Futura Resources

Fairhill Coal Project

Groundwater Monitoring Program

Version: 002

1.1.1.1.1 Document History

Revision	Date	Type	Author	Reviewed
001	01/10/2024	Final	Fiona Moloney	Barbara van der Pol
002	31/01/2025	Final	Fiona Moloney	Barbara van der Pol

1.1.1.1.2 Document details

Printed	31/01/2025
Last saved	31/01/2025
Type	Monitoring Program
Document name	Groundwater Monitoring Program
Version	002
Project manager	Barbara van der Pol
Project number	N/A

1.1.1.1.3 Contact details

Client Contact	Barbara van der Pol
Client Email	barbara.vanderpol@futuraresources.com.au
Client Organisation	Futura Resources
Project Name	Fairhill Coal Project

Table of Contents

1 Introduction

The Fairhill Coal Project (FHCP) is a small open-cut coal mine northeast of Emerald. FHCP is located on Mining Leases (ML) 700043 and operates under Environmental Authority (EA) number BRID0071. The FHCP authorized site disturbance and location is presented in ***Figure 1.***

As the holder of the EA, Fairhill Coking Coal Pty Ltd—a wholly owned subsidiary of Futura Resources Limited—has a responsibility under the Environmental Protection Act 1994 to adhere to the conditions of this EA.

This GMP describes the objectives, existing environmental values, potential impacts and monitoring program in place to manage risks to groundwater resources from the FHCP.

This GMP is designed to meet the conditions D13 and D14 of the EA, as detailed below.

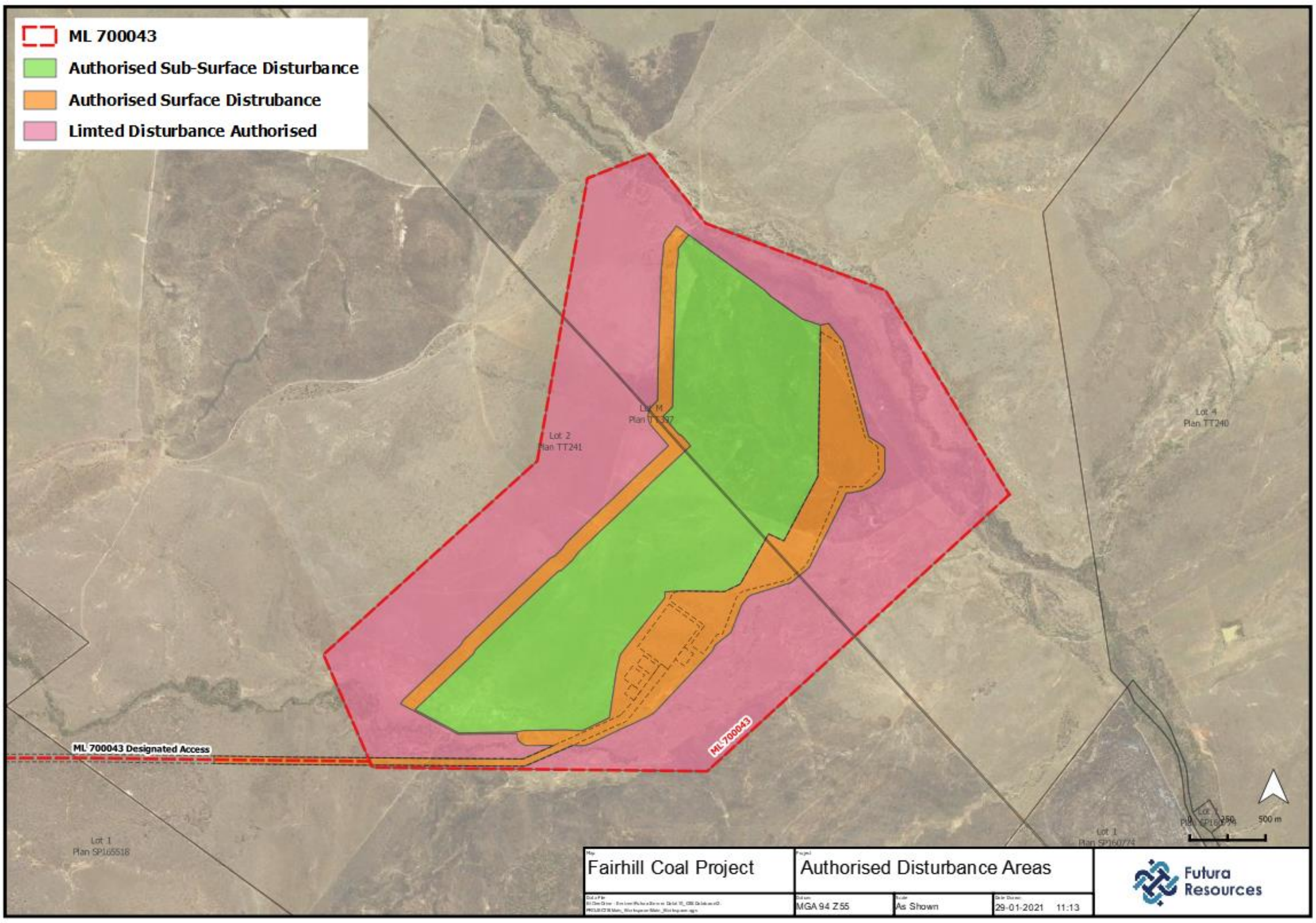

Figure 1: Authorised Site Layout and Disturbance

2 Background

2.1 Environmental Authority BRID0071

The relevant conditions of BRID0071, and where they are addressed in this GMP, are detailed in Table 1.

Table 1: EA Conditions

EA Condition	Relevant Document Section
D13 – Groundwater Monitoring Program	
A groundwater monitoring program must:	
a) Be developed prior to commencing mining activities; and	Section 1
b) Implemented for the duration of mining activities.	Section 1
D14 – The Groundwater Monitoring Program required by condition D13 must:	
a) identify potential sources of contamination to groundwater from mining activities;	Section 2.2.1
b) identify the environmental values that need to be protected;	Section 2.4
c) ensure that all potential groundwater impacts due to the activity are identified, monitored and mitigated	Section 0 and Section 3
d) document sampling and monitoring methodology;	Section 3
e) ensure that adequate groundwater monitoring and data analysis is undertaken to achieve the following objectives	
(a) detect any impacts to groundwater levels due to the activity;	Section 3
(b) detect any impacts to groundwater quality due to the activity;	Section 3
(c) determine compliance with condition F1;	Section 3
(d) determine trends in groundwater quality;	Section 3
f) include an appropriate quality assurance and quality control program;	Section 3.4
g) a numerical groundwater model;	Section 2.2.3
h) include a conceptual groundwater model; and	Section 2.2.1
i) include a review process to identify improvements to the program.	Section 5

2.2 Hydrogeological Setting

The following subsections describe the state of ML700043 prior to the commencement of operations. The below details are summarised for the Underground Water Impact Report (SLR, 2019).

2.2.1 Local Hydrogeology

Regionally, groundwater occurs within three main geological units:

- Quaternary alluvium;
- Tertiary sediments; and
- Permian coal measures.

Within the FHCP area water-bearing strata are only limited to isolated pockets of Tertiary material and multi-layered Permian coal measures. The following sub-sections present a detailed assessment of potential aquifers at the FHCP, these aquifers are also shown in the conceptual model outputs available in ***Figure 2*** and ***Figure 3***.

2.2.1.1 Quaternary Alluvium

Regionally the main resource aquifers are located within the Quaternary alluvium that occurs in discontinuous lenses along major streams and rivers throughout the Nogoa and Mackenzie River sub-catchments. Locally, quaternary floodplain alluvium associated with the northwest to southeast flowing Cooroora Creek has been mapped, and consist of clay, silt sand and gravel. This alluvium extends up to 16.5km upstream of the northern tenement boundary.

Bores drilled intersected the unit and indicated that the aquifer potential of the Cooroora Creek alluvium is limited, as shown by ***Figure 3***, the disturbance does not extend into the alluvial area on the mining lease.

2.2.1.2 Tertiary Sediments

Local surface geology mapping of the site shows that the Tertiary material only covers a small area in the north-eastern corner of the tenement. Drilling on the site indicated that the Permian strata is overlain by wither colluvium or in-situ weathered sandstone rather than Tertiary Sediments which leads to the conclusion that there are no Tertiary aquifers within the project area. Pockets of water have been identified between 10 – 12km from the lease, these bores have low yields and are most likely semi-confined aquifers.

2.2.1.3 Permian Coal Measures

The Permian coal measures at the FHCP constitute the main water-bearing geological unit, ***Figure 2***, with the Fairhill Formation being the only water bearing unit onsite, as this project does not intersect the Burngrove Formation.

2.2.1.3.1 Fairhill Formation

The Fairhill Formation underlies the project area, water within this unit is the shallowest groundwater locally. The coal seam within this formation represent the main, generally confined aquifers. Depth to groundwater is on average 14mBGL, with the highest yielding bore (FHMB02) intercepting water at 11mBGL.

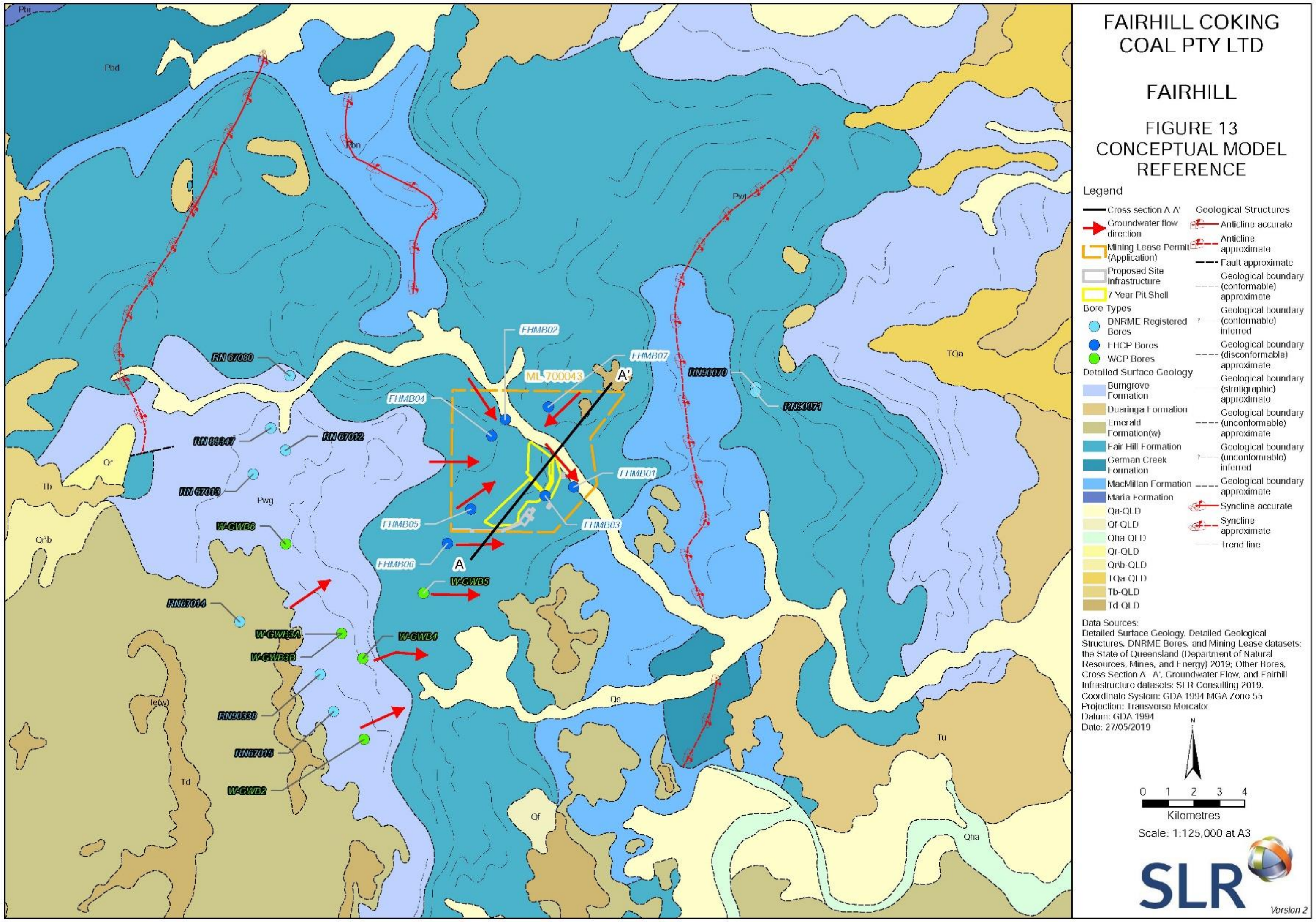

Figure 2: Conceptual Hydrogeological Model (SLR, 2019).

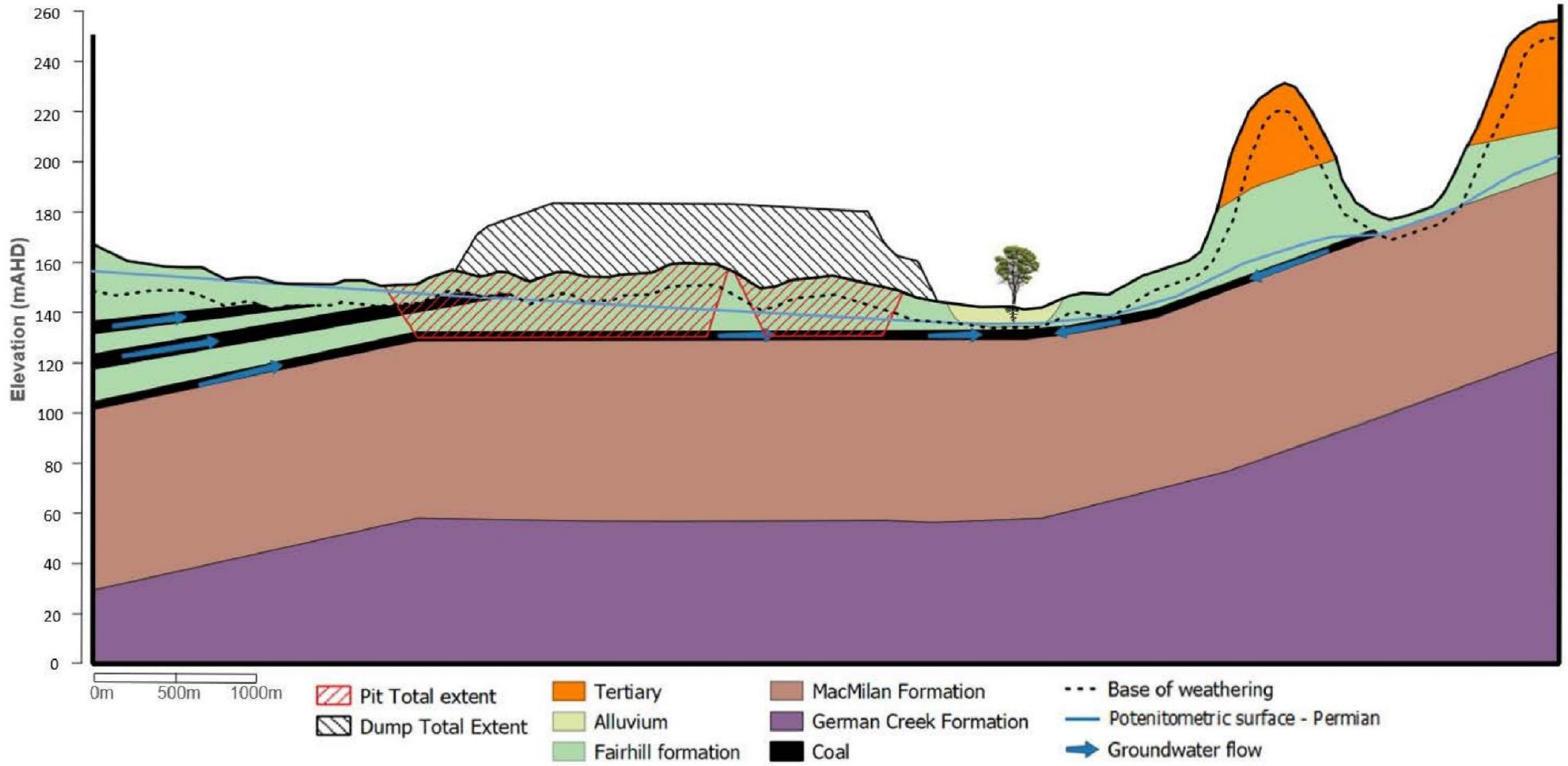

Figure 3: Conceptual Groundwater Model Cross-Section (SLR, 2019).

2.2.2 Hydrologic Cycle

The hydrologic cycle at the FHCP is dominated by low rainfall, high evaporation rates and limited diffuse recharge, which largely occurs uniformly over the landscape (Scanlon et al. 2002). As a result, groundwater is generally brackish to saline with only a few isolated locations able to produce small pockets of fresh groundwater. DES published a selection of maps (DEHP 2011) visualising groundwater characteristics of the greater Fitzroy Basin. The maps place the FHCP site into a low rainfall, low recharge area of the Highlands Groundwater Management Area of the Water Plan (Fitzroy Basin).

2.2.2.1 Groundwater Recharge

Recharge of groundwater occurs predominantly through infiltration of rainfall. Additional localised recharge may occur through slow infiltration of ponded surface water along Cooroora Creek. Extensive small ponds (gilgais) over clay-rich alluvium adjacent to Cooroora Creek are evident in aerial imagery. Heavy clay content in surficial soils mean that these ponds have little connectivity to underlying groundwater. Significant evaporation/evapotranspiration in ponds above surficial clays and subsequent slow infiltration may be one of the mechanisms resulting in salinisation of groundwater in the region. Some recharge may also occur through the infiltration of surface water into the underlying Permian strata below Sandy Creek.

2.2.2.2 Groundwater Flow

As shown in ***Figure 2***, the groundwater flows converge toward the topographic low formed by Cooroora Creek.

2.2.2.3 Groundwater and surface water interaction

The SLR 2019 report indicated that a review of the drillhole lithology, water level and water quality data suggests little potential for surface – water groundwater connectivity.

2.2.3 Numerical Modelling

A 2D numerical model was built by SLR in 2019. This model used MODLFOW-SURFACT to assess the potential drawdown from the FHCP pit excavation. The model was developed based on the conceptual model also developed by SLR in 2019.

As shown in Figure 4, results indicate that the predicted drawdown toward the west of the pit is <1m at a distance of 4.3km from the put centre. Toward the east in the Permian unit, the predicted drawdown is <1m at a distance of 2.1km from the Pit centre. The maximum predicted drawdown in the alluvium is predicted to be 0.6m close to the western edge of Cooroora Creek (200m from the pit eastern wall) and is negligible on the eastern edge. The difference between predicted drawdown to the west and east of the pit is expected considering both the natural and mining influenced hydraulic gradients are greater toward the west.

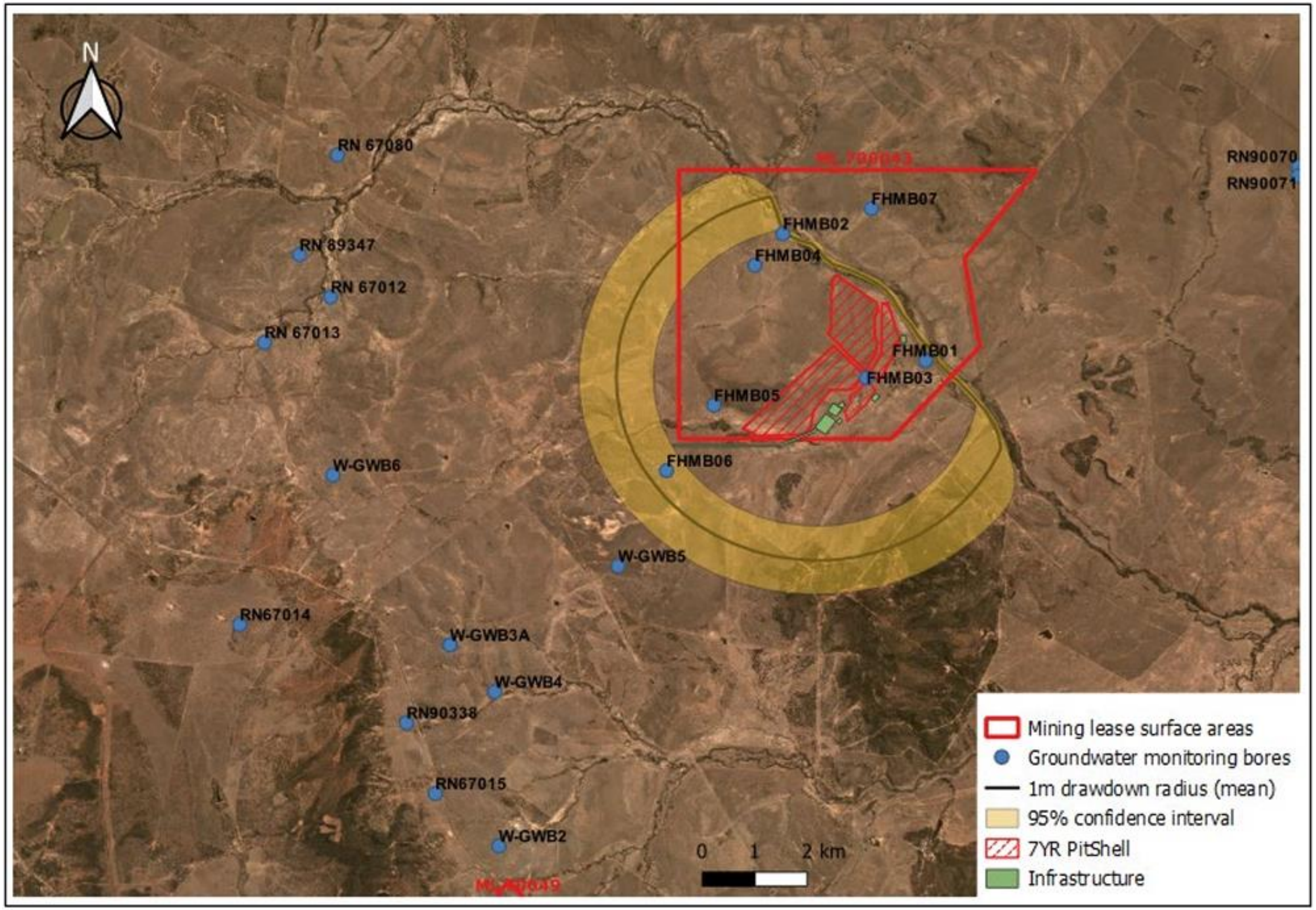

Figure 4: Numerical Model Results (SLR, 2019).

2.2.4 Groundwater Quality

Background groundwater quality data for FHCP was collected in a number of campaigns as shown in Table 2.

Table 2: Background Groundwater Quality Monitoring

Campaign	Sites included		Years
1	FHMB02 FHMB04 FHMB05 FHMB07	FHMB06 FHMB01	2018 June, August and October.
2	FHMB02 FHMB04 FHMB05 FHMB07	FHMB06 FHMB01 FHMB03 FCC1 (Nov)	2019 January, August, September, October and November.

Background data indicates that groundwater in all local bores is relatively saline. Median electrical conductivity for bores at the FHCP range between 4,900 and 47,000 μS/cm, with highest values recorded in bore FHMB01. Baseline pH values were between 7.1 and 8.4.

Metal and metalloid concentrations in groundwater were higher than is typical for surface water. Slow flow rates of groundwater increase the contact time for mineral dissolution to occur. Boron, manganese, selenium, copper, zinc, arsenic, aluminium and chromium exceeded trigger levels for aquatic ecosystems in at least one bore within the FHCP. Note that Total selenium was only elevated in the first sampling event at each bore, as a result of high turbidity and insufficient purging following drilling.

Concentrations of dissolved boron, zinc and copper appear to be naturally elevated above the Aquatic ecosystems triggers in the majority of groundwater sampled at the FHCP. In some of the bores at the FHCP, dissolved aluminium, lead, arsenic, chromium and cadmium exceed the Aquatic ecosystems triggers. This means that Aquatic ecosystems triggers are unsuitable for representing natural groundwater quality at Fairhill.

Due to the high concentrations of metals, any groundwater brought to the surface by artificial means during mining activities should not be discharged directly into surface water drainage channels without dilution.

2.2.5 Groundwater-dependent Ecosystems

A groundwater dependent ecosystem (GDE) is an ecosystem that needs access to groundwater permanently or intermittently to maintain its communities of flora and fauna, its ecological processes and its ecosystem services.

A search of the Queensland wetland mapping database (Cooroorah 100k map tile 8651) and the GDE atlas (BOM, 2018) found the following;

- High potential terrestrial GDEs in a large portion of Cooroora Creek within and downstream of the FHCP tenement.
- Moderate potential for GDEs along additional areas of Cooroora Creek within, upstream and downsrea of the FHCP tenement.
- Low confidence terrestrial GDEs along Cooroora Creek, Sandy Creek and Back Creek within, upstream and downstream of the FHCP tenement.

- No aquatic GDEs were identifiedin the QLD Globe database, however Low-Moderate aquatic GDE potential was identified by the GDE Atlas.
- No subterranean GDES were identified in either assessment.

Several field surveys were conducted in both 2018 and 2019 to confirm the desktop assessment, results of these in the following sections.

2.2.5.1 Potential aquatic GDEs

No aquatic GDEs were located during the flora and fauna surveys at FHCP.

2.2.5.2 Potential terrestrial GDEs

The flora and fauna assessments indicated that there was potential for areas of mature Eucalyptus camaldulensis (Red Gum) to utilise groundwater as a water source when surface water is not available. A groundwater dependent ecosystems Management Plan was developed and submitted under EPBC Ref. 2019/8549. This includes all monitoring and management requirements for terrestrial GDEs associated with the project.

2.3 Potential Impacts

The Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DoE 2013) define a “significant impact” as “an impact which is important, notable, or of consequence, having regard to its context or intensity”. For a water resource, a “significant impact” may occur where, as a result of the action, one of the following changes to the hydrological characteristics of a water resource are of a sufficient scale or intensity to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes: changes in the water quantity, including the timing of variations in water quantity, changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large-scale subsidence), and changes in the area or extent of a water resource.

The FHCP has the potential to affect both the level and quality of groundwater within local aquifers. The degree to which this is expected, and whether this qualifies as a significant impact under the guidelines is discussed in the following subsections.

2.3.1 Potential impacts on groundwater

Groundwater dewatering volume during the proposed excavation of the Fairhill Coal Project pit is expected to be minimal. At 130mAHD pit excavation a hydraulic gradient of 0.125 exists 200m west of the pit wall, where the natural groundwater level is 155mAHD. To the east of the pit wall (in the alluvium), the natural groundwater level is 141mAHD so the modelled hydraulic gradient is 0.055 over 200m.

2.3.2 Potential impacts on groundwater quality

Groundwater quality can be affected by changes in groundwater flow and/or geochemical reactions within excavated materials. Geochemical analysis of overburden and coal reject material found that the minerals present in waste rock had low total sulphur, high pH and low reactivity (Northern Resource Consultants 2018). This indicated no risk of acid or metalliferous drainage as a result of the FHCP. Leachate also possessed low electrical conductivity, suggesting low risk of saline drainage (Northern Resource Consultants 2018). This implies that the FHCP is not expected to affect groundwater quality, as a result of chemical reactions in exposed materials.

Groundwater quality can be potentially impacted due to infiltration through the overburden or waste rock dump. Characterisation of the overburden/waste rock dump indicates that rainwater encountering overburden/waste rock will most likely be alkaline with moderate EC (450– 900μS/cm) and elevated levels of manganese (in reduced environment). Barium, arsenic, zinc and copper were also present in the waste rock that could potentially leach under acidic conditions, which is unlikely at the FHCP.

The open pit is proposed to be backfilled progressively during mining. Containment dams proposed for waste rock/overburden dump and occasionally in the event of high rainfall, the open pit, can facilitate infiltration of mine affected water into groundwater. Due to the presence of low permeability strata the rate of such infiltration is expected to be very low. In addition, since the footprint of the proposed waste rock dump is insignificant compared to the total catchment area, any impacts to groundwater quality is expected to be localised only and not on a catchment or regional scale.

2.4 Environmental Values

The Department of Environment, Science and Innovation (DESI) defines environmental values (EVs) for water as qualities of water that make it suitable for supporting aquatic ecosystems and for human water uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use.

The EVs specific for the FHCP are defined in the Mackenzie River Sub-basin Environmental Values and later Quality Objectives document (Department of Environment and Heritage Protection, 2011) for following areas:

- aquatic ecosystems;
- irrigation;
- farm supply/use;
- stock water;
- primary recreation;
- drinking water; and
- cultural and spiritual.

Given the number of coal mines operating in the catchment, industrial use of groundwater was also evaluated, although not part of official values listed in the Mackenzie River Sub-basin Environmental Values and Water Quality Objectives document.

2.4.1 Aquatic ecosystems

The water quality objective (WQO) for aquatic ecosystems, where groundwaters interact with surface waters, is that groundwater quality should not compromise the identified EVs for those waters. Given the levels of salinity in FHCP groundwaters (classified as brackish to highly saline), and limited natural groundwater-surface water interaction, the FHCP groundwaters are not suitable to support fresh or marginal aquatic ecosystems.

2.4.2 Farm use / irrigation

The Australian and New Zealand guidelines for fresh and marine water quality (ANZECC & ARMCANZ, 2018) provides guidelines for irrigation use of groundwater. The FHCP groundwaters are outside of the accepted salinity interval of EC values between 1,000 µS/cm and 7,300 µS/cm (ANZG 2018, Table 4.2.5). The volume of water available coupled with less than optimal groundwater quality limits its farm use / irrigation potential.

2.4.3 Livestock watering

Authors of Australian and New Zealand guidelines for fresh and marine water quality (ANZECC & ARMCANZ, 2018, section. 4.3.3.5) state that if stock are exposed to high salinity water for prolonged periods of time, loss of production and a decline in animal health can occurs. For beef cattle, decline in health or loss of production may occur if the EC is between 7,463 µS/cm and 14,925 µS/cm (ANZECC & ARMCANZ, 2018). The bores at FHCP are not suitable for livestock watering.

2.4.4 Primary recreation

This category of EVs is considered not applicable to FHCP groundwaters. There are no groundwater springs in the area of the FHCP which are considered for recreational use. This EV is more common for surface water features that are readily accessible for recreation.

2.4.5 Drinking water suitability

The FHCP groundwater quality data, indicates that groundwater is unsuitable for human consumption before treatment primarily due to its elevated salinity. Other indicators exceeding the recommended values are total hardness (recommended limit of 150 mg/L) and sodium (recommended limit of 30 mg/L).

2.4.6 Cultural and spiritual values

There are no groundwater springs or seeps that supply surface water bodies in the area of the FHCP known to have significant indigenous and/or non-indigenous cultural heritage associations.

2.4.7 Industrial use

No industrial users, other than neighbouring mines, appear to be within close proximity of the FHCP. The elevated salinity of the local groundwater would likely impede most industrial uses. Saline groundwater which reports to the FHCP pit(s) and remains available after evaporation, may be incorporated into the on-site water management system and could be used for dust suppression.

2.4.8 Summary

In summary, the evaluation of groundwater EVs at the FHCP and surrounding area indicates that groundwater is of limited environmental value. The groundwater could be used for industrial purposes such as dust suppression in mining.

3 Groundwater Monitoring Program

The groundwater monitoring program aims at early detection of any potential impacts to groundwater resources at Fairhill to prevent deterioration of identified EVs of groundwater.

Baseline groundwater monitoring will be conducted as per Table 2. Monthly monitoring of the complete network has been scheduled commencing in November 2024.

3.1 Overview

The GMP has been developed for FHCP to detect any changes to groundwater levels or quality due to mining activities. The GMP has been developed by taking into consideration the potential discharge to surface water that may occur after significant weather events.

Routine monitoring during the Fairhill operations will provide an early warning of any variation in the response of the groundwater system to that predicted. This will enable Fairhill management to undertake mitigation measures to minimise impact on surrounding groundwater users and the environment, such as the implementation of make-good measures as needed.

3.2 Monitoring Network Details

The FHCP groundwater monitoring network and program includes groundwater levels and quality monitoring at the locations and frequencies defined in Table 3, which also shows the formation that will be monitored. The quality characteristics that will be monitored are identified in Table 4. The locations of the proposed monitoring bore network at the FHCP are shown in Figure 5.

Table 3: Monitoring Locations

Monitoring Bores	Location		Surface RL (m)	Screened interval (mBGL)	Aquifer	Monitoring Frequency
	Longitude (GDA94)	Latitude (GDA94)				
Interpretation Bores						
FHMB07	148.6378685	-23.2040189	167.3	37-48	Sandstone, mudstone/coal (Fairhill)	Monthly
Compliance Bores (Water Quality & Water Levels)						
FHMB01	148.6496123	-23.2325322	151	10 - 20	Alluvium (Quaternary)	Monthly
FHMB02	148.6214938	-23.2087581	153.4	8 - 18.5	Coal/siltstone (Fairhill)	Monthly
FHMB03	148.6370413	-23.2355354	158.9	12 - 20	Sandstone/siltstone (Fairhill)	Monthly
FHMB04	148.6159283	-23.2146583	168.3	18 - 29.5	Tuffaceous siltstone (Fairhill)	Monthly

FHMB05	148.6086543	-23.2406059	165.2	7.5 - 23.5	Coal/tuff (Fairhill)	Monthly
FHMB06	148.5998478	-23.2527789	179.8	11 - 41	Sandstone, mudstone/coal (Fairhill)	Monthly
FHMB08	148.6316266	-23.2421586	153.3	2.8 - 11	Permian Sediments (Sandy Creek)	Monthly
FHMB09 (New)	148.6408149	-23.2221619	151.3	2.8 – 12.1	Permian Sediments (Cooroora Creek)	Monthly
FHMB010A	148.5848781	-23.2428885	TBC	TBC	Nested/Adjacent: Alluvium & Permian (Fairhill) – Sandy Creek	Monthly
FHMB010B	148.5848489	-23.2428978	TBC	TBC	Nested/Adjacent: Alluvium & Permian (Fairhill) – Sandy Creek	Monthly
FHMB011A	148.6135283	-23.1992966	TBC	TBC	Nested/Adjacent: Alluvium & Permian (Fairhill) – Cooroora Creek	Monthly
FHMB011B	148.6135457	-23.2474692	TBC	TBC	Nested/Adjacent: Alluvium & Permian (Fairhill) – Cooroora Creek	Monthly
FHMB012 (New)	148.617144	-23.2474692	158.3	2.8 - 9	Tertiary Sediments (Sandy Creek)	Monthly
FH002 developed/ New bore adjacent to FH002	148.6139012	-23.2421085	162.4	7 - 55	Permian (Fairhill)	Monthly

1. RL must be measured to the nearest 5cm from the top of the bore casing.
2. *Where monitoring is no longer possible because of the removal of a bore as a direct result of the mining activity, the impact on the monitoring network must be evaluated and replacement bore(s) constructed, where required, to complete the network.*

Table 4: Monitoring Quality Characteristics

Groundwater quality parameter	Bore	Limit A	Limit B
Drawdown	B02, B03, B04, B05, B06	> 2m	> 2m
	B01, FHMB010, FHMB011, New 1	> 0.6 m	> 0.6 m
	FHMB09	> 0.5m	> 0.5m
pH (pH Units)[3]	All bores		7.1 – 8.1
Electrical Conductivity (µS/cm) [3]	B01		47,000

	B02, B03, B04, B05, B06	24,000	24,300
Major ions (Na, Ca, Mg, K, Cl, HCO_3, CO_3)	All bores	For interpretation only	
Total Hardness (as CaCO3)	All bores	For interpretation only	
Aluminium (mg/L)[3]	B01	0.194	0.207
	B02, B03, B04, B05, B06	0.055	0.08
Ammonia (mg/L as N)[3]	All bores	1	1.6
Arsenic (mg/L)[3]	B01, B02, B04, B05		0.013
	B03, B06	0.03	0.04
Boron (mg/L)[3]	All bores	0.6	0.7
Cadmium (mg/L)[1]	All bores		0.0002
Chromium (mg/L)[1]	All bores		0.001
	B02, B03, B04, B05, B06	0.002	0.005
Cobalt (mg/L)[3]	B01	0.017	0.018
Copper (mg/L)[2]	All bores	0.003	0.004
Iron (mg/L)[3]	All bores	3	5
Lead (mg/L)[1]	All bores		0.0034
	B02, B03, B04, B05, B06	0.6	1
Manganese (mg/L)[3]	B01	9	9.7
Mercury (mg/L)	All bores		0.0006
Nickel (mg/L)[3]	All bores		0.011
Selenium (mg/L)[1]	All bores	0.005	0.011
Sulphur as Sulfate SO_4 (mg/L)[3]	B02, B03, B04, B05, B06	430	450
	B01	2,380	2.400
Uranium (mg/L)[3]	All bores	0.01	0.013
Vanadium (mg/L)[3]	All bores		0.006
Zinc (mg/L)[2]	All bores	0.06	0.008

Notes:

[1] Default ANZECC & ARMCANZ (2000) Freshwater Aquatic ecosystems trigger value for 95% species protection used with the exception of Se which is 99% due to potential for bioaccumulation

[2] Fitzroy Groundwater zone 34, 80th percentile, deep bores.

[3] Site-specific triggers.

Figure 5: Monitoring Network

3.3 Monitoring and sampling methodology

Groundwater monitoring and sampling will be conducted by a suitably qualified and experienced professional in accordance with the Department of Environment and Science (DES) Monitoring and Sampling Manual (DES, 2018; or subsequent updated versions), the Geoscience Australia Groundwater Sampling and Analysis – A Field Guide (Sundaram et al. 2009), and the Australian/New Zealand Standard (AS/NZS) 5667.11:1998 for water quality – sampling Part 11 guidance on sampling groundwater.

3.4 Quality assurance and control

The DES Monitoring and Sampling Manual (DES, 2018) provides guidance on the types of quality control measures and the frequency of collection of quality control samples.

Fairhill proposes the following quality assurance and control measures for its GMP:

- Field blank (one per trip or one per 20 samples)
- Blind duplicates (one per 10 samples)

Field blanks are used to estimate the contamination of a sample during the collection procedure. They are prepared in the field in the same manner as the sample. For example, if a sample is field filtered, the field blank will also be filtered. It is recommended that water is supplied by the testing laboratory.

Blind duplicates are to be taken at the same time as the sample. It is recommended that the same bottle type be collected one after the other. The date and time of the sample should not be disclosed to the laboratory.

4 Impact Triggers and Response Protocols

4.1 Groundwater Exceedance Notification

Groundwater level and groundwater quality trigger levels are discussed in the following sub-sections. Should these trigger levels outlined in EA Condition D6 be exceeded, Conditions D7, D8, D9 and D10 of the FHCP EA would require the following actions to be completed:

Notification to the Administering Authority via the DES WaTERS portal within 24 hours.

Commencement of an investigation into the cause of exceedance within 14 days of the notification, including:

- an investigation of the potential for environmental harm
- the actions taken or to be taken to mitigate/prevent contamination of groundwater

The exceedance investigation be completed and submitted to the administering authority via WaTERS within 3 months of notification

If the exceedance investigation identifies the potential for environmental harm, an action plan to mitigate this potential environmental harm must be developed by a qualified person and implemented within 1 month of the investigation completion

4.2 Groundwater Quality Triggers

As outlined in

1. RL must be measured to the nearest 5cm from the top of the bore casing.
2. *Where monitoring is no longer possible because of the removal of a bore as a direct result of the mining activity, the impact on the monitoring network must be evaluated and replacement bore(s) constructed, where required, to complete the network.*

Table 4, in accordance with Table D2 of the EA, groundwater triggers and contaminate limits have been set based on the following:

- Default (ANZECC & ARMCANZ, 2000) trigger values for freshwater aquatic ecosystems for 95% species protection;
- Fitzroy Groundwater zone 34 80th percentile for deep bores (DEHP, 2011); and
- Site-specific triggers.

If groundwater quality results exceed trigger levels set out in the EA, then an investigation into cause, optimum response, and the potential for environmental harm will be conducted in accordance with Conditions D7 and D8 of the FHCP EA. The administering authority will be first notified about the exceedance within 24 hours of receiving the results and submit an Investigation report within 3 months of notification.

4.3 Groundwater Level Triggers

If groundwater level measurements exceed drawdown levels shown in EA Table D1, then an investigation into cause, optimum response, and the potential for environmental harm will be conducted in accordance with Condition D11of the FHCP EA. The administering authority will be notified within 24 hours and conduct an investigation in to the cause of the exceedance within ten (10) business days.

4.4 Mitigation

Where it is identified that there is potential for environmental harm in any investigation undertaken following water level or quality trigger exceedances as outlined in Section 4.1, an action plan to mitigate potential environmental harm will be developed by a suitably qualified person in accordance with EA Condition D10 and D11.

It is anticipated that the proposed Fairhill pit will only need minor dewatering, hence will only cause minor drawdown of groundwater levels in the surrounding bores. In the unlikely event that monitoring identifies a reduction in groundwater levels in excess of the interim trigger level as a consequence of mining, Fairhill Coking Coal Pty Ltd will notify the adjacent landholders and EHP. If landholder bores are impacted, Fairhill Coking Coal Pty Ltd will enter into negotiations with affected landowners with the intent of reaching an agreement that provides access to alternative water sources through deepening of existing bores or installation of new bores or will provide financial compensation to reflect the costs of additional or alternative groundwater pumping equipment.

Possible mitigation measures that may be applied by Fairhill may include, but not limited to:

- The refurbishment of an existing groundwater bore
- The installation of a new groundwater bore
- The establishment of an alternative water supply arrangement
- The use of another mutually agreed form of mitigation

FHCP will ensure as a minimum that the proposed mitigation measures are acceptable to the affected groundwater user, and if acceptable, will enter into a legal agreement for the installation of the proposed mitigation measures. Fairhill will also ensure the proposed mitigation measures are commensurate with the identified groundwater impact.

5 Review and Improvement Process

5.1 Groundwater Monitoring Program Review

The GMP will be reviewed by an appropriately qualified person to determine if the GMP continues to meet the requirements in accordance with condition D15 of the EA within one year of commencement of mining activities. Subsequent reviews will be completed at regular intervals, not exceeding the one year timespan after completion of the previous review. The review may include:

As required, this GMP may be updated or revised based on the outcomes of the review process. It is suggested that this review be completed following the preparation of each Annual Monitoring Report.

Peer review reports are to be submitted via WaTERS at the same time as each annual return.

5.2 Annual Monitoring Report

An Annual Monitoring Report is required by Condition D16 of the EA to be completed and submitted to the administering authority with each annual return. The Annual Monitoring Report must include:

- All standing water level data in compliance bores from the reporting period
- Any changes in water quality in compliance bores during the reporting period
- Groundwater level contour mapping depicting any drawdown in each aquifer caused by extraction of groundwater
- Details of any review undertaken of the numerical groundwater model since the previous Annual Monitoring Report
- An assessment of any differences between the actual observed groundwater level impact and the predicted impact for the same period in the most current numerical groundwater model
- Details of any bores predicted to be affected by drawdown according to the most current groundwater model
- Raw data in a usable electronic format

6 Roles and Responsibilities

Responsible Person	Management Measure	Timing
Environmental Manager	Oversee implementation of the Groundwater Monitoring Program	Throughout the construction, operational and rehabilitation phases
	Notify administering authority in the event of a trigger event	Immediately after being notified of a trigger event
	Engage a qualified professional to undertake an investigation in the event of a trigger event	Immediately after being notified of a trigger event
	In the event there is excessive drawdown, develop a make-good agreement with affected neighbouring bore owners	Immediately after receiving an investigation report that identifies FHCP as a cause of excessive drawdown
	Oversee bore replacement and decommissioning	Construction and rehabilitation phases
	Oversee the revision of the Groundwater Monitoring Program	At start of the construction phase, then annually
	Oversee implementation of the Groundwater Monitoring Program	Throughout the construction, operational and rehabilitation phases
Environmental Officer	Collection of water samples and shipping to a laboratory	Monthly throughout construction, operational and rehabilitation phases
	Incorporation of monthly monitoring data into a raw data spreadsheet and identification of trigger events	Monthly throughout construction, operational and rehabilitation phases
	Notification of Environmental Manager in the event of a trigger event.	As soon as a trigger event is identified
	Prepare the annual groundwater monitoring reports	Annually, throughout the construction, operational and rehabilitation phases
Contractor – groundwater specialist	Undertake annual review of the Groundwater Monitoring Program	Within one year of the commencement of mining, and every year thereafter
	Review the numerical groundwater model	Within two years from the commencement of the construction phase and every 5 years thereafter
	Undertake an investigation in the event of a trigger event	As soon as a trigger event is identified
	Prepare an action plan in the event that investigations reveal potential for environmental harm	As soon as a trigger event is deemed to be potentially harmful to the environment

7 References

ANZECC & ARMCANZ. (2000). Australian water quality guidelines for fresh and marine waters. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, Australia.

Department of Environment and Heritage Protection (DEHP). (2011). Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin. State of Queensland, September 2011. (note: DEHP has been renamed to Department of Environment and Science (DES)).

Department of Environment and Science (DES). (2018). Monitoring and Sampling Manual Environmental Protection (Water) Policy 2009. Brisbane: Department of Environment and Science Government.

National Health and Medical Research Council (NHMRC). (2011). Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

National Uniform Drillers Licensing Committee (NUDLC). (2011). Minimum construction requirements for water bores in Australia.

Scanlon, B. R., Healy, R. W., & Cook, P. G. (2002). Choosing appropriate techniques for quantifying groundwater recharge. Hydrogeology Journal 10, 18–39.

Singhal, B. B. S., & Gupta, R. P. (2010). Applied hydrogeology of fractured rocks. Springer Science & Business Media. Pp 23-24.

SLR Consulting Australia Pty Ltd (SLR). (2019). Underground Water Impact Report.

Sundaram, B., Feitz, A., Caritat, P. de, Plazinska, A., Brodie, R., Coram, J. and Ransley, T. (2009). Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95 pp.