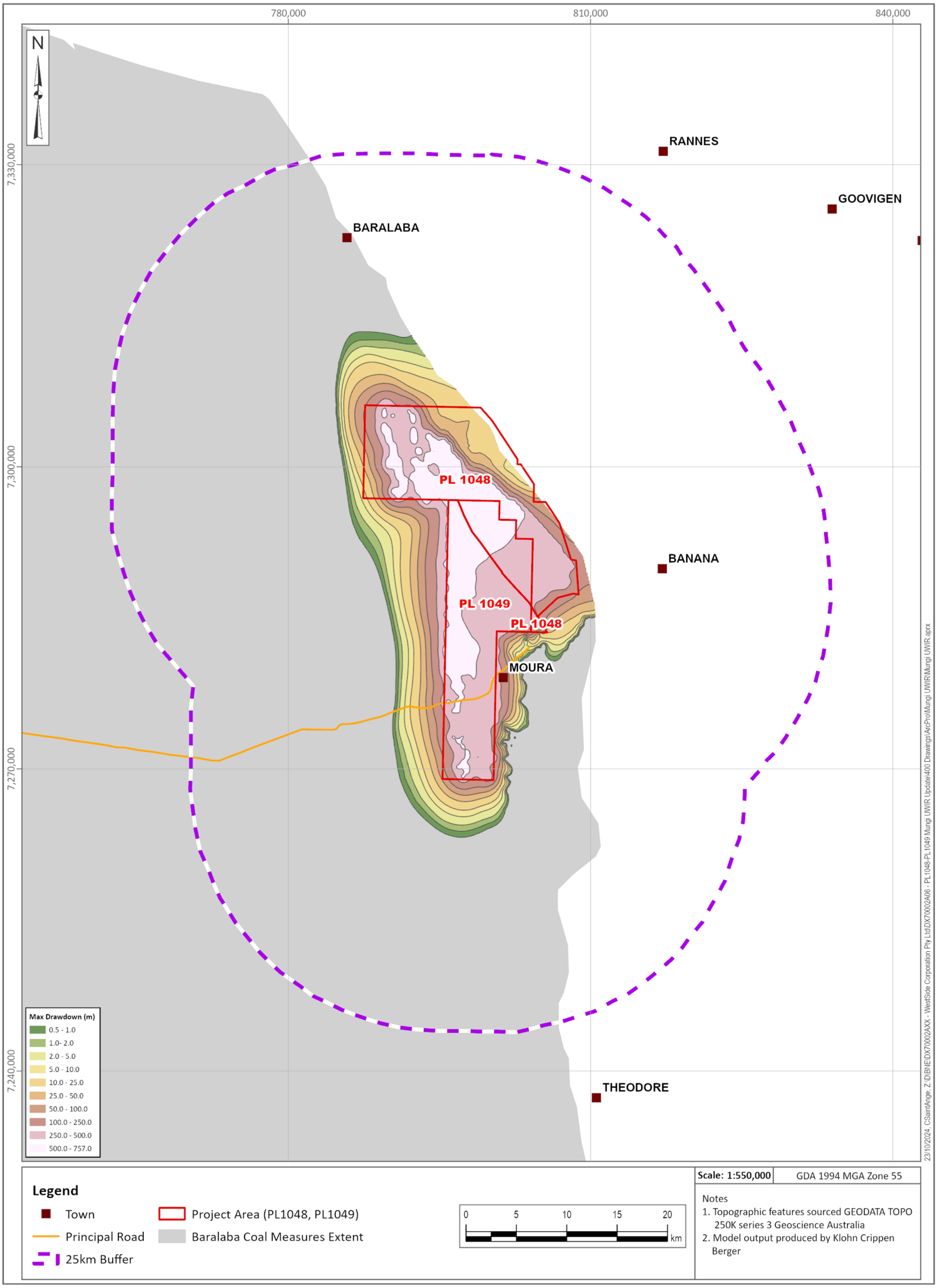

Figure 8.6 Maximum Predicted Drawdown Model Layer 10 – Baralaba Coal Measures

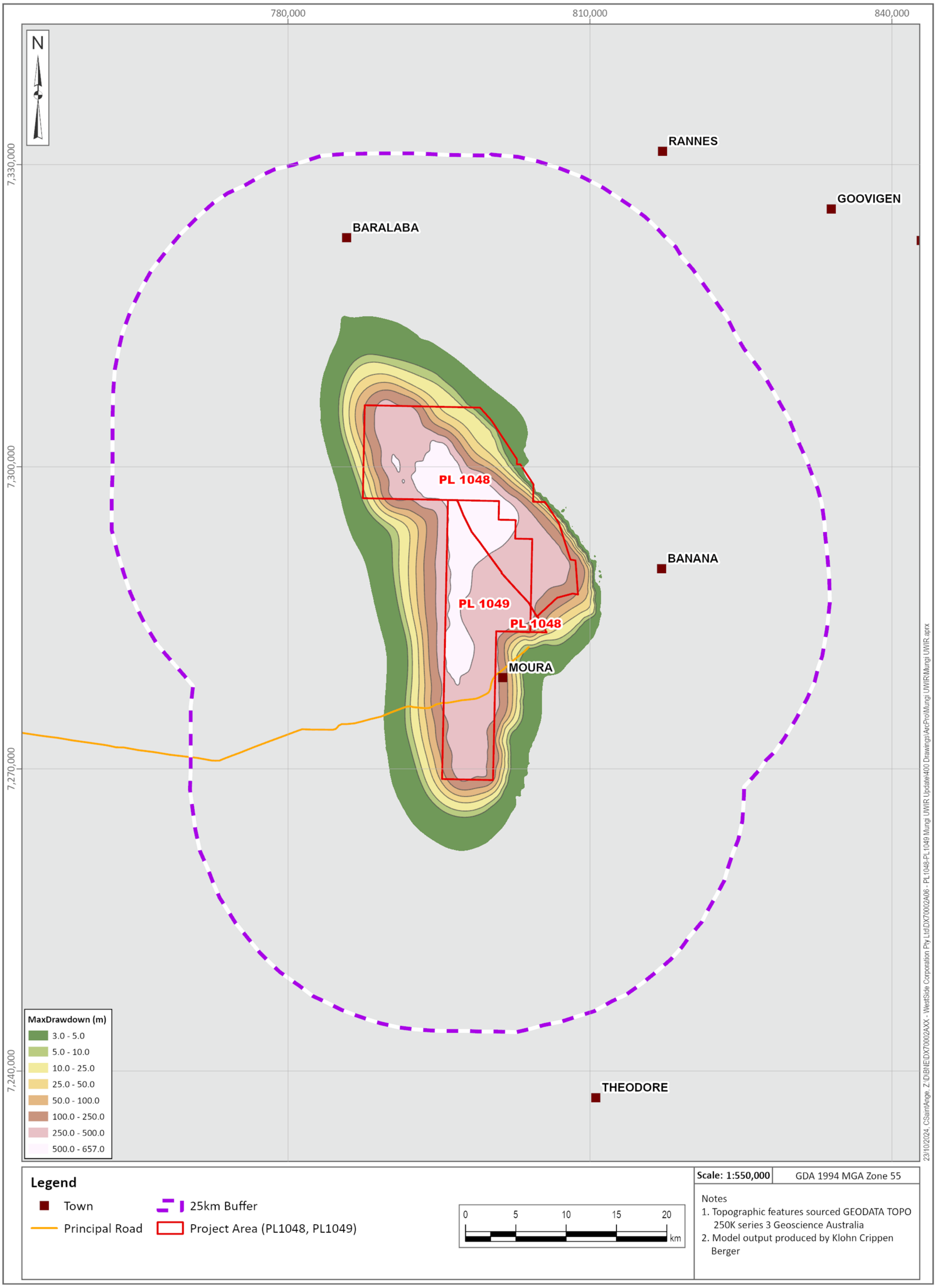

Figure 8.7 Maximum Predicted Drawdown Model Layer 11 – Undivided Basement

8.2.2 Groundwater Depressurisation During the UWIR Period

As identified in Section 8.2.1, predicted drawdown for the UWIR period as a result of the Project development is restricted to the Rewan Group, Baralaba Coal Measures, and Undivided Basement. Drawdown is not predicted in the surficial Cenozoic units (e.g. Quaternary alluvium, Tertiary sediments) overlying the Rewan Group.

Figure 8.2 shows that a maximum of ~27 m of drawdown is predicted in the Rewan Group. The lateral extent of drawdown in the Rewan Group aquitard exceeding 5 m (drawdown trigger threshold for bores screened in a consolidated aquifer), the IAA, is predicted to reach an extent of ~2 km from the CSG development area.

The greatest drawdown is predicted in the Baralaba Coal Measures, as a result of the proposed CSG development, where a maximum of ~358 m is predicted during the UWIR period (Figure 8.3). Peak drawdown is anticipated for the Baralaba Coal Measures as this is the target seam for gas production. The lateral extent of drawdown in the Baralaba Coal Measures exceeding 5 m is predicted to extend approximately 5 km from the CSG development area.

8.2.3 Groundwater Depressurisation Over the Project Life

Figure 8.5 shows maximum predicted depressurisation in the Rewan Group over the entire Project life (LTAA). Drawdown within the Rewan Group is predicted to be greatest in the central region of the Project where the highest density of CSG wells are proposed to be located. Zones of high depressurisation are also observed in the western area of PL 1048 and southern area of PL 1049, also coinciding with increased density of CSG wells. The maximum drawdown in the Rewan Group is predicted to be ~97 m (Figure 8.5). The zone of depressurisation is predicted to extend more than 7 km west of the Project site, and less than 5 km to the east and south.

Figure 8.6 shows maximum predicted depressurisation within the Baralaba Coal Measures over the entire Project life (LTAA). Depressurisation within the Baralaba Coal Measures is predicted to be greatest in the central, northwestern and southern regions of the Project. The Baralaba Coal Measures layer is predicted to experience a maximum depressurisation of ~757 m as a result of the CSG development. The zone of depressurisation is predicted to extend more than 7 km north and west of the Project, and approximately 5 km to the east and south.

Propagation of depressurisation through the Rewan Group aquitard to the overlying Tertiary sediments and/or Quaternary alluvium, as a result of the proposed Project development, is not predicted to occur. Stratigraphically, the Rewan Group aquitard is the highest stratigraphic unit that is predicted to observe depressurisation impacts from the development.

9 PART D : IMPACTS TO THE ENVIRONMENTAL VALUES

9.1 Identified Environmental Values

9.1.1 Groundwater Surface Water Interactions

Groundwater surface water interaction within the Project 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, 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 where flow is only observed during and following rainfall event. 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 (Figure 7.2), there is limited potential for baseflow from the groundwater system to contribute to the Dawson River within the vicinity of the Project. This is supported by the comparison between groundwater levels in the alluvium monitoring bore (RN 13030385 – assessed as part of the Greater Meridian Field Groundwater Assessment (KCB 2020)) 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, is a result of groundwater baseflow contribution up-catchment of the Project.

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 alluvium, there is limited connection between groundwater and surface water within the vicinity of the Project.

9.1.2 Groundwater Dependent Ecosystem

Potential groundwater dependent ecosystems (GDEs) have been mapped in the vicinity of the Project by the DESI (DESI 2024b). GDEs are defined in water-related responses to coal seam gas extraction and coal mining (DoEE 2015) as:

> *'Natural ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services* (Richardson et al. 2011)*. The broad types of GDE are* (Eamus et al. 2006)*:*
>
> - Ecosystems dependent on surface expression of groundwater,
> - Ecosystems dependent on subsurface presence of groundwater,
> - Subterranean ecosystems.'

OGIA (2019b) provides further terminology relating to surface expression GDE's, which include spring vents / complexes:

- Spring vents are described as a single location in the landscape where groundwater discharges at the surface. A spring vent can be mounded or flat and can also present as wetland vegetation, with no visible water at the location of the spring.
- A spring complex is a group of spring vents located close to each other. The spring vents are located in the same surface geology and share the same source aquifer and landscape position. No adjacent pair of spring vents in the complex is more than 10 km apart.
- A watercourse spring is a section of a watercourse where groundwater from an aquifer enters the stream through the streambed. This includes waterholes and flowing sections of streams dependent on groundwater. This type of spring is also referred to as a baseflow-fed section of a watercourse.

9.1.2.1 Spring Complexes

Spring complexes, as recorded in the Queensland spring database (Queensland Herbarium 2018), are presented in Figure 9.1. The majority of spring complexes are located over 65 km west of the Project, while other spring complexes are located over 40 km to the southwest of the Project.

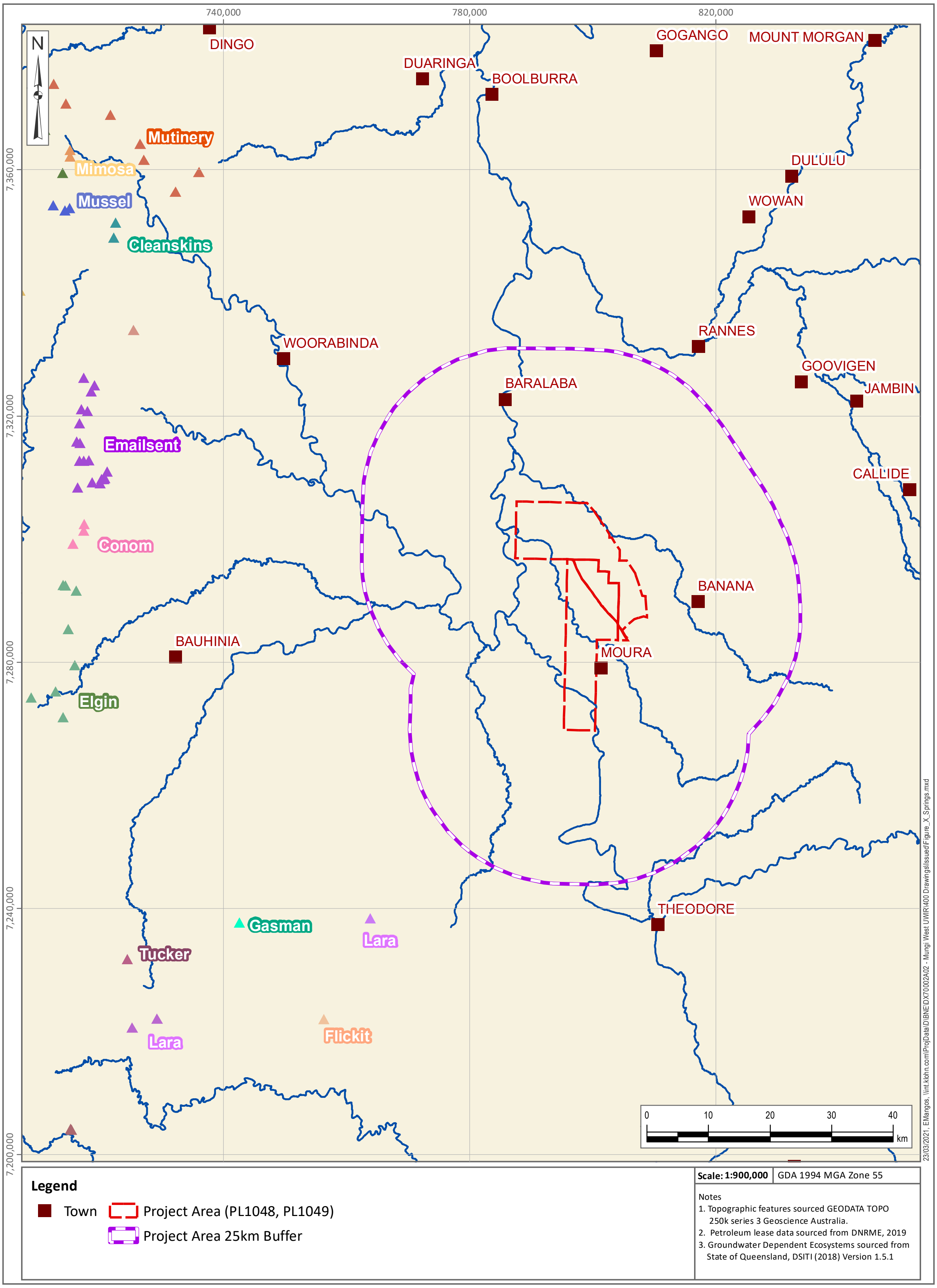

Figure 9.1 Location of Spring Vents / Complexes in the Vicinity of the Project

9.1.2.2 Potential Terrestrial GDEs

The distribution of potential GDEs, as mapped by DESI (2024b), within the vicinity of the Project is presented in Figure 9.2. The potential GDEs are generally located in the vicinity of watercourses, such as the Dawson River and associated tributaries (Fish Creek / Zamia Creek). The majority of potential GDEs are mapped as being 'low confidence' and are all derived from satellite or regional ecosystem mapping, rather than assigned based on known groundwater dependence.

Figure 9.3 presents the potential terrestrial GDEs using the GDE mapping rule sets as defined by the Queensland Government (2017) in 'Groundwater dependent ecosystem mapping rulesets for the Comet, Dawson and Mackenzie River Catchments'. The rule set occurring in the vicinity of the Project include:

- SURAT_RS_01A: Quaternary alluvial aquifers overlying sandstone ranges with fresh, intermittent groundwater connectivity regime
- SURAT_RS_01C: Quaternary alluvial aquifers with fresh, intermittent groundwater connectivity regime
- SURAT_RS_01D: Quaternary alluvial aquifers with fluctuating, intermittent groundwater connectivity regime and neutral pH
- SURAT_RS_02A: Permeable rock aquifers (basalts) greater than or equal to 100 ha in size with fresh, intermittent groundwater connectivity regime
- SURAT_RS_02B: Permeable rock aquifers (basalts) less than 100 ha in size with fresh, episodic groundwater connectivity regime
- SURAT_RS_03A: Permeable consolidated sedimentary rock aquifers with fresh, intermittent groundwater connectivity regime
- SURAT_RS_05: Permeable old loamy or sandy plain aquifers with fresh, intermittent groundwater connectivity regime
- SURAT_RS_07: Fractured rock aquifers (igneous rocks) with fresh, intermittent groundwater connectivity regime

Further discussion of the potential terrestrial GDEs, in the context of impacts, is provided in Section 9.2.

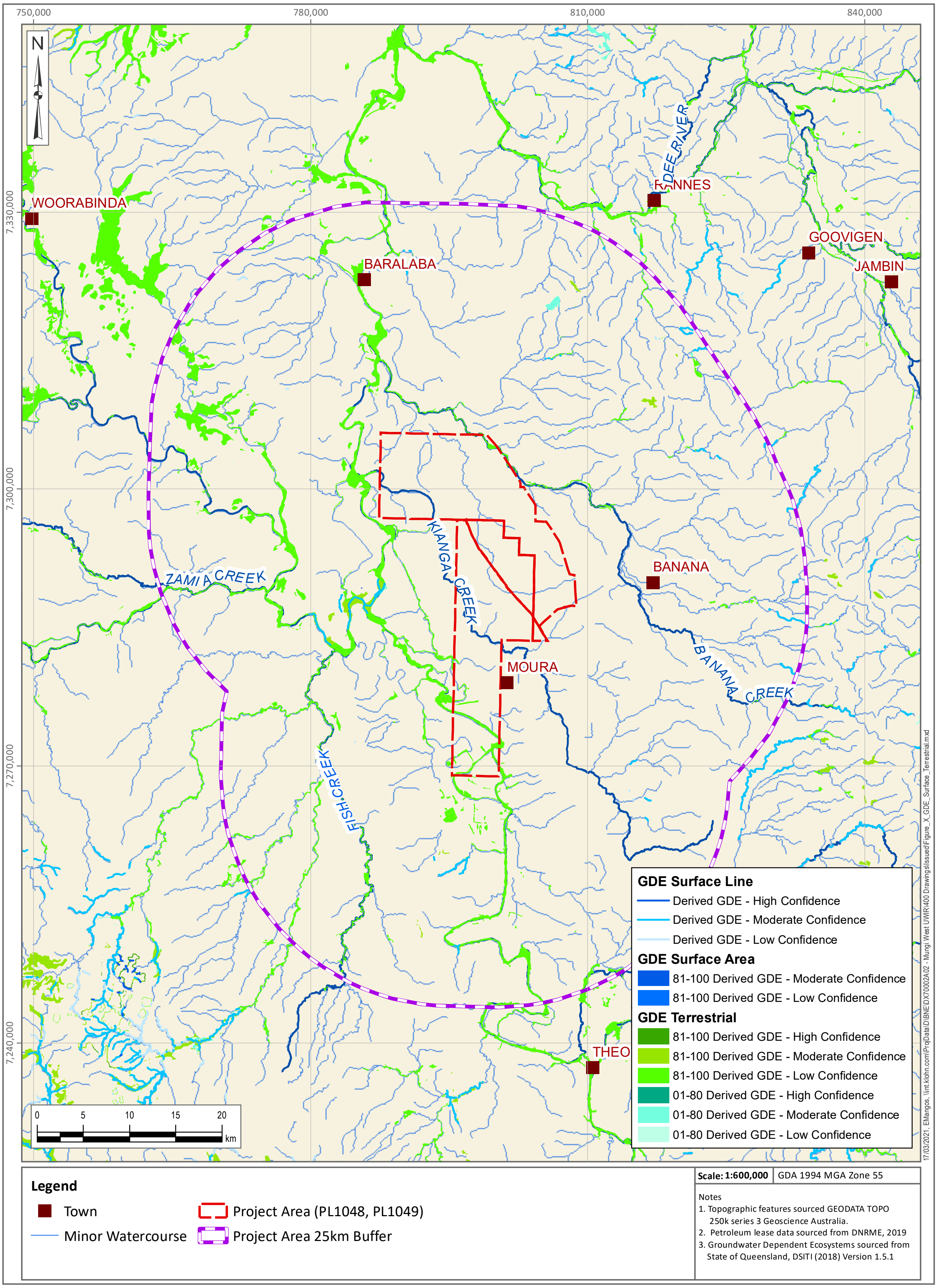

Figure 9.2 Location of Potential Terrestrial GDEs in the Vicinity of the Project

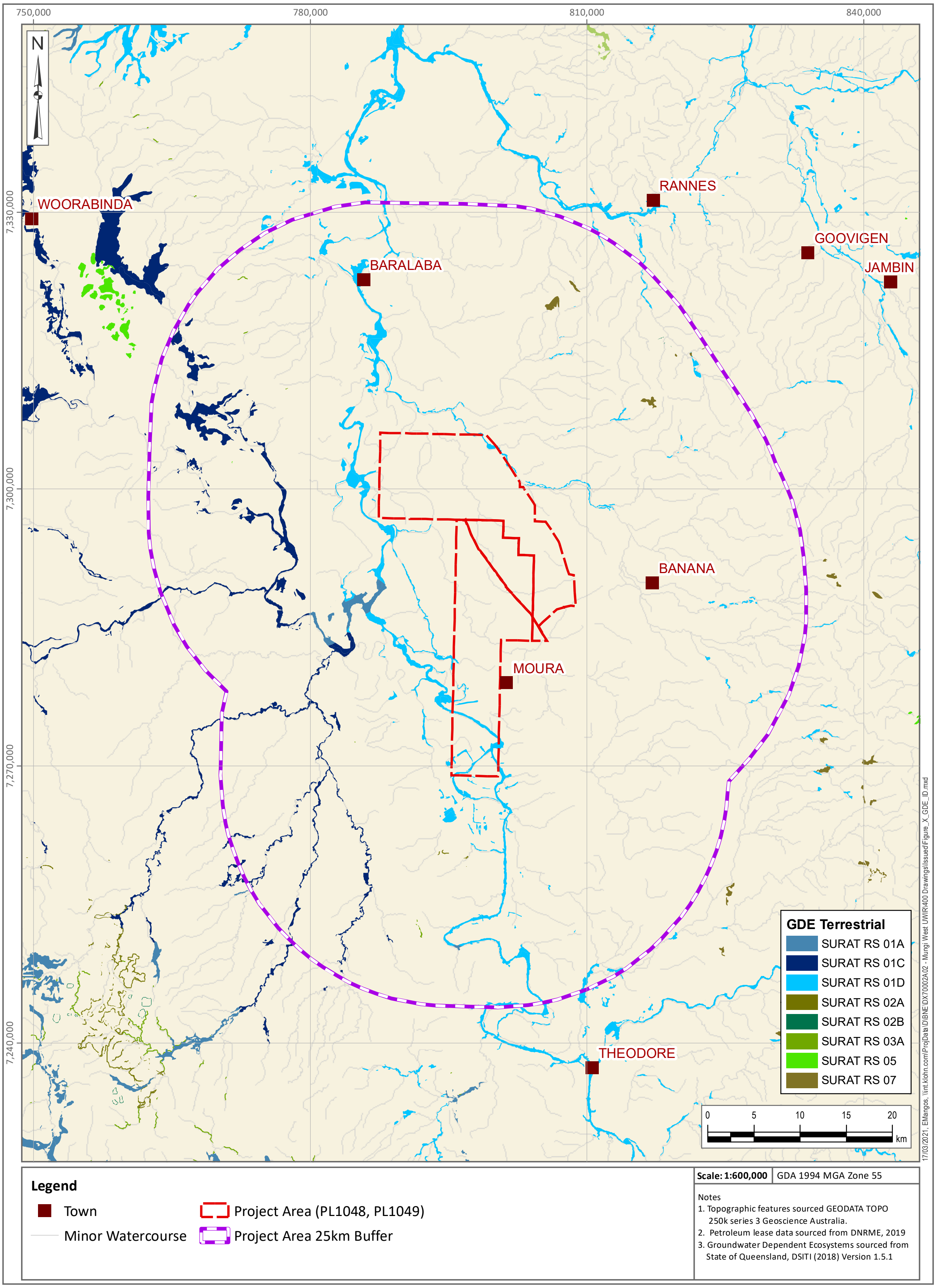

Figure 9.3 Potential Terrestrial GDEs by Rule Set

9.1.3 Third-Party Groundwater Users

9.1.3.1 Registered Groundwater Bores

Within the vicinity of the Project (within PL 1048, PL 1049 and a 25 km buffer outside), there are 242 registered groundwater bores recorded in the GWDB, as of August 2024 (DRDMW 2024). A summary of registered bores is presented in Table 9.1 along with their type and status, as derived from the GWDB. Bores abandoned and destroyed have not been presented in the associated figures.

Table 9.1 Summarised Bore Type and Condition within a 25 km radius of Project

Type	Abandoned and Destroyed (AD)	Abandoned But Useable (AU)	Existing (EX)	Total
Condition Unknown (AB)	0	0	19	19
Controlled Flow (AF)	0	0	8	8
Sub-artesian Facility (SF)	59	23	133	215
Total	**59**	**24**	**159**	**242**

Other groundwater bores may also be present within the Project that are not registered in the GWDB (e.g. installed prior to the requirement to register water bores with the DRDMW). It is not known how many unregistered bores may exist; however, these bores may be identified during future bore baseline assessments. The data from baseline assessments is provided to OGIA and DRDMW for incorporation into future updates to the GWDB.

9.1.3.2 Bore Baseline Assessment

Under the Water Act, petroleum tenure holders are required to undertake baseline assessments of water bores prior to commencement of production. Baseline assessments are undertaken in accordance with the 'Baseline Assessment Guideline' (DESI 2016a), to obtain information such as:

- Bore status;
- Type and purpose;
- Information related to construction of the bore; and
- Bore equipment.

Baseline assessments for bores located within the Project were undertaken as part of the Mungi West CSG EA Application Groundwater Assessment (SLR Consulting Australia Pty Ltd 2019), which were completed in accordance with Water Act requirements. The baseline information with regards to existence, construction, condition and accessibility of water bores, and where possible, aquifer data including water level, water quality, groundwater yield and use were assessed. A summary of the groundwater bores within the Project for which baseline assessment have been undertaken are provided in Table 9.2. Figure 9.4 presents the locations of the bores where baseline assessments were completed / attempted.

Table 9.2 Summary of Completed / Attempted Bore Baseline Assessments

Bore ID / Local Name	Easting	Northing	Landholder	Static Water Level Monitoring	Groundwater Quality Analysis
Unknown Bore 1	798810	7292497	2SP128480	YES	X
Unknown Bore 2	800910	7292622	2SP128480	X	X
128580	802998	7294999	2FN197	YES	X
128574 (missing)	799547	7289008	20FN208	X	X
128576	800242	7283198	6FN180	YES	X
128577	802990	7286080	6FN180	YES	YES

* Coordinates in GDA94, Zone 55.

9.1.3.3 Groundwater Use and Purpose

Groundwater abstraction within the Project area provides a water source for the pastoral industry, population centres, mining activities, and other extractive industries. Most bores target shallow aquifers for stock watering and domestic water supply. A number of bores are used for mining activities and CSG extraction activities.

A summary of the estimated purpose for bores located within the 25 km buffer of the Project is shown in Figure 9.5. Groundwater abstraction for water supply is the dominant water use purpose within the vicinity of the Project, with 65 bores considered as potential water supply bores.

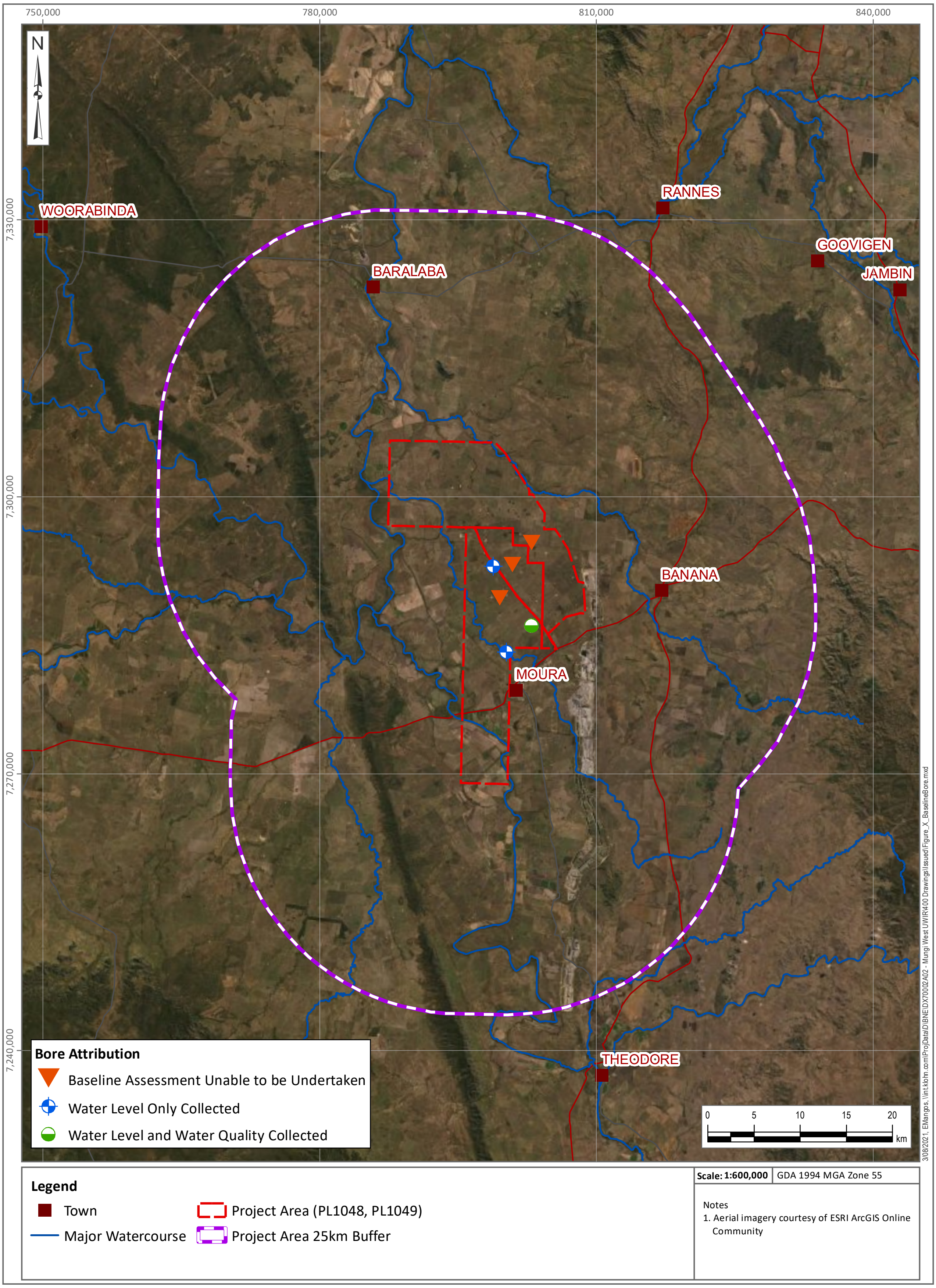

Figure 9.4 Locations of Completed / Attempted Bore Baseline Assessments

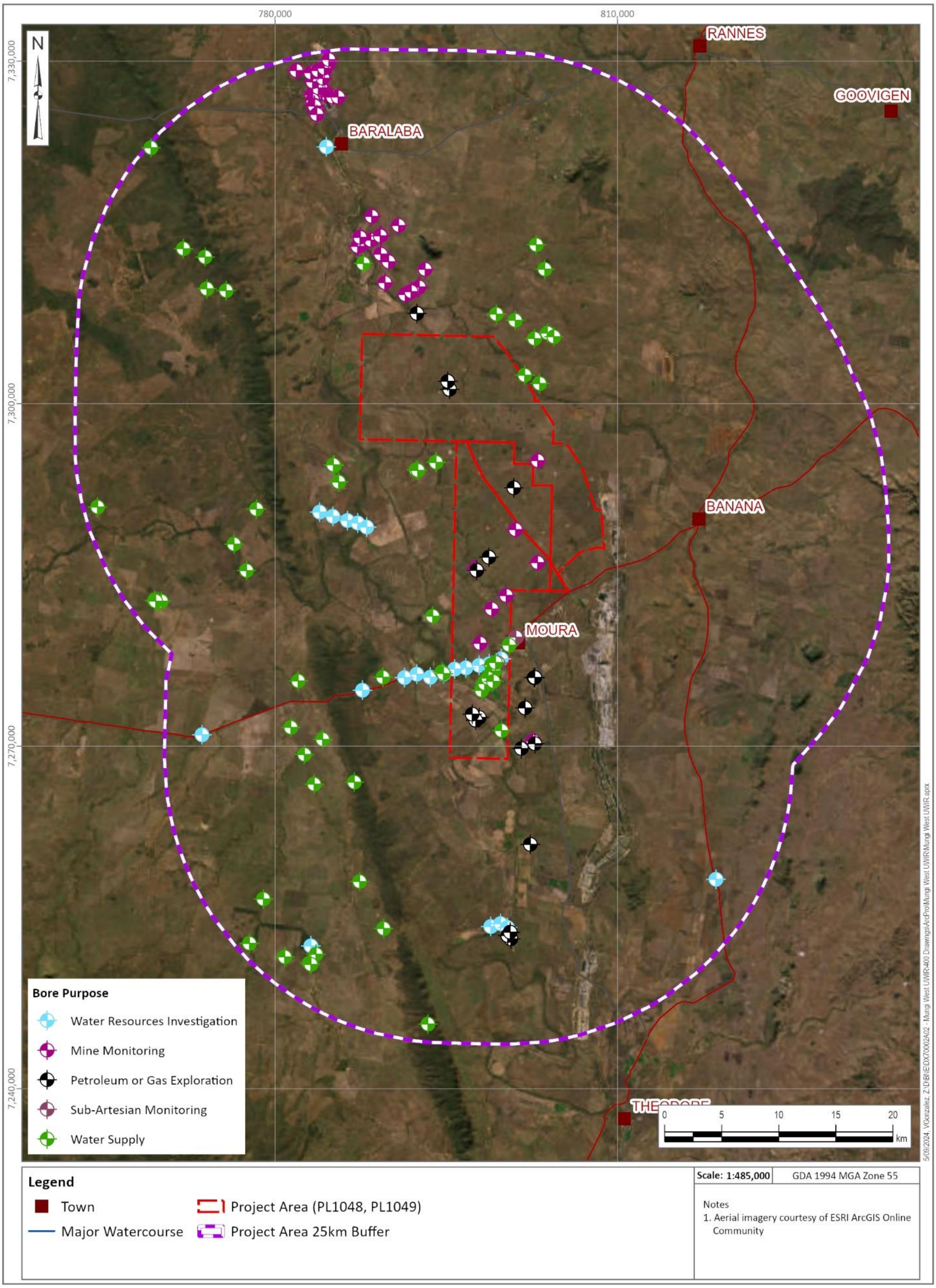

Figure 9.5 Estimated Bore Purpose (provided by OGIA)

9.2 Impacts to Environmental Values

Groundwater level drawdown/depressurisation predictions from the numerical modelling results presented in Section 8.2.1 identify that drawdown/depressurisation is restricted to the Rewan Group, the Baralaba Coal Measures, and the Undivided Basement. There is no predicted drawdown impact to the shallow groundwater in the overlying Quaternary alluvium or Tertiary sediments, therefore, there will be no predicted impacts to environmental values associated with the shallow groundwater system. An assessment of the environmental impact related to the planned CSG activities is therefore not required.

9.2.1 Impacts on Groundwater Resources

Groundwater abstraction occurs as part of the CSG production process. Groundwater is removed via production wells to depressurise the coal seams, which liberates gas flow. This depressurisation, and associated gas flow, results in groundwater abstraction that is required to maintain the target operational pressure for gas production.

Water Production is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* (Chapter 2). Potential impacts as result of water production may include:

- Decline in groundwater level / pressure at water bores, reducing water availability and potentially impacting groundwater EVs;
- Reduction in groundwater head resulting in reduction of groundwater discharge at spring complexes, potentially causing degradation of GDEs; and
- Reduction of baseflow to watercourses, potentially resulting in reduced availability of water to GDEs and reduced water availability to potential users downstream.

Those potential impacts, where receptors exist within the vicinity of the Project, are assessed against the Water Act trigger thresholds as outlined in Section 2.2.

Monitoring, management, and mitigation practices associated with the above activities are discussed further in Section 10.

9.2.2 Impacts on Groundwater Users

Potential short term and long-term impacts to groundwater bores have been assessed against the Water Act bore trigger threshold of 2 m for an unconsolidated aquifer (e.g. alluvium), and 5 m for a consolidated aquifer (e.g. Rewan Group; Baralaba Coal Measures; Undivided Basement), using the drawdown predictions from the numerical model (Section 8.2.1). The Year 3 (IAA) predicted drawdown is presented for this assessment alongside the maximum (LTAA) predicted drawdown for the Project, irrespective of timing.

Many groundwater bores within the Project vicinity are constructed to intersect multiple formations. All of the water supply bores within a 25 km radius of the Project were assessed for depressurisation/drawdown as a result of the Project development. Predicted drawdowns to third-party water supply groundwater bores within a 25 km radius of the Project are presented in Table 9.3.

Table 9.3 Summary of Drawdown Predictions for Groundwater Bores

RN	Bore Use	Hydrogeological Unit	IAA Drawdown (m)	LTAA Drawdown (m)
30691	Water Supply	Moolayember Formation	0.00	0.00
43557	Water Supply	Clematis Group	0.00	0.00
44055	Water Supply	Moolayember Formation	0.00	0.00
47008	Water Supply	Clematis Group	0.00	0.00
62042	Water Supply	Moolayember Formation	0.00	0.00
62632	Water Supply	Moolayember Formation	0.00	0.00
89554	Water Supply	Moolayember Formation	0.00	0.00
89556	Water Supply	Moolayember Formation	0.00	0.00
89557	Water Supply	Clematis Group	0.00	0.00
89558	Water Supply	Clematis Group	0.00	0.00
89614	Water Supply	Moolayember Formation	0.00	0.00
89615	Water Supply	Moolayember Formation	0.00	0.00
89623	Water Supply	Moolayember Formation	0.00	0.00
89690	Water Supply	Alluvium	0.00	0.00
89755	Water Supply	Alluvium	0.00	0.00
89948	Water Supply	Moolayember Formation	0.00	0.00
128033	Water Supply	Tertiary	0.00	0.00
128034	Water Supply	Tertiary	0.00	0.00
128188	Water Supply	Alluvium	0.00	0.00
128305	Water Supply	Moolayember Formation	0.00	0.00
128583	Water Supply	Alluvium	0.00	0.04
128584	Water Supply	Alluvium	0.00	0.04
128585	Water Supply	Alluvium	0.00	0.04
128587	Water Supply	Alluvium	0.00	0.03
128605	Water Supply	Clematis Group	0.00	0.00
128801	Water Supply	Alluvium	0.00	0.05
128802	Water Supply	Alluvium	0.00	0.00
128898	Water Supply	Alluvium	0.00	0.04
128917	Water Supply	Alluvium	0.00	0.04
128973	Water Supply	Basalt	0.00	0.00
128980	Water Supply	Alluvium	0.00	0.04
170278	Water Supply	Alluvium	0.00	0.00
170308	Water Supply	Alluvium	0.00	0.04
170324	Water Supply	Alluvium	0.00	0.04
13030640	Water Supply	Alluvium	0.00	0.00

Bores installed within unconsolidated aquifers (i.e. applicable to the groundwater bore trigger threshold of 2 m) are not predicted to have an induced drawdown in groundwater levels as a result of Project development.

No water supply bores are predicted to experience a drawdown that exceeds the trigger thresholds (>5 m) during the UWIR period (IAA). No water supply bores have predicted drawdowns that exceed the trigger threshold over the Project life (LTAA). The location and a summary of the estimated purpose for bores located within the 25 km buffer of the Project is shown in Figure 9.5. As per the requirements of the Water Act: bore assessments will be undertaken at those bores and make good agreements will be implemented with each bore owner where required, prior to the trigger threshold being exceeded. This is further discussed in Section 10.1.2.

9.2.3 Impacts on Surface Drainage

The Project does not include any planned discharge to, or abstraction from (including abstraction due to groundwater drawdown impacts), the surface water system. Numerical modelling did not predict drawdown within the surficial Quaternary alluvium of Tertiary sediments aquifer which is potentially hydraulically connected to surface water systems in the Project. Other potential impacts associated with Project construction and operation will be managed through implementation of the appropriate management, mitigation, and monitoring practices associated with construction and operation. There will be no discernible impacts to the surface water system, or surface water users as a result of Project development.

Drawdown on the groundwater table will therefore not impact the overlying surface drainage features.

9.2.4 Impacts on Springs

The nearest spring complex to the Project is approximately 40 km to the southwest of the Project (Figure 9.1). Predicted depressurisation/drawdown from the proposed Project will not propagate to the spring locations, therefore, no impacts to surrounding spring complexes are expected as a result of Project development.

9.2.5 Impacts on Groundwater Dependent Ecosystems

Section 9.1.2.2 identified the potential TGDEs that have been mapped in the vicinity of the Project. Typically, the mapped areas of TGDEs in the vicinity of the project are located adjacent to watercourses (e.g., Dawson River), which are reliant on groundwater within the shallow Quaternary alluvium or Tertiary sediments.

The predicted groundwater level drawdowns from the numerical modelling (Section 8.2.1) indicate that drawdown resulting from the proposed Project development will be limited to the Rewan Group, Baralaba Coal Measures, and Undivided Basement; and will not propagate to the shallow Cenozoic units (i.e. Quaternary alluvium, Tertiary sediments). Therefore, no impacts to the mapped potential TGDEs as a result of the Project development are anticipated.

10 PART E: GROUNDWATER MONITORING PROGRAM

The following sections describe the monitoring and management measures for groundwater levels and quality and groundwater take. Each section provides an overview of the existing monitoring requirements and proposed monitoring and management measures. These measures will be implemented.

10.1 Groundwater Level and Quality Monitoring and Management

10.1.1 Environmental Authority Requirements

The EA for PL 1048 and PL 1049 (EA0002230) has identified conditions, and associated procedures, for the monitoring and management of groundwater. These comprise:

- EA Condition A7 – Monitoring and sampling must be carried out in accordance with the requirements of the following documents (as relevant to the sampling being undertaken), as amended from time to time: - (b) for groundwater, Groundwater Sampling and Analysis – A Field Guide (2009:27 GeoCat #68901).
- EA Conditions G10 to G12 – conditions relate to the establishment of a seepage monitoring network and program to detect/monitor seepage of contaminants to groundwater from onsite contaminant storage facilities.
- EA Conditions I11 to I13:

  Condition I11 – Prior to undertaking stimulation activity, a baseline bore assessment must be undertaken of the water quality of:

  (a) all landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a two (2) kilometre horizontal radius from the location of the stimulation initiation point within the target gas producing formation; and

  (b) all landholder's active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200 m above or below the target gas producing formation and is spatially located within a two (2) kilometre radius from the location of the stimulation initiation point; and

  (c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the finding of the risk assessment required by conditions (I9) and (I10).

  Condition I12 – Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (I13)

  Condition I13 – Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to:

(a) pH

(b) electrical conductivity (µS/m)

(c) turbidity (NTU)

(d) total dissolved solids (mg/L)

(e) temperature (^{o}C)

(f) dissolved oxygen (mg/L)

(g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulfide) (mg/L)

(h) alkalinity (bicarbonate, carbonate, hydroxide and total $CaCO_3$) (mg/L)

(i) sodium adsorption ration (SAR)

(j) anions (bicarbonate, carbonate, hydroxide, chloride, sulfate) (mg/L)

(k) cations (aluminium, calcium, magnesium, potassium, sodium) (mg/L)

(l) dissolved and total metals and metalloids (including but not necessarily being limited to aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) (µg/L)

(m) total petroleum hydrocarbons (µg/L)

(n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) (µg/L)

(o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo(a)pyrene) (µg/L)

(p) sodium hypochloride (mg/L)

(q) sodium hydroxide (mg/L)

(r) formaldehyde (mg/L)

(s) ethanol (mg/L)

(t) gross alpha + gross beta or radionuclides by gamma spectroscopy (Bq/L)

The majority of the groundwater-related conditions identified in the EA (EA0002230) relate to monitoring associated with contaminate seepage to the groundwater or baseline monitoring prior to the undertaking of stimulation activities; however, onsite contaminant storage and well stimulation is not proposed to be undertaken as part of the Project development. Therefore, the established EA conditions are not specifically applicable for the proposed Project.

10.1.2 Current Annual Groundwater Monitoring

Westside has undertaken annual monitoring in five groundwater bores and gas wells for the initial UWIR period (Jan 2022 to Jan 2023). The groundwater bores and gas wells which were monitored in 2023 are presented in Table 10.1.

Table 10.1 Groundwater Bores and Monitoring Locations (Arris, 2023)

Bore ID	Bore Type	Monitoring Formation	Water Level Monitoring Frequency	Water Quality Monitoring Frequency	Sampled	Comment
QNP	Monitoring Bore	Rewan	Quarterly	Biannually	N	Replaced by GW14
GW14	Monitoring Bore	Unknown	Quarterly	Biannually	Y	February 2023
Mungi	Monitoring Bore	Tertiary sediments	Quarterly	Biannually	Y	February 2023 April 2023
MN17V	Gas Well	Baralaba Coal Measures	Monthly	Biannually	Y	Offline
MW0001L	Gas Well	Baralaba Coal Measures	Monthly	Biannually	Y	February 2023
MW0002L	Gas Well	Baralaba Coal Measures	Monthly	Biannually	Y	February 2023

The results for the groundwater level data for the project bores and surrounding registered groundwater bores are presented on Figure 7.2 to Figure 7.7. The water quality sampling for the registered groundwater bores and Project monitoring bores are presented on Figure 7.8.

10.1.3 Proposed Monitoring and Management Measures

Predicted drawdown/depressurisation results from the numerical modelling of the proposed Project development (Section 8.2) has identified that no third-party water supply bore will be triggered (i.e. >2 m drawdown in an unconsolidated aquifer and >5 m drawdown in a consolidated aquifer) during the UWIR period (i.e. no bores within the IAA). The drawdown/depressurisation results from the numerical modelling of the proposed Project development period (LTAA) identified that no third-party water supply bores were bore triggered (i.e. >2 m drawdown in an unconsolidated aquifer and >5 m drawdown in a consolidated aquifer) during the UWIR period.

The numerical groundwater modelling has also identified that impacts to the surface water system, surrounding springs and mapped TGDEs are not anticipated as a result of the proposed Project development. This is due to the laterally extensive and thick low permeability Rewan Group aquitard that limits the propagation of drawdown from the target Baralaba Coal Measures to the shallow Cenozoic aquifers (i.e. Quaternary alluvium and Tertiary sediments). As a result, groundwater monitoring of the Quaternary alluvium and Tertiary sediments is not considered warranted for the Project.

The proposed monitoring and sampling schedule for the years 2025 to 2028 considers the limited observed changes to groundwater level and quality over the previous reporting period (i.e. no discernible change in water level or quality). The proposed groundwater monitoring and management measures will focus on the baseline assessments of third-party groundwater bores within the vicinity of the CSG wells as they are commissioned/developed. The groundwater monitoring program will be based on the following:

- Baseline assessments are to be conducted on water supply bores screened within the Rewan Group or Baralaba Coal Measures that are located within 2 km of a proposed CSG well, prior to the establishment and development of the well.

- Groundwater monitoring will focus on the recording of groundwater levels and the collection of groundwater samples for preliminary laboratory testing. This monitoring program is proposed to focus on the assessment/identification of potential impacts to third-party water supply bores as a result of CSG development, therefore, changes in water levels and changes in basic groundwater quality (e.g. salinity) are considered as triggers for the identification of potential impacts. Water quality parameters to be analysed as part of this monitoring program should comprise:
    - pH;
    - Electrical Conductivity (EC);
    - Total Dissolved Solids (TDS); and
    - Major ionic constituents – Ca, Mg, K, Na, Cl, CO3, HCO3, SO4.
- Monitoring is proposed to be conducted on an annual basis, with the first monitoring round to be completed prior to the establishment/operation of the adjacent CSG well (within 2 km of the CSG well).
- As per the requirements of the Water Act: should monitoring indicate that the bore trigger threshold will be exceeded make good agreements will be implemented with each bore owner where required, prior to the trigger threshold being exceeded.

10.2 Groundwater Production Monitoring and Management

10.2.1 Regulatory Requirements

As per the requirements outlined in the *Petroleum and Gas (Production and Safety) Act 2004*, the volume of produced water will be monitored and recorded and provided to the relevant authority as required. Results will be included in annual reports.

10.2.2 Proposed Monitoring and Management Measures

In accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004*, Westside will continue to assess actual groundwater abstraction using the acceptable methods. The method used will be reviewed annually and revised, as necessary.

The actual groundwater take assessed under the *Petroleum and Gas (Production and Safety) Act 2004*, requirements will be compared to the predicted groundwater take presented in this UWIR. This comparison will be undertaken annually. If the monitoring program shows groundwater take exceeds the predictions presented in this UWIR, an investigation will be undertaken to confirm whether the actual impacts on groundwater users or sensitive environmental features are likely to be significantly greater than expected. The investigation outcomes will be considered as part of the annual UWIR review described in Section 12.2.

11 PART F: SPRING IMPACT MANAGEMENT STRATEGY

According to the GAB Spring Register, there are no Discharge Springs, Recharge Springs, or Watercourse Springs located within the vicinity of PL 1048 and PL 1049 (Figure 9.1). The nearest discharge spring is located approximately 40 kilometres to the southwest of the project (Figure 9.1).

As discussed in Section 9.2.4, no impacts to surrounding spring complexes are expected as a result of the Project. A spring impact management strategy is not required and has not been developed.

12 PART G: UWIR UPDATES AND REVIEW

12.1 Roles and Responsibilities

Westside is responsible for ensuring that the UWIR is implemented.

12.2 Review and Revision

As discussed in Section 9.2, depressurisation of the Rewan Group due to the Project development is not predicted to exceed the bore trigger threshold as part of the IAA and the LTAA.

Westside will undertake an annual review of the accuracy of the IAA and LTAA mapping, as required by Section 376(1)(e) of the Water Act.

The review process will comprise:

- An initial review of any new geology or groundwater data to identify potentially significant departures from the data used in the UWIR to develop the IAA and LTAA mapping.
- Where potentially significant departures are identified, the potential effect of these departures on the IAA and LTAA will be investigated.
- If the investigation concludes that the IAA or LTAA are likely to have been under-estimated and additional water bores are likely to be affected, the IAA and LTAA will be revised.

The UWIR has been designed to align with the current, relevant EA groundwater conditions. It is therefore necessary to review and update the UWIR in response to any material changes to the EA conditions.

12.3 Reporting and Record Keeping

The outcome of each annual review will be reported to the DESI and the OGIA following completion of each annual review. The reported outcomes will include a statement of whether there has been a material change in the information or predictions used to prepare the maps.

13 CONCLUSIONS

The key conclusions of this UWIR are as follows:

- The impacts of the Project over the UWIR period and the life of the Project has been assessed based on a conceptualisation of the hydrogeological system and proposed Project development. This served as the basis for the development of numerical groundwater model that was used to quantify the potential impacts to the groundwater regime.
- CSG development will result in localised depressurisation of the target Baralaba Coal Measures, overlying Rewan Group and the underlying undivided Permian basement.
- The total amount of groundwater produced from the gas wells for the project between January 2022 to July 2024 is 8797 KL.
- The groundwater levels in the monitoring bores (between January 2022 and July 2024) indicate that gas and water extraction activities within the Baralaba Coal Seam aquifer are not having a noticeable impact on water levels within the overlying unconfined aquifers.
- The shallow surficial Cenozoic aquifers (i.e. Quaternary alluvium, Tertiary sediments) are not predicted to experience drawdown as a result of the Project due to the laterally extensive, homogeneous and thick low permeability Rewan Group aquitard that limits propagation of drawdown from the Baralaba Coal Measures to the surficial units.
- The Project will not impact surface waters, TGDEs or spring complexes during the Project duration because:
  - Drawdown induced by the Project development does not propagate through the Rewan Group to impact the surface water system.
  - Mapped TGDEs are interpreted to source groundwater from the shallow surficial Cenozoic aquifers, are not interpreted to be impacted by the Project development.
  - The nearest spring complex is approximately 40 km away from the Project and will not be impacted by drawdown/depressurisation.
- Drawdown/depressurisation is not predicted to occur in any water supply bores screened in / attributed to the Rewan Group during the Project development (LTAA), or the current UWIR period (IAA). Baseline assessments and a monitoring and management plan for these bores will continue to be implemented prior to the establishment and development of CSG wells.

This groundwater report demonstrates that impacts to surficial Cenozoic aquifers as a result of the Project is limited based on the IAA predictions. Some depressurisation of the Baralaba Coal Measures used for CSG production can be expected, with limited propagation to the layers immediately above it. The depressurisation does not propagate to the surface. It is considered that Westside's current CSG activities pose little risk to the Fitzroy Basin surface water, shallow groundwater systems and associated ecosystems.

14 CLOSING

We thank you for the opportunity to work on this assignment. Should you have any further queries please do not hesitate to contact the undersigned.

KCB AUSTRALIA PTY LTD.

Carly Waterhouse, RPGeo
Senior Hydrogeologist Associate

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