Clean TeQ Sunrise Project
Groundwater Management Plan
2020-CTEQ-0000-66AA-0017

11 December 2019

REVISION 1

CONTENTS

FIGURES

TABLES

CHARTS

ATTACHMENTS

1. INTRODUCTION

The Clean TeQ Sunrise Project (the Project)[1] is a nickel cobalt scandium open cut mining project situated near the village of Fifield, approximately 350 kilometres (km) west-northwest of Sydney, in New South Wales (NSW) (Figure 1).

The Project includes the establishment and operation of the following (Figure 1):

- mine (including the high pressure acid leach processing facility);
- limestone quarry;
- rail siding;
- gas pipeline;
- borefields, surface water extraction infrastructure and water pipeline;
- accommodation camp; and
- associated transport activities and transport infrastructure (e.g. the Fifield Bypass, road and construction upgrades).

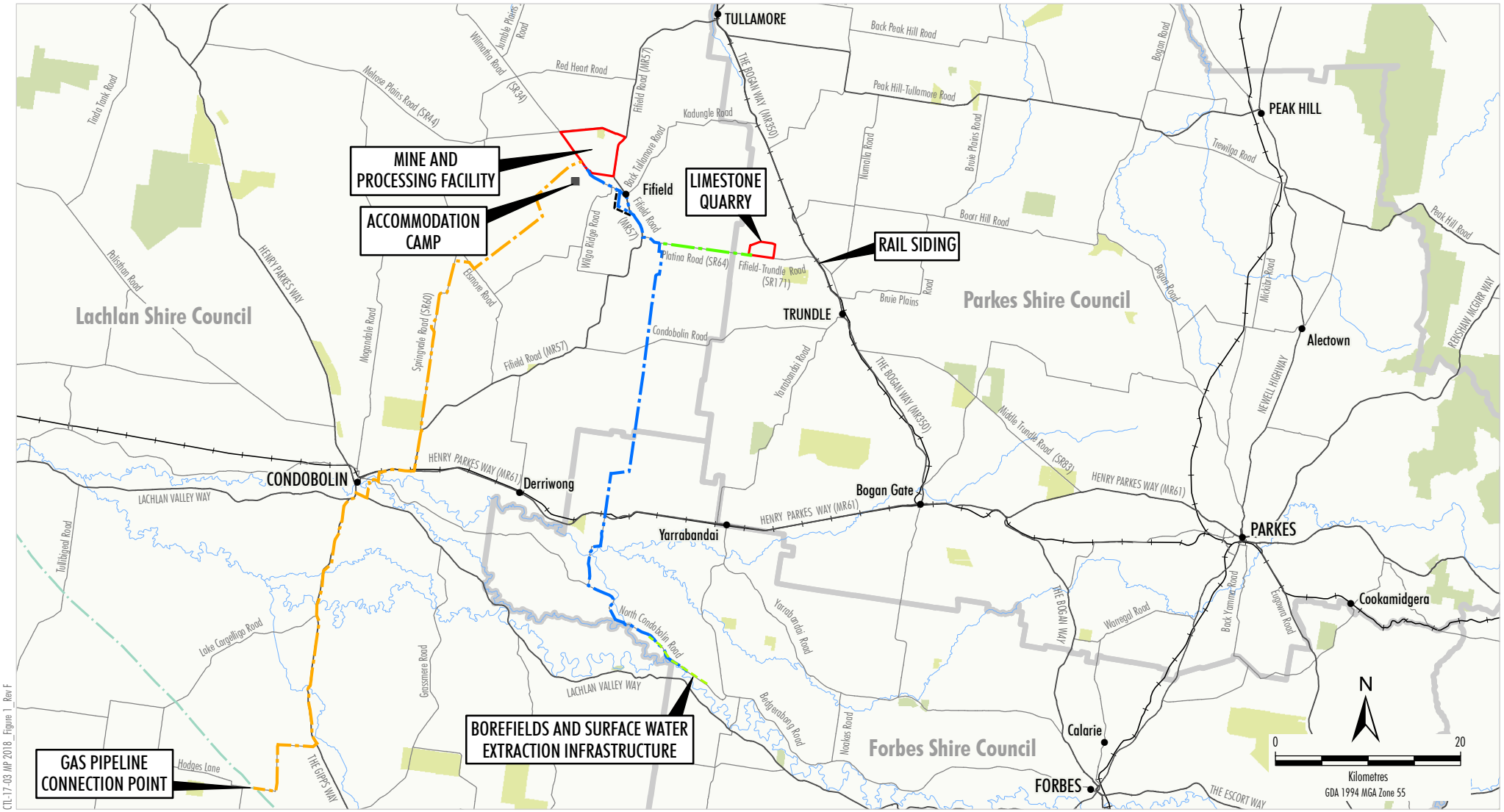
Clean TeQ Sunrise Pty Ltd owns the rights to develop the Project. Clean TeQ Sunrise Pty Ltd is a wholly owned subsidiary of Clean TeQ Holdings Limited (Clean TeQ).

Development Consent DA 374-11-00 for the Project was issued under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2001. Six modifications to Development Consent DA 374-11-00 have since been granted under the EP&A Act:

- 2005 – to allow for an increase of the autoclave feed rate, limestone quarry extraction rate and adjustments to ore processing operations;
- 2006 – to allow for the reconfiguration of the borefields;
- 2017 (May) – to allow for the production of scandium oxide;
- 2017 (December) – to amend hazard study requirements;
- 2018 (May) – to relocate the accommodation area; and
- 2018 (December) – to implement opportunities to improve the overall efficiency of the Project.

The general arrangement for the mine layout during the initial Project construction activities and full development are shown on Figures 2 and 3.

[1] The Project was previously known as the Syerston Project.



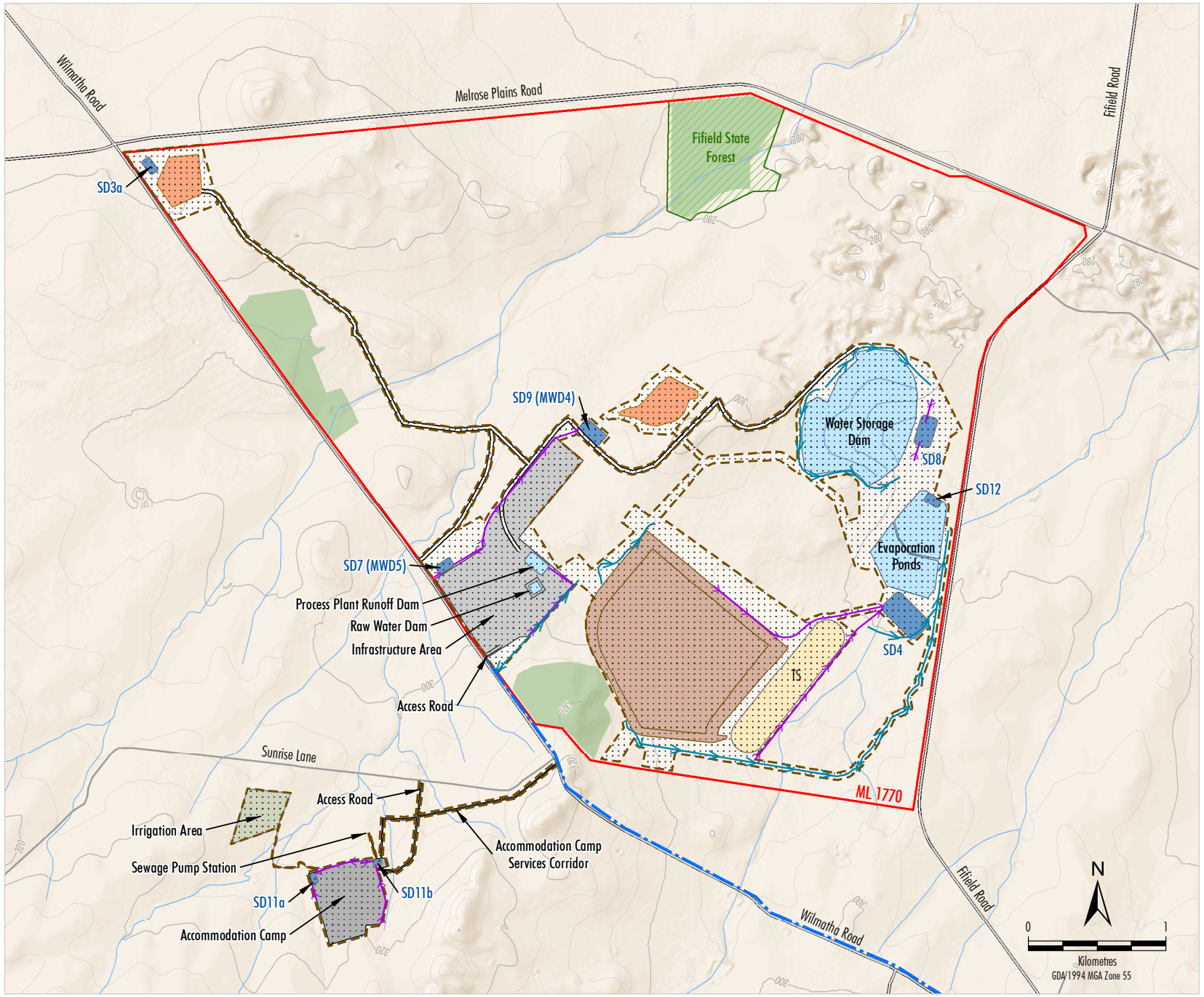
CTL-17-03 MP 2018_Figure 1_Rev F

Source: Black Range Minerals (2000); Clean TeQ (2017, 2018); NSW Department of Industry (2018); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

CLEAN TEQ SUNRISE PROJECT

Regional Location

Figure 1



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Initial Construction Activities
- Surface Development Area
- Tailings Storage Facility
- Borrow Pit
- TS Topsoil Stockpile
- Infrastructure Area
- Water Storage
- Sediment Dam
- Existing Open Woodland to be Maintained
- Water Pipeline
- Collection Drain
- Diversion Channel

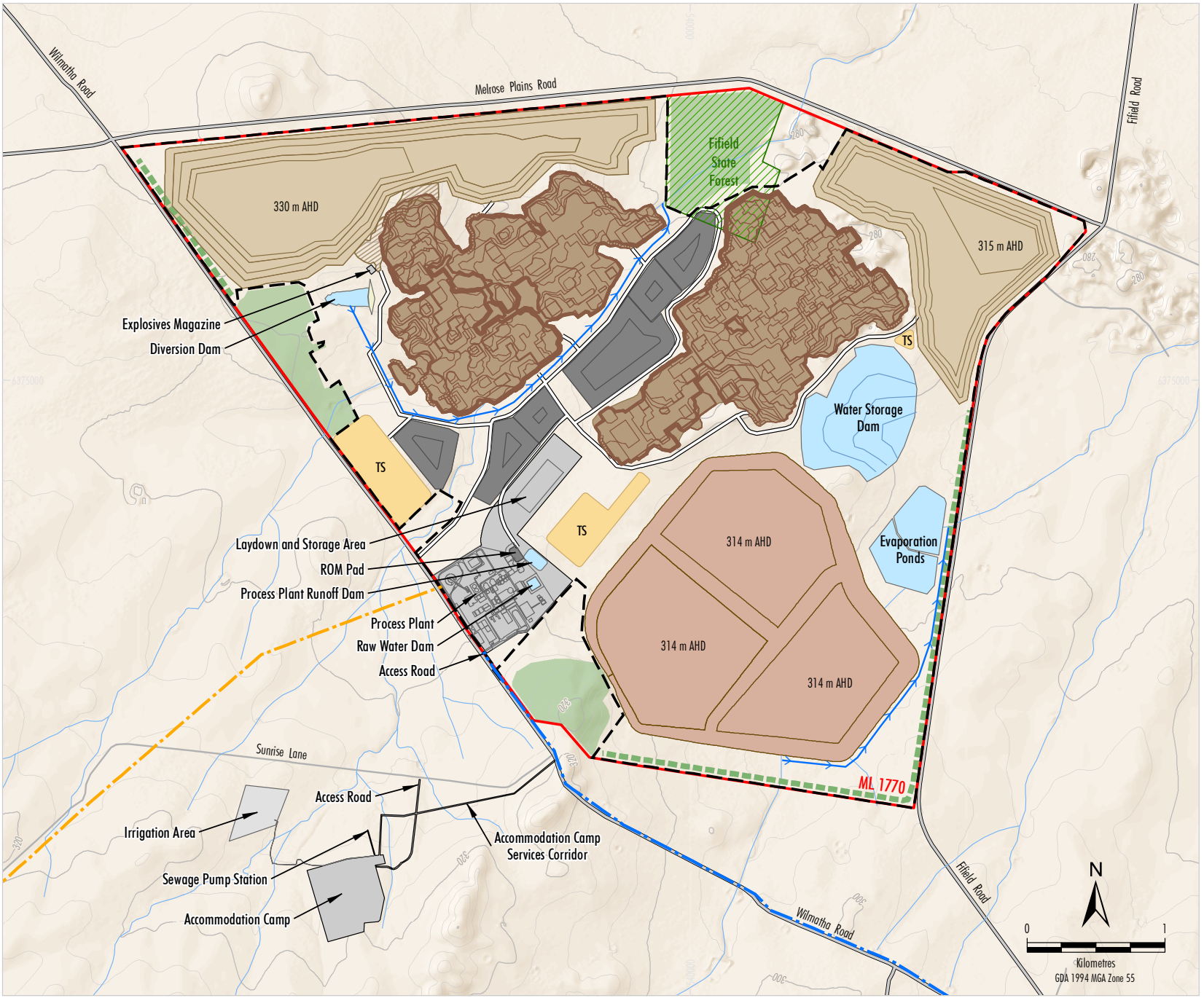
Source: Black Range Minerals (2000); Clean TeQ (2017, 2019); NSW Department of Industry (2018); NSW Land & Property Information (2017)

CLEAN TEQ SUNRISE PROJECT

Mine and Processing Facility General Arrangement (Initial Construction Activities)

Figure 2

CTL-17-03 MP 2018_WMP_202B



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Approved Surface Development Area
- Open Cut Pit (Scandium Oxide)
- Open Cut Pit
- Waste Rock Emplacement
- Tailings Storage Facility
- TS Topsoil Stockpile
- Ore Stockpile
- Mine Infrastructure Area
- Diversion Structure
- Vegetation Screening
- Existing Open Woodland to be Maintained
- Gas Pipeline
- Water Pipeline

Source: Black Range Minerals (2000); Clean TeQ (2017, 2019); NSW Department of Industry (2018); NSW Land & Property Information (2017)

CLEAN TEQ SUNRISE PROJECT

Mine and Processing Facility Conceptual General Arrangement

Figure 3

CTL-17-03 MP 2018_MOD4_Figure 3_Rev C

1.1 Purpose and Scope

This Groundwater Management Plan (GWMP) has been prepared by Clean TeQ in accordance with the requirements of Condition 30(c), Schedule 3 of Development Consent DA 374-11-00 (Table 1).

Table 1 – GWMP Requirements in Development Consent DA 374-11-00

Development Consent DA 374-11-00 Schedule 3	Section Where Addressed in this GWMP
30. Prior to carrying out any development after 6 May 2017, the Applicant must prepare a Water Management Plan for the development in consultation with DoI Lands & Water and the EPA, and to the satisfaction of the Secretary. This plan must include:	The Water Management Plan (WMP)
c) a Groundwater Management Plan, that includes:	This GWMP
• *baseline data on groundwater levels, yield and quality in the region and privately-owned groundwater bores that could be affected by the development in the vicinity of the borefields;*	Section 4
• *groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts associated with the development in the vicinity of the borefields;*	Section 5
• *a program to monitor and report on:* - *groundwater inflows into the open cut pits, if relevant;* - *the seepage/leachate from the tailings storage facility and evaporation ponds; and* - *the impacts of the development on:* ▪ *groundwater supply of any potentially affected landholders, particularly around the borefields;* ▪ *regional and local aquifers; and* ▪ *post-mining groundwater recovery;*	Section 7 to 9
• *a plan to respond to any exceedances of the groundwater assessment criteria, and mitigate any adverse impacts of the development;*	Sections 7 to 9
31. The Applicant must implement the approved Water Management Plan for the development.	Section 3.1.1

On 5 July 2018, the Secretary of the Department of Planning, and Environment (now the Department Planning, Industry and Environment [DPIE]) (the Secretary) approved the progressive submission of environmental management plans for the Project in accordance with Condition 12, Schedule 2 of Development Consent DA 374-11-00. The scope of this GWMP is specifically related to the following initial Project construction activities:

- development of the mine, including:
  - site establishment and earthworks;
  - construction of site access roads and haul roads;
  - processing facility earthworks;
  - establishment of temporary facilities required for construction activities (e.g. offices, lay down areas, communications infrastructure);
  - construction of the mine infrastructure area including the offices, workshops, warehouse, laboratory and amenities buildings, fuel storage areas, potable water treatment plant and car parking facilities;
  - construction of the tailings storage facility and evaporation pond;
  - construction of water management infrastructure including the raw water dam, water storage dam and sediment dams;
  - construction and operation of the concrete batch plant;

    - development of gravel and clay borrow pits (including blasting and crushing);
    - installation of appropriate fencing and barriers for public safety and security for mining and construction; and
    - other associated minor infrastructure, plant, equipment and activities.
- development and operation of the accommodation camp;
- installation of the borefields, surface water extraction infrastructure and water pipeline[2]; and
- road upgrades.

The initial construction activities would not include any development of the limestone quarry, rail siding or gas pipeline.

No groundwater or surface water extraction would occur as part of the initial Project construction activities under this version GWMP. The GWMP will be updated prior to groundwater extraction from the borefields (Section 2).

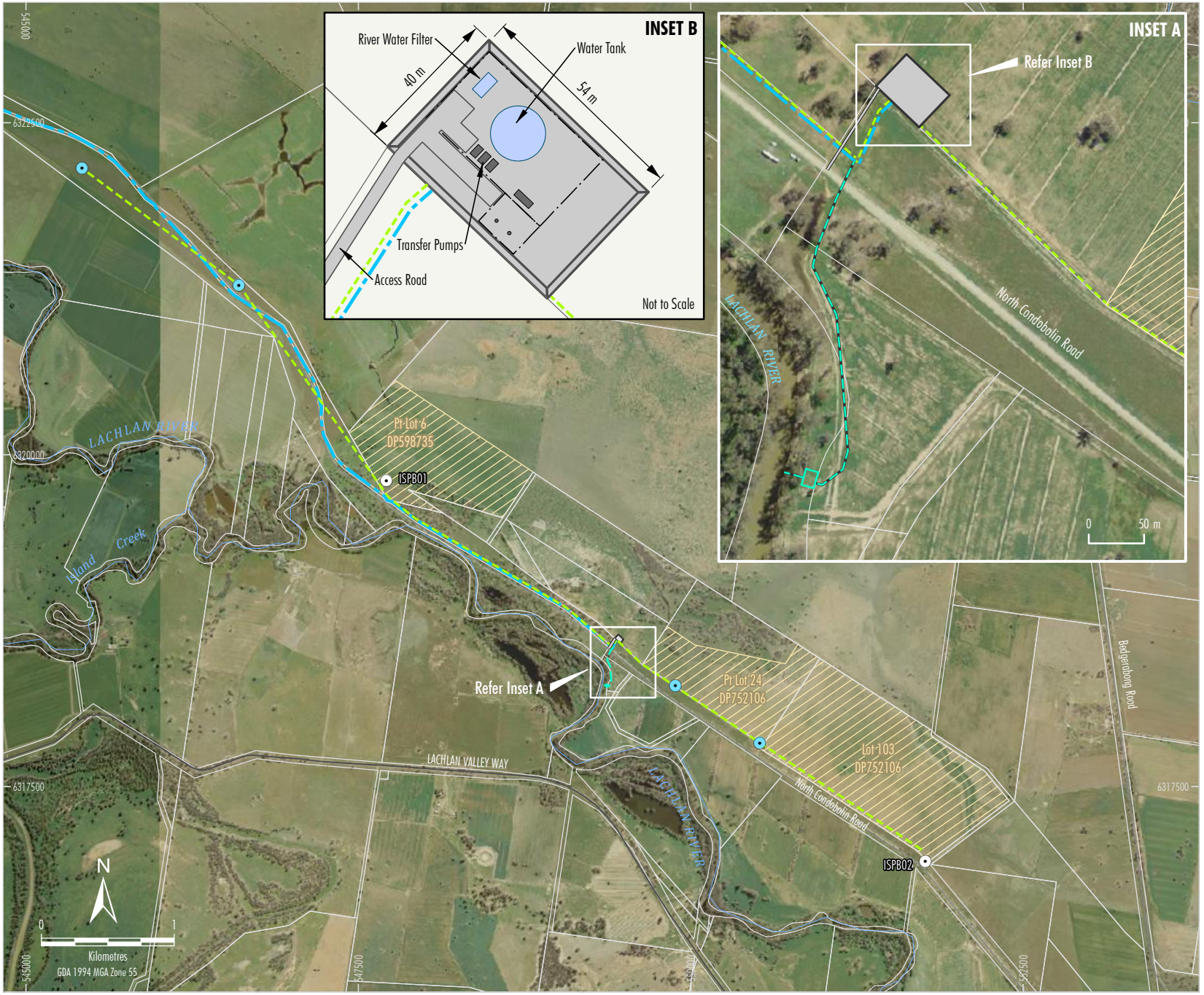
The approximate extent of the initial Project construction activities at the mine site and accommodation camp are shown on Figure 2. The approved water pipeline alignment and borefields and surface water extraction general arrangement is shown on Figures 1 and 4 respectively.

1.2 Structure of the Groundwater Management Plan

The remainder of this GWMP is structured as follows:

Section 2: Describes the review and update of the GWMP.
Section 3: Outlines the statutory requirements applicable to the GWMP.
Section 4: Provides an overview of the hydrogeological setting and baseline data.
Section 5: Details the performance measures and performance indicators that will be used to assess the Project, including trigger levels.
Section 6: Provides a description of the Project borefields layout and other groundwater management measures.
Section 7: Details the groundwater monitoring program.
Section 8: Provides a Contingency Plan to manage any unpredicted impacts and their consequences.
Section 9: Describes the program to review and report on the effectiveness of management measures and improvement of environmental performance.

[2] The water pipeline includes the Fifield Bypass and Alternative Pipeline Route alignments.



LEGEND

- Property Boundary
- Borefield Location
- Water Pipeline
- Borefield Infrastructure Corridor *
- Surface Water Infrastructure Corridor *
- Pump Station
- Transfer Station
- Access Road
- Production Bore (constructed)
- Production Bore (not constructed)

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

Source: Clean TeQ (2017, 2019); Ivanplats Syerston (2005); NSW Land & Property Information (2018)
NSW Imagery: © Department of Finance, Services & Innovation (2018)

CLEAN TEQ SUNRISE PROJECT

Borefields and Surface Water Extraction General Arrangement

Figure 4

CTL-17-03 MP 2018_MOD4_Figure 4_Rev B

Section 10: Describes the protocol for management and reporting of incidents, complaints and non-compliances with statutory requirements.

Section 11: Lists the references cited in this GWMP.

2. GROUNDWATER MANAGEMENT PLAN REVIEW AND UPDATE

2.1 Consultation

This GWMP was provided to the NSW Environment Protection Authority (EPA) and the Department of Industry – Lands & Water (DoI - L&W) for the purposes of consultation on 20 June 2018 and 25 June 2018, respectively, in accordance with Condition 30, Schedule 3 of Development Consent DA 374-11-00.

The DoI – L&W provided comments on 26 September 2018. These comments have been incorporated into this GWMP. The EPA indicated on 19 October 2018 that it had no comments on the GWMP.

The revised GWMP, incorporating the DoI – L&W's review comments, was provided to the DoI – L&W on 4 March 2019. The DoI – L&W indicated on 12 April 2019 that it had no further comments on this GWMP.

2.2 Review and Update

Consistent with the Secretary's approval for the progressive submission of environmental management plans, the GWMP would be re-submitted and approved prior to the commencement of activities not included in the scope of this GWMP. This GWMP includes construction of the remaining four approved production bores and no extraction from the two existing production bores. The GWMP will be updated prior to groundwater extraction from the borefields in the following stages:

- Construction Stage (after the initial construction phase) – allow for the extraction of up to 900 million litres per year (ML/year) from the two existing production bores.
- Operations Stage – allow for the extraction of more than 900 ML/year from the approved six production bores.

In accordance with Condition 6, Schedule 5 of Development Consent DA 374-11-00, this GWMP will be reviewed, and if necessary revised (to the satisfaction of the Secretary), within three months of the submission of:

- an Annual Review (Condition 5, Schedule 5);
- an incident report (Condition 8, Schedule 5);
- an independent environmental audit (Condition 10, Schedule 5); or
- any modification to the conditions of Development Consent DA 374-11-00 (unless the conditions require otherwise).

The reviews would be undertaken to ensure the GWMP is updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the Project.

Within four weeks of conducting a review of the GWMP, the Secretary will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

If agreed with the Secretary, a revision to the GWMP required under Development Consent DA 374-11-00 may be prepared without undertaking consultation with all parties nominated under the relevant condition of Development Consent DA 374-11-00.

The revision status of this GWMP is indicated on the title page of each copy.

The approved GWMP will be made publicly available on the Clean TeQ website, in accordance with Condition 12, Schedule 5 of Development Consent DA 374-11-00.

3. STATUTORY REQUIREMENTS

Clean TeQ's statutory obligations relevant to groundwater management are contained in:

- the conditions of Development Consent DA 374-11-00;
- relevant licences and permits, including conditions attached to mining leases; and
- other relevant legislation.

Obligations relevant to this GWMP are described below.

3.1 Development Consent

3.1.1 GWMP Requirements

Condition 30(c), Schedule 3 of Development Consent DA 374-11-00 requires the preparation of a GWMP. Table 1 presents these requirements and indicates where they are addressed in this GWMP.

In accordance with the requirements of Condition 30, Schedule 3 of Development Consent DA 374-11-00 (Table 1), this GWMP is included as a component of the WMP (Appendix C of the WMP).

In accordance with Condition 31, Schedule 3 of Development Consent DA 374-11-00, Clean TeQ will implement the Water Management Plan (including the GWMP).

3.1.2 Management Plan (General) Requirements

In addition to the GWMP requirements prescribed in Condition 30(c), Schedule 3; Condition 4, Schedule 5 of Development Consent DA 374-11-00 outlines the management plan (general) requirements that are also applicable to the preparation of this GWMP.

Table 2 presents these requirements and indicates where each is addressed within this GWMP. As noted, the Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

Table 2 – Management Plan (General) Requirements

Development Consent DA 374-11-00 Schedule 5	GWMP Section
Management Plan Requirements	
4. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, are consistent with other plans prepared for other stakeholders, and include:	
a) detailed baseline data;	Section 4
b) a description of:	
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	Section 3
• *any relevant limits or performance measures/criteria;*	Section 5
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 5
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 6
d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Sections 7 to 9
e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 8
f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 9
g) a protocol for managing and reporting any:	
• *incidents;*	Section 10.1
• *complaints;*	Section 10.2
• *non-compliances with statutory requirements; and*	Section 10.3
• *exceedances of the impact assessment criteria and/or performance criteria; and*	Sections 10.4
h) a protocol for periodic review of the plan.	Section 2
Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.	

3.1.3 Water Management Performance Measures

Table 9 in Development Consent DA 374-11-00 prescribes the water management performance measures for the Project, as follows:

- **Water Management – General**
  - Maintain separation between clean and mine water management systems.
  - Minimise the use of clean water on-site.
- **Construction and Operation of Infrastructure**
  - Design, install and maintain erosion and sediment controls generally in accordance with the series *Managing Urban Stormwater: Soils and Construction including Volume 1* (Landcom, 2004)*, Volume 2A – Installation of Services* (Department of Environment and Climate Change [DECC], 2008a) and *Volume 2C – Unsealed Roads* (DECC 2008b).
  - Design, install and maintain infrastructure within 40 metres (m) of watercourses generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (Department of Primary Industries [DPI], 2012), or its latest version.

- Design, install and maintain any creek crossings generally in accordance with the Policy and *Guidelines for Fish Habitat Conservation and Management* (DPI, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull, S. and Witheridge, G., 2003), or their latest versions.

- **Clean Water Diversion Infrastructure**
  - Maximise the diversion of clean water around disturbed areas on-site.
  - Design, construct and maintain the clean water diversions to capture and convey the 100 year, peak flow rainfall event.
- **Sediment Dams (Mine and Limestone Quarry)**
  - Design, install and/or maintain the dams generally in accordance with the series *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008c).
- **Mine and Limestone Quarry Water Storages**
  - Design, install and/or maintain mine and limestone water storage infrastructure to ensure no discharge of mine or limestone quarry water off-site (except in accordance with an EPL).
  - On-site storages (including mine infrastructure dams, groundwater storage and treatment dams) are suitably designed, installed and/or maintained to minimise permeability.
  - Ensure that the floor and side walls of the tailings storage facility, Evaporation Basin and Surge Dam are designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1×10^{-9} metres per second (m/s), or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1×10^{-14} m/s (or equivalent).
  - Design, install and maintain a seepage interception system in the Tailings Storage Facility embankments in accordance with Dams Safety Committee (DSC) guidelines.
  - Design, install and maintain the water storages to capture and convey the 100 year, 72-hour Average Recurrence Interval (ARI) rainfall event.
  - Design, install and/or maintain the facilities to meet the requirements of the DSC.
  - The design of the tailings storage facility should conform to:
    - DSC3A – Consequence Categories for Dams (DSC, 2015); and
    - DSC3F – Tailings Dams (DSC, 2012).
- **Chemical and Hydrocarbon Storage**
  - Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.
- **Irrigation Area**
  - Manage the irrigation area in accordance with the EPA's *Environmental Guidelines: Use of Effluent by Irrigation* (Department of Environment and Conservation [DEC], 2004).

Clean TeQ will undertake the Project in accordance with these performance measures.

3.1.4 Notification Requirements

In accordance with Condition 10, Schedule 2 of Development Consent DA 374-11-00, Clean TeQ will notify the DPIE, LSC, FSC and PSC in writing of the day which the:

- commissioning of the borefields starts;
- development of the water pipeline starts; and
- commissioning of the water pipeline starts.

3.2 Licences, Permits and Leases

In addition to the requirements of Development Consent DA 374-11-00, all activities at or in association with the Project will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending issue:

- Mining Lease 1770 sought and issued by the NSW Minister for Resources under the NSW *Mining Act, 1992*.
- Mining Operations Plan(s) submitted and approved by the NSW Division of Resources and Geoscience.
- Environment Protection Licence (EPL) 21146 issued by the EPA under the NSW *Protection of the Environment Operations Act 1997* (POEO Act).
- Water supply works, water use approvals and water access licences (WALs) issued by DoI – L&W under the NSW *Water Management Act 2000* including:
  - Water Supply Works Approval 70CA614098 for the Project borefields.
  - WAL 32068 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 3,154 share components under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*.
  - WAL 39837 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 766 share components under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*.
  - WAL 28681 in the Lachlan Fold Belt Murray-Darling Basin (MDB) Groundwater Source (Lachlan Fold Belt MDB [Other] Management Zone), for 243 share components under the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011*.
  - WAL 6679 in the Lachlan Regulated River Water Source, for 123 share components (General Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.

  - WAL 1798 in the Lachlan Regulated River Water Source, for 300 share components (General Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.
  - WAL 42370 in the Lachlan Regulated River Water Source, for zero share components (High Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.
- Groundwater licences for monitoring bores under the *Water Management Act 2000*.
- Aboriginal Heritage Impact Permits (AHIP #C0003049 and AHIP #C0003887) issued by the Office of Environment and Heritage (OEH) under the NSW *National Parks and Wildlife Act 1974*.
- Mining and workplace health and safety related approvals granted by the NSW Department of Industry and SafeWork NSW.
- Permits under the *Roads Act 1993*.
- Heavy Vehicle Authorisation Permit 119039 issued by the National Heavy Vehicle Regulator under the *Heavy Vehicle National Law NSW.*
- Crown Land Licences issued under the *Crown Land Management Act 2016*.

3.3 Other Legislation, Policies and Guidelines

Clean TeQ will conduct the Project consistent with the requirements of Development Consent DA 374-11-00 and any other legislation that is applicable to an approved Part 4 Project under the EP&A Act.

In addition to the statutory obligations described in Sections 3.1 and 3.2, the following NSW Acts (and their Regulations) may be applicable to the conduct of the Project:

- *Aboriginal Land Rights Act 1983*;
- *Biodiversity Conservation Act 2016;*
- *Biosecurity Act 2015;*
- *Crown Land Management Act 2016;*
- *Contaminated Land Management Act 1997;*
- *Dams Safety Act 2015;*
- *Dangerous Goods (Road and Rail Transport) Act 2008;*
- *Energy and Utilities Administration Act 1987;*
- EP&A Act;
- *Fisheries Management Act 1994;*
- *Forestry Act 2012;*
- *Local Government Act 1993;*
- *Mining Act 1992;*
- *National Parks and Wildlife Act 1974;*

- *Pipelines Act 1967;*
- POEO Act;
- *Rail Safety (Adoption of National Law) Act 2012;*
- *Roads Act 1993;*
- *Soil Conservation Act 1938;*
- *Water Act 1912;*
- *Water Management Act 2000;*
- *Work Health and Safety Act 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

Commonwealth Acts which may also be applicable to the conduct of the Project include:

- *Environment Protection and Biodiversity Conservation Act 1999; and*
- *Native Title Act 1993.*

Relevant licences or approvals required under these Acts will be obtained as required.

Further details relating to the above NSW Acts regulated by DoI – L&W and EPA, and other relevant water policy and guideline documentation relevant to this GWMP is provided in the following sub-sections.

3.3.1 Water Management Act 2000

As water sharing plans have commenced under the *Water Management Act 2000* for all groundwater systems within which the Project lies, the *Water Management Act 2000* is relevant to groundwater licensing considerations for the Project. The following water sharing plans have commenced under the *Water Management Act 2000* for all groundwater systems within which the Project lies:

Mine (including Processing Facility)

- *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011*.

Borefields

- *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*.

The *Water Management Act 2000* incorporates the provisions of various prior Acts relating to the management of surface and groundwater in NSW and provides a single statute for regulation of water access, use and works (e.g. pumps or bores) that affect the licensing of surface water and alluvial and non-alluvial (i.e. fractured rock and porous rock) groundwater in the vicinity of the Project.

3.3.2 Water Act 1912

As water sharing plans have commenced under the *Water Management Act 2000* for all groundwater systems within which the Project lies (Section 3.3.1), the *Water Act 1912* is not relevant to groundwater licensing considerations for the Project.

3.3.3 Protection of the Environment Operations Act 1997

Clean TeQ holds EPL 21146 for the Project.

In accordance with Condition 27, Schedule 3 of Development Consent DA 374-11-00, unless EPL 21146 authorises otherwise, the Project will be carried out to comply with Section 120 of the POEO Act.

3.3.4 Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (NSW Government, 2012) has been developed by the NSW Government as a component of the NSW Government's Strategic Regional Land Use Policy. The Aquifer Interference Policy applies statewide and details water licence and impact assessment requirements. The Aquifer Interference Policy has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The Aquifer Interference Policy also enhances existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The *NSW Aquifer Interference Policy* (NSW Government, 2012) includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality. Where relevant, these minimal impact considerations have informed the groundwater impact trigger levels (i.e. more than 2 m drawdown) (Section 5.1).

3.3.6 National Water Quality Management Strategy/ANZECC & ARMCANZ (2000)

The National Water Quality Management Strategy is a joint national approach to improving water quality in Australian and New Zealand waterways. The ANZECC water quality guidelines (ANZECC & ARMCANZ, 2000) have been considered where applicable in this GWMP (Section 5.1.2).

3.3.7 Australian Standard 1940-2017

Australian Standard (AS) 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids* sets out requirements and recommendations for the safe storage and handling of flammable liquids of dangerous goods (Class 3) and also provides requirements and recommendations for the storage and handling of combustible liquids. It also provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection.

AS 1940-2017 have been considered where applicable in this GWMP.

4. HYDROGEOLOGICAL SETTING AND BASELINE DATA

4.1 Mine Site

4.1.1 Local Geology

Previous hydrogeological investigations for the Project have encountered the following geological formations within the mine site and immediate surrounds (Golder Associates [Golder], 2017):

- Laterite;
- Ultrabasic intrusive rocks (pyroxenite, gabbro, diorite); and
- Residual soils/alluvial (including palaeochannel deposits.

Residual soil/alluvial covers up to 2 m of low-lying area of the mine site (Golder, 2017). In addition, an unsaturated palaeochannel exists through the mine site in a north-easterly direction (encountered in several boreholes [GAM 07, GAM 09 and GAM 16 – Section 4.1.2]). The palaeochannel is up to 1,500 m wide and 35 m deep and comprises silts, clays, gravels, quartz and rock fragments (Golder, 2017).

The residual soil/alluvium is generally underlain by highly and slightly weathered ultrabasic intrusive rocks including pyroxenite, gabbro and diorite. The average thickness of the highly and slightly weathered rock stratum are reported as 11 m and 13 m, respectively (Golder, 2017).

The mine site is formed predominantly of an oblate Dunite core intrusion approximately 2 km north-south by 3 km east-west which is surrounded by ultramafic and mafic rocks (gabbro, diorite and olivine pyroxenite) and Laterite. The deposit targeted for mining contains resource grade nickel and cobalt mineralisation within the Laterite profile overlying the Dunite core intrusion.

The Girilambone Group forms the basement rock beneath the three geological formations. The bedrock is mostly dominated by fine quartz sandstone, siltstones and shale, mostly metamorphoses to quartzite, phyllite and schist (Golder, 2017). The occurrence of groundwater within the bedrock (slightly weathered and fresh rock) is expected to be limited to secondary permeability such as joints, fault/shear zones or other geological discontinuities in the rock mass (Coffey, 2018a).

4.1.2 Groundwater Levels

A number of groundwater monitoring sites have been established at the mine site and surrounds and are shown on Figure 5. Generally, groundwater levels are 30 m to 60 m below ground level and follow the surface topography, being highest in the western area of the mine site. The open cut pits will have an average depth of 35 m with localised deeper areas up to approximately 55 m.

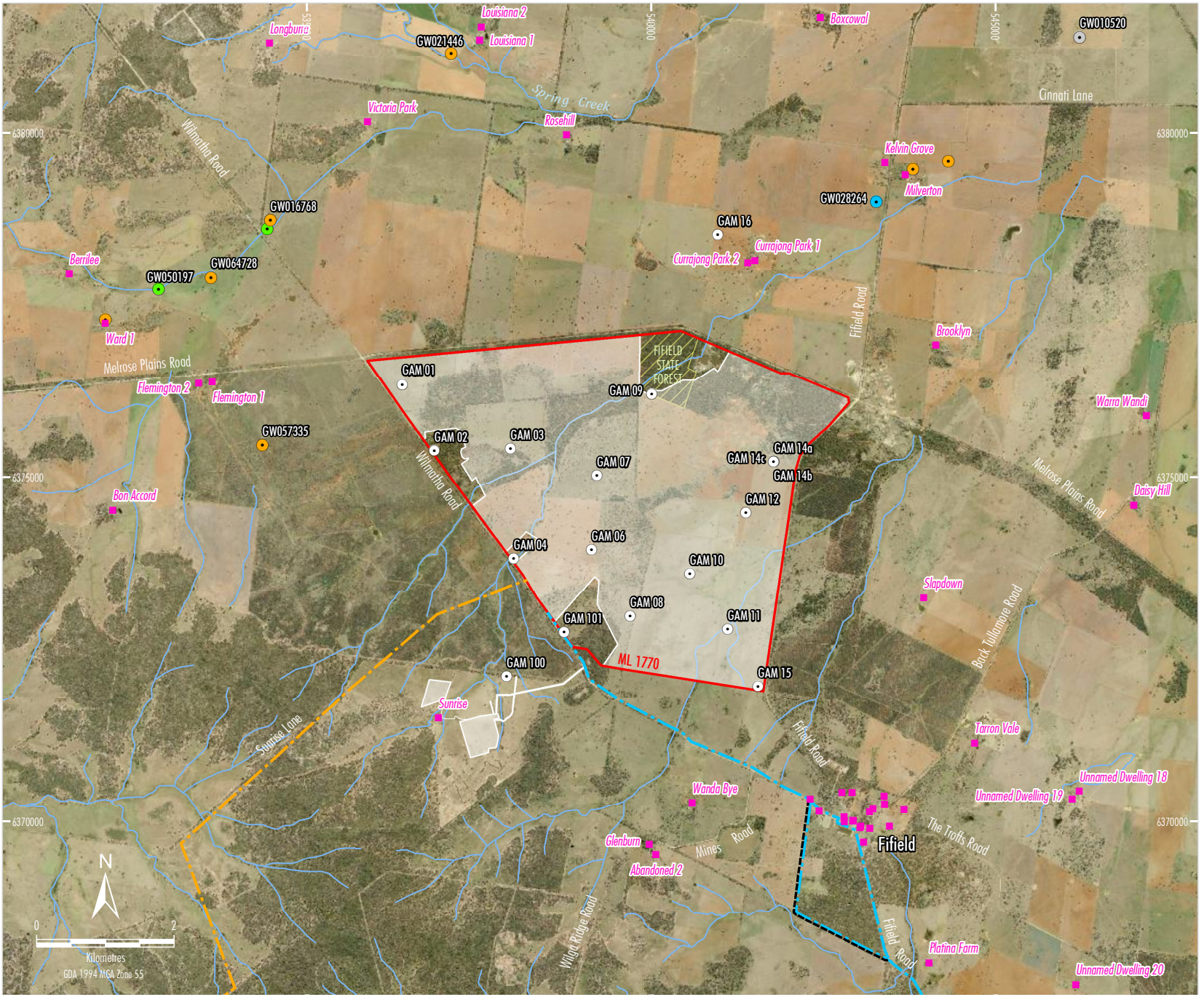
Four groundwater level measurements (December 2016, June 2017, June 2018 and September 2018) were recorded at the monitoring sites and the results are summarised in Table 3. Continuous loggers have been installed in these monitoring sites.

Table 3 – Groundwater Level Measurements – Mine Site

Bore ID	Easting (m)	Northing (m)	TOC (mAHD)	Standing Water Level Measurement (mAHD)			
				Dec 2016	Jun 2017	Jun 2018	Sep 2018
GAM 01	536383	6376352	301.79	272.87	276.38	274.33	273.75
GAM 02	536851	6375388	301.00	268.64	268.97	269.90	269.91
GAM 03	537953	6375460	293.98	247.28	247.73	248.47	248.54
GAM 04	538007	6373817	293.36	263.73	264.13	264.03	263.81
GAM 06	539132	6373939	295.12	249.14	249.67	250.42	250.37
GAM 07	539211	6375016	289.81	-	242.55	243.32	243.45
GAM 08	539695	6372982	294.33	244.38	248.58	244.39	244.36
GAM 09	540003	6376210	280.30	237.98	238.69	239.68	239.67
GAM 10	540563	6373602	283.83	249.53	249.82	250.78	250.43
GAM 11	541109	6372792	282.96	241.86	242.32	243.62	243.69
GAM 12	541376	6374443	281.08	250.31	251.99	252.38	252.15
GAM 14a	541787	6375224	283.42	243.8	244.59	245.32	244.82
GAM 14b	541782	6375225	283.53	231.28	232.3	233.71	233.88
GAM 14c	541776	6375225	283.69	250.88	250.63	249.80	249.46
GAM 15	541551	6371961	294.83	239.12	239.68	240.57	240.55
GAM 16	540976	6378523	273.54	216.19	216.79	218.42	218.07
GAM 100	537901	6372105	307.37	-	-	257.15	257.20
GAM 101	538740	6372750	308.29	-	-	257.12	257.12

mAHD – metres Australian Height Datum

Groundwater enters the mine site from the west and flows either south-east towards the paleochannel or north-east following the lowering topography. A groundwater divide is interpreted to exist beneath the topographical ridge in the (centre) eastern area of the site (Golder, 2017).



Source: Black Range Minerals (2005); Clean TeQ (2017, 2018); ENRS (2019); NSW Department of Industry (2017); NSW Land and Property Information (2017); Office of Environment and Heritage NSW (2017)
NSW Imagery: © Department of Finance, Services & Innovation (2018)

CLEAN TEQ SUNRISE PROJECT

Existing Project Groundwater Monitoring Network and Groundwater Users - Mine Site

Figure 5

CTL-17-03 MP 2018_GWMP_202L

4.1.3 Groundwater Yield

Groundwater at the mine site and surrounds is typically low yielding as indicated by hydraulic testing. The hydraulic testing (falling head) was conducted and analysed on five of the existing groundwater monitoring locations at the mine site and the results summarised in Table 4. The hydraulic conductivities are generally very low and the potential yield of the fractured rock aquifer is expected to be low (in the order of 0.1 L/s or less (Golder, 2017).

Table 4 – Summary of Hydraulic Testing – Mine Site

Bore ID	Formation Tested	Test Interval (mbTOC)	Aquifer Thickness (m)	K (Average) [metres/second]
GAM 06	Pyroxenite, fresh rock, some veining	51.4 to 57.4	13.14	$1.9x10^{-6}$
GAM 07	Pyroxenite, slightly weathered	51.0 to 57.0	10.27	$6.6x10^{-7}$
GAM 11	Pyroxenite, slightly weathered	54.0 to 60.0	22.10	$2.4x10^{-7}$
GAM 12	Gabbro fresh rock	50.8 to 56.8	29.59	$9.3x10^{-9}$
GAM 15	Pyroxenite, slightly weathered	64.7 to 70.7	16.85	$1.4x10^{-6}$

4.1.4 Groundwater Use

Groundwater use at the mine site and surrounds is limited.

A contemporary bore census has been undertaken in the vicinity of the mine site by ENRS (2019a), on behalf of Clean TeQ. The bore census included inspections of the Pine Park, Milverton, Victoria Park, Berrilee, Louisiana, Slapdown and Currajong Park properties and information collected included bore location, groundwater level and groundwater quality. The locations of bores inspected during the bore census are included on Figure 5. A copy of the Bore Census (ENRS, 2019a) was provided to the DPIE with this GWMP.

The closest privately-owned bore (GW057335) is located approximately 1.8 km to the west of Mining Lease 1770 (Figure 5).

4.1.5 Groundwater Quality

Based on the groundwater quality monitoring in June 2018, groundwater salinity across the mine site and surrounds varies from fresh (214 mg/L total dissolved solids [TDS]) to saline (10,100 mg/L TDS). Fresh groundwater has been encountered in the north-west area of the site (GAM 1), brackish in and near the palaeochannel, and saline in the south-east area of the site (GAM 11) (Coffey, 2018a). These results are similar to groundwater quality monitoring reported in Golder (2000).

In June 2018, the groundwater was generally neutral to slightly alkaline and the metal concentrations were generally below the ANZECC and ARMCANZ (2000) livestock trigger values. Where available, metals concentrations show similar values between 1999 and 2018 (Coffey, 2018a).

Detailed water quality results from June 2018 are provided in Attachment 1.

4.1.6 Previous Groundwater Assessments

Golder (2000b) assessed the potential groundwater impacts associated with the mine site.

The most recent groundwater assessments prepared for the mine site are Golder (2017) and Coffey (2018b). The key potential groundwater impacts at the mine site will be associated with the excavation of the open cut and potential seepage from the tailings storage facility.

A summary of the predicted potential impacts is provided below:

- **Groundwater Inflows** – the excavation of the open cut pits has the potential to intercept groundwater in the deepest area of the open cut pits resulting in predicted groundwater inflows of up to approximately 0.071 ML/year (or 0.0023 litres per second [L/s]) (base case) reducing to be generally less than 0.002 L/s in the long-term (Golder, 2017).
- **Groundwater Drawdown** – the excavation of the open cut pits has the potential to intercept groundwater in the deepest area of the open cut pits resulting in the predicted maximum groundwater drawdown extent of 1 m not extending beyond the ML 1770 boundary (Golder, 2017).
- **Seepage** – seepage from the tailings storage facility is not anticipated to migrate significantly beyond the tailings storage facility footprint during the Project life and thereafter the open cuts would act as sink that would collect the majority of seepage from the tailings storage facility (Coffey, 2018b).
- **Groundwater Users** – given no significant groundwater drawdown or seepage impacts are predicted, and the closest privately-owned bore (GW057335) is located approximately 1.8 km to the west of Mining Lease 1770 (Figure 5), no significant impacts are predicted to groundwater users (Golder, 2017 and Coffey, 2018b).

Given the small extent of groundwater drawdown over the Project life, post-mining groundwater levels are expected to recover slowly, although the open cut pit is expected to remain a groundwater sink.

4.2 Borefields

4.2.1 Borefield Layout

The approved borefield consists of six production bores with three at each of the eastern and western borefield (Figure 4). Two of the approved production bores (ISPB01 and ISPB02) were constructed and tested in 2006. The following staging of the development of the borefield is proposed:

- Initial construction – no extraction from the two existing production bores and construction of the remaining four approved production bores.
- Construction (after the initial construction phase) – the extraction of up to 900 ML/year from the two existing production bores.
- Operations Stage – extraction of more than 900 ML/year from the six production bores.

The predicted average and maximum annual off-site water demand during the operations phase is approximately 2,800 ML/year and 4,080 ML/year, respectively (HEC, 2019). This would be sourced from the Project borefield and the Lachlan River.

4.2.2 Existing Groundwater Regime

The borefields site associated with the Lachlan River floodplain comprises generally the Cowra Formation which disconformably overlies the Lachlan Formation. The Cowra Formation comprises clay, silt and gravel. The Lachlan Formation consists of sand, fine to medium gravel, with a minor silt and clay unit, and is the main water supply media for the Project borefields (Coffey, 2016b).

Bedrock below the Lachlan River Floodplain consists of Silurian phyllite, schist, micaceous siltstone, sandstone, dolomite, andesite and conglomerate within the north-south trending Tullamore and Murda Synclines (Coffey, 2016b).

4.2.3 Groundwater Levels

Two production bores (ISPB01 and ISPB02) and seven monitoring bores (including two existing bores constructed suitable for pumping) were installed over the period 1999 to 2006 (Figure 6). Both production bores were paired with a monitoring well, ISMW01 and ISMW02, respectively (Figure 6). Details of the production bores and monitoring wells are provided in Table 5. Clean TeQ will include updated details of the bores listed in Table 5 in the next version of the GWMP.

LEGEND

- Property Boundary
- Borefield Location
- Water Pipeline
- Borefield Infrastructure Corridor *
- Surface Water Infrastructure Corridor *
- Pump Station
- Transfer Station
- Access Road
- Monitoring Bore
- Production Bore (constructed)
- Production Bore (not constructed)

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

Source: Ivanplats Syerston (2005); Clean TeQ (2017); NSW Land & Property Information (2018)
NSW Imagery: © Department of Finance, Services & Innovation (2018)

CLEAN TEQ SUNRISE PROJECT

Existing Project Network - Borefields

Figure 6

CTL-17-03 MP 2018_GWMP_206A

Table 5 – Lachlan Formation – Borefields Production and Pumping Bores and Monitoring Wells

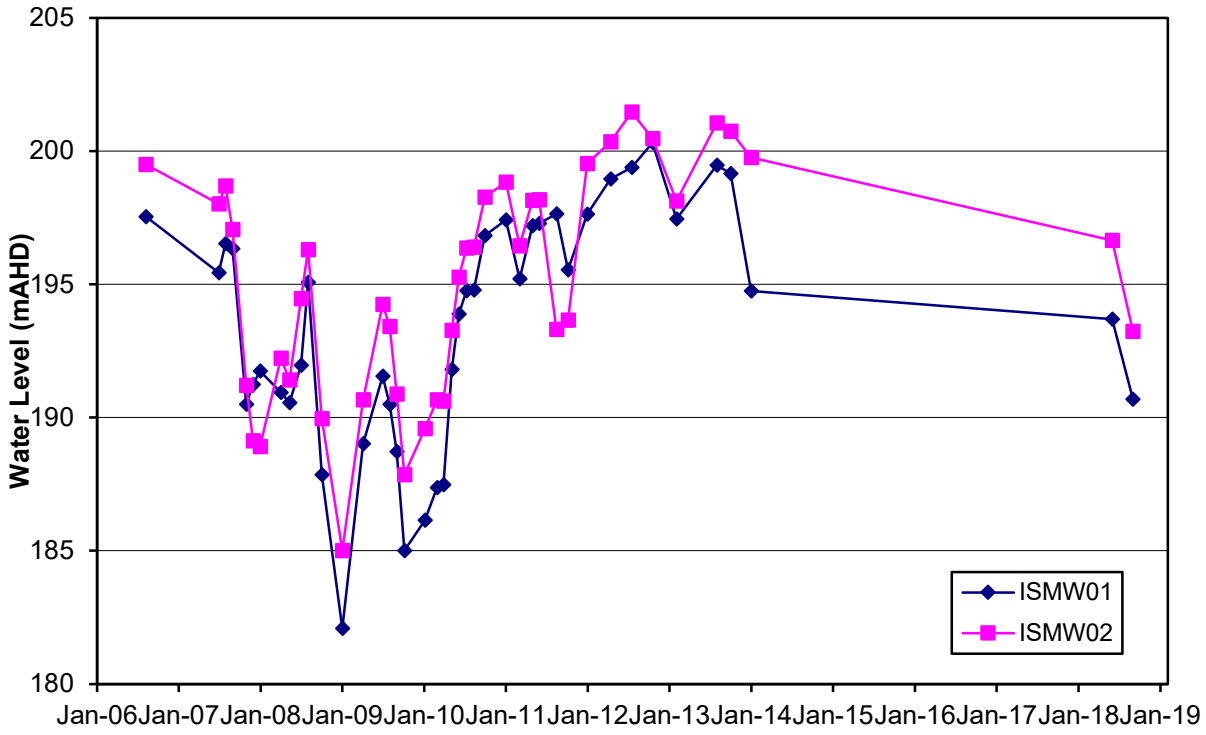
Bore ID	Type	Easting	Northing	Drilled Depth (mbgl)	TOC (mAHD)	Ground Level Survey [June 2018] (mAHD)	Pumping / Screen Depth (mbTOC)		Logger Depth [June 2018] (mbgl)
							Sump	Screen	
ISPB01	Production	547711	6319812	141.7	208.6	~208	134-136	112-134	No Logger
ISPB02	Production	551766	6316941	128.6	210.6	~211	126-128	104-126	No Logger
ISMW01	Monitoring	547695	6319812	141.1	208.93	208.38	N/A	114-135	29.5
ISMW02	Monitoring	551775	6316929	129.8	211.40	210.64	N/A	117-129	29.2*
MW-W1	Monitoring	547196	6320263	137.0	209.10	208.11	N/A	126-136	29.0
MW-E1	Monitoring	553407	6316482	127.0	212.04	211.10	N/A	108-126	29.1
PBW1	Monitoring	547240	6320179	141	TBC	~208	N/A	126-136	No Logger
PBW2	Monitoring/ Pumping	547230	6320190	137	TBC	~208	TBC	115-135	No Logger
PBE1	Monitoring/ Pumping	553413	6316485	128	TBC	~211	TBC	108-126	No Logger

Source: After Coffey (2016b) and (2018c)
mAHD = metres Australian Height Datum
mbgl – metres below ground level
mbTOC – metres below top of casing
TBC: To Be Confirmed

* Atmospheric logger also installed.

ISMW01 and ISMW02 have been monitored for standing water levels since 2006. Chart 1 shows observed water levels at these bores.

Chart 1 – Hydrographs for Monitoring Bores ISMW01 and ISMW02



Automatic standing water level loggers (recording on 6 to 12 hour intervals) have since been installed (June 2018) in four existing monitoring wells, namely: ISMW01; ISMW02; MW-E1; and MW-W1 (Table 5 and Figure 6). Logger data is downloaded from each monitoring bore on a regular basis. Manual groundwater level measurements are also taken during the downloads using a down-hole interface probe to allow for comparison with logger data.

By comparison to Chart 1, the recorded water levels at ISMW01 and ISMW02 in June and September 2018 were 193.69 to 190.69 mAHD and 196.65 to 193.23 mAHD respectively (Coffey, 2018c), within the previously recorded ranges.

Subject to the results of the contemporary numerical groundwater model construction phase scenario (i.e. extraction of up to 900 ML/annum total), and in conjunction with a review of the results of the bore census (ENRS, 2019b), the baseline groundwater monitoring network will be augmented as required and construction details of monitoring bores (including any new bores) and the baseline monitoring results (including water quality and water levels) will be provided in the revised GWMP prior to operation of the borefield.

Jemalong Irrigation Limited[3] and DoI – L&W maintain extensive networks of standpipe monitoring piezometers in the area for various purposes. A database has been compiled (including 59 subsurface measurement points at 32 locations) for assessment of the hydraulic field head and numerical model calibration and verification and is summarised in Coffey (2016b). The location of select monitoring locations is provided on Figure 7.

For illustration purposes, the results presented for two nested piezometers (GW036083 and GW036526 – Figure 7) are shown in Chart 2 which demonstrates the significant drawdown in the Lachlan Formation from 2002 (caused by the onset of drought conditions and therefore rise in groundwater use to offset the reduced surface water allocations).

[3] Jemalong Irrigation Limited is a private irrigation scheme located on the southern side of the Lachlan River opposite the borefields.

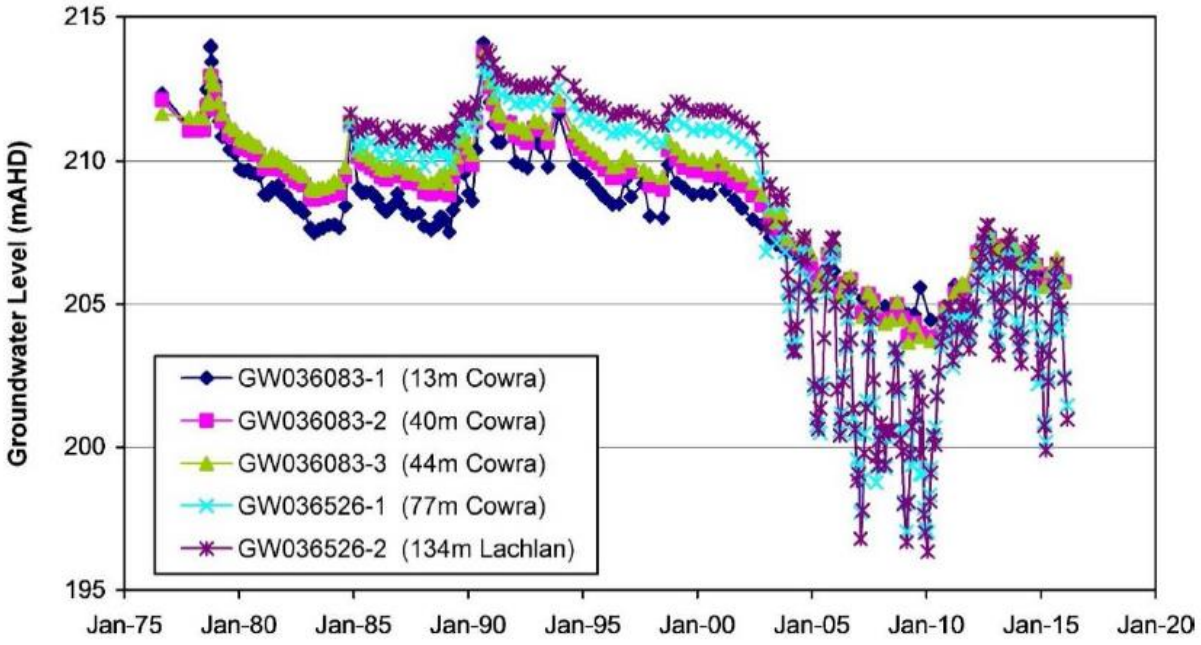
CTL-17-03 MP 2018_GWMP_205D

CLEAN TEQ SUNRISE PROJECT

Location of Existing Select Monitoring Bores and Surface Water Flow Gauges - Borefields

Figure 7

Chart 2 – Hydrographs for Nested Piezometers and GW036083 and GW036526



Piezometer nests GW036087, GW036088, and GW036089 are within close proximity of each other (Figure 7). Observed water levels at these piezometers have been used to calculate the observed drawdown over the period 2001 to 2010, shown in Chart 3. Results show the attenuation of drawdown moving vertically up the profile, due to pumping from the Lachlan Formation.

NSW Government monitoring piezometer nest GW036087 is the nearest nest to the borefields (Figure 7), and includes a piezometer screened in the Lachlan Formation. Chart 4 shows water level observations at this nest since 1976. These are typical of water level behaviour in the area, and in conjunction with other piezometers, provide a pre-mining baseline dataset of water levels throughout the profile in proximity to the borefields. Drawdowns between depths of 80 m and 130 m below ground are similar, however the drawdown at 40 m depth is greatly attenuated.

Chart 3 – Observed Drawdown in the Lachlan Formation (2001 to 2010)

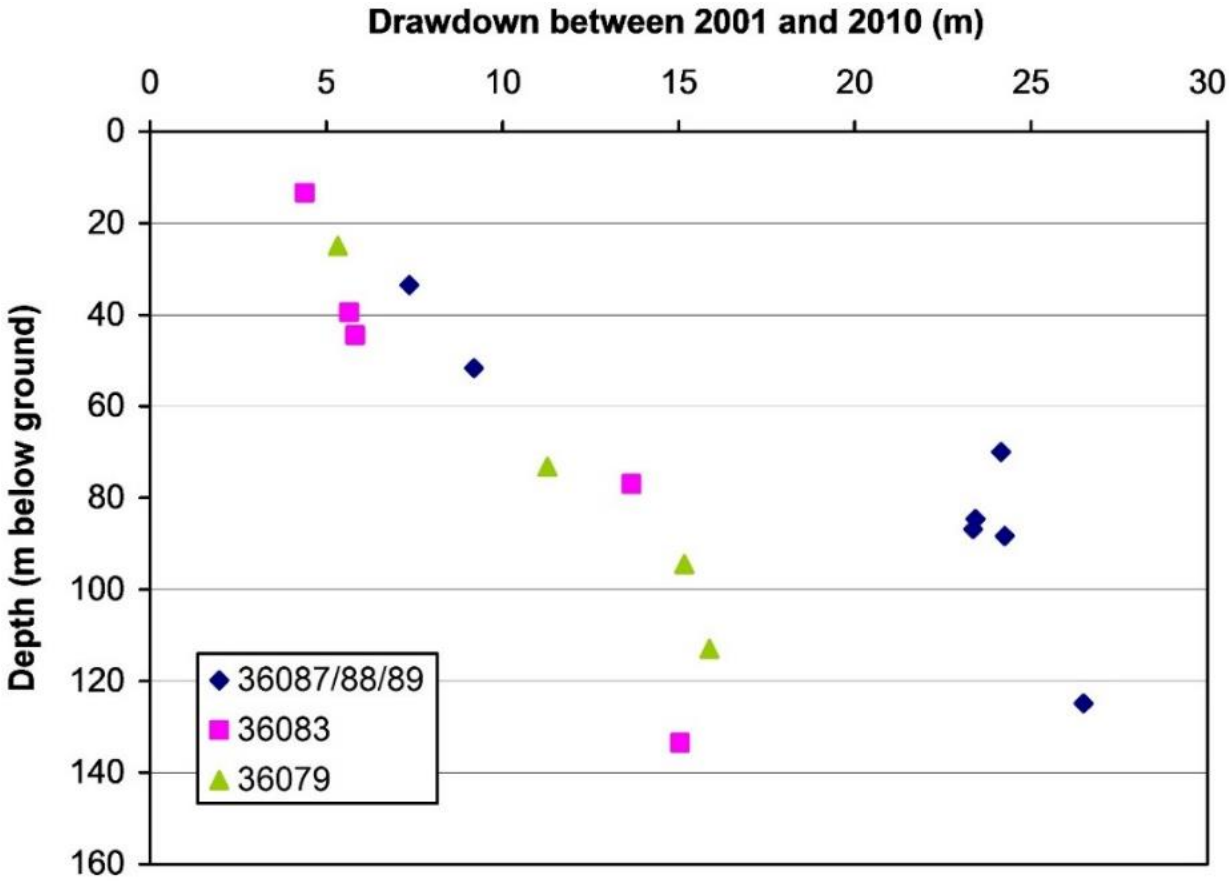
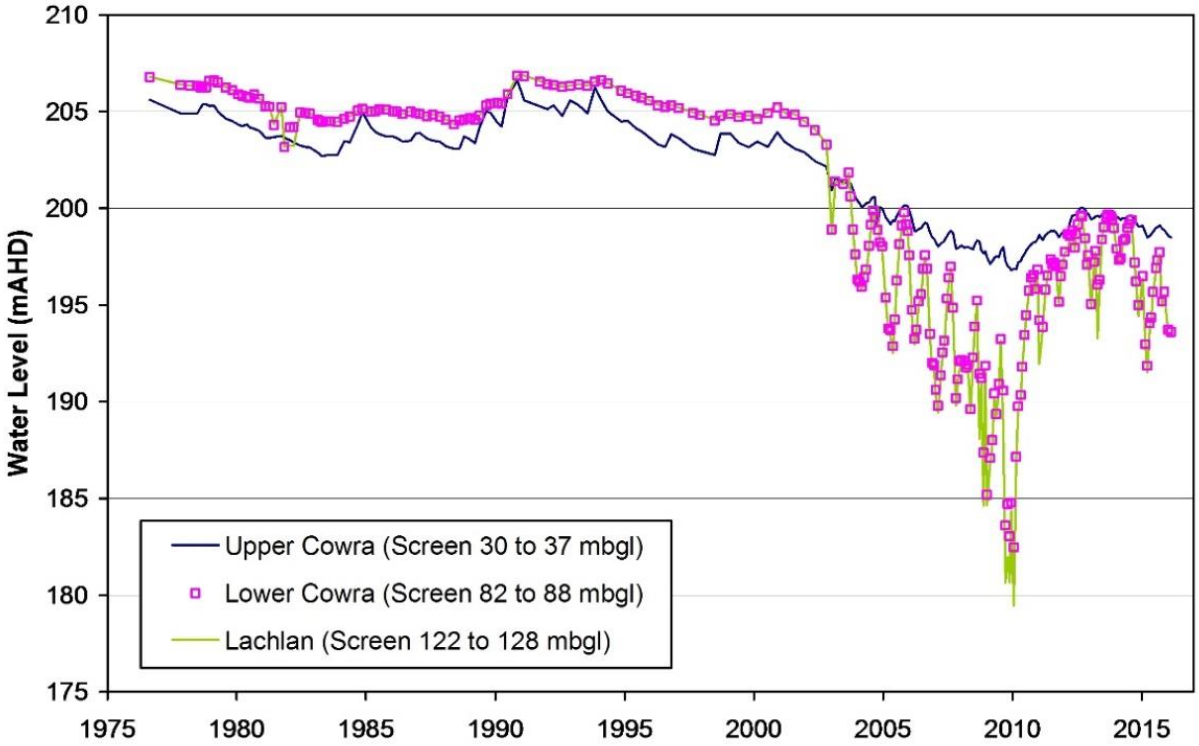


Chart 4 – Groundwater Level Observations at GW036087



4.2.4 Groundwater Yield

Pumping tests (48 hour) have been carried out on the two existing production bores at the borefields. ISPB01 was pumped at a rate of 50 L/s and ISPB02 at 80 L/s for a 48 hour duration. Monitoring results for ISPB02 showed that a barrier boundary was apparent after 200 minutes of pumping. The interpreted transmissivity ranged between 1,260 square metres per day (m^2/day) and 5,500 m^2/day (Coffey, 2016a).

A 3-day single rate pumping test was also undertaken at ISPB02 at the Project borefields in 1999 with monitoring at several observation piezometers. Analysis of the pumping test results presented the following (Coffey, 2016b):

- K (optimised): 19.5 metres per day (m/day) (over a saturated media interval of 136 metres [m]);
- Kv (optimised): 0.024 m/day
- Kv/Kh ratio: 0.001
- Specific storage (optimised): 2.2 x $10^{-5}m^{-1}$

No hydraulic test data is available for determining specific yield for the Cowra Formation at the borefields. Notwithstanding, Williams (1993) estimated a value of 5% for the refillable void space at the water table in the Upper Cowra Formation in the Jemalong Plains Irrigation District.

4.2.5 Groundwater Use

A survey of existing bores within 10 km of the borefields was originally completed in 2000 and included recording of relevant bore information including depths, estimated yield, groundwater levels and bore owner details for the following:

- Cowra Formation:
  - 105 stock and domestic bores;
  - 39 stock and domestic wells; and
  - 7 irrigation bores.
- Lachlan Formation:
  - 4 installed irrigation bores; and
  - 6 properties with groundwater allocation although no irrigation bores were installed at the time of the survey.

Another bore survey was undertaken in 2005 (Coffey Geosciences, 2005a). This work updated and superseded the bore survey conducted by Coffey in 2000. The 2005 survey focussed on accruing up to date information on current groundwater usage in a wider area, within a 12 km to 15 km radius of the proposed borefields. Information on property boundaries and owners within a 10 km to 15 km radius of the borefields was obtained from Forbes and Lachlan Shire Councils. The information gained in the first survey conducted in 2000 was used as a basis for the 2005 survey. The area of the survey was increased to the north-east, east and south to take in areas of past high groundwater usage. Changes of land ownership were also noted in the field and the contact database and property ownership maps were updated accordingly. The survey comprised field work with visits to the bores.

A contemporary bore census has since been undertaken by ENRS (2019b), on behalf of Clean TeQ. The 2018 bore census extended across an area of approximately 735 km^2 including approximately 84 properties. The 2018 bore census culminated in a database with records for one hundred and forty-six (146) bores comprising (ENRS, 2019b):

- 1 Commercial and Industrial;
- 2 Domestic water supply bores;
- 19 Irrigation;
- 2 Monitoring;
- 119 Stock and domestic; and
- 3 Town Water Supply (not equipped).

The location of the bores identified during the 2018 bore census and the results of a recent (2019) search of the PINNEENA register for groundwater works in the vicinity of the borefields is presented in Attachment 2.

The results of the bore census are currently being used in the development of the contemporary groundwater model for the development of triggers for the Project borefields.

A copy of the 2018 bore census (ENRS, 2019b) was provided to the DPIE with this GWMP.

4.2.7 Groundwater Quality

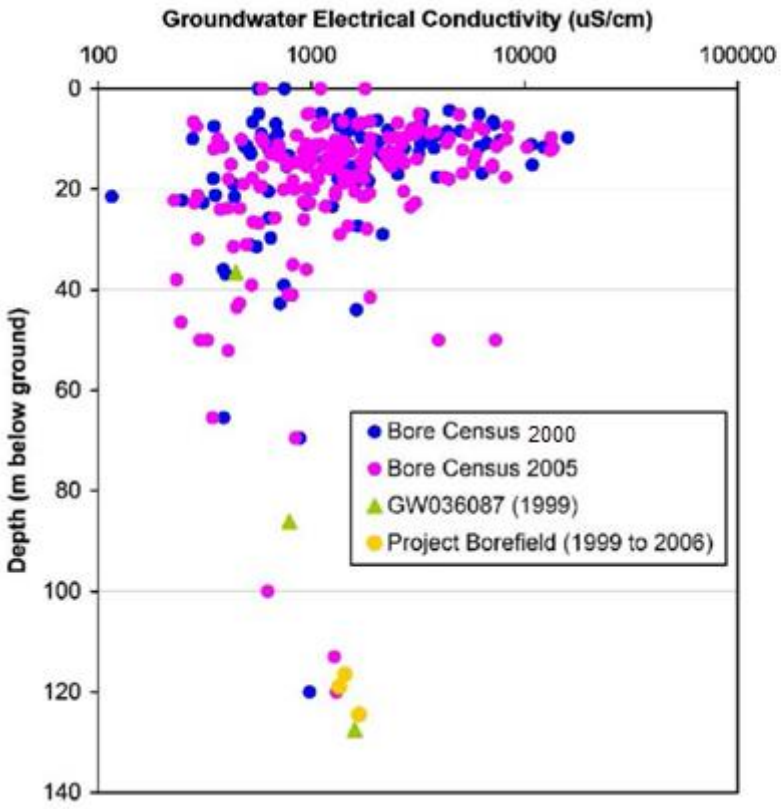
Water quality samples were collected from ISPB01 in August 2006, August 2017 and November 2019 and from ISPB02 in August 2006. The results are in Table 6.

Table 6 – Summary of Laboratory Analysis of Groundwater Samples Collected in 2006, 2017 and 2019

Parameter	Units	ISPB01			ISPB02
		19 August 2006	15 August 2017	13 November 2019	13 August 2006
• **pH**	-	7.37	7.1	7.2	7.16
• **Electrical Conductivity**	µS/cm	1,280	1,350	1,200	1,330
Alkalinity					
• Total Alkalinity as $CaCO_3$	mg/L	206	193	210	184
Dissolved Major Anions					
• Sulphate as SO_4^{2-}	mg/L	67	52	69	71
• Chloride	mg/L	240	235	770	277
Dissolved Major Cations					
• Calcium	mg/L	24	24	25	31
• Magnesium	mg/L	22	21	23	25
• Sodium	mg/L	188	188	190	215
• Potassium	mg/L	3.0	3.0	3.0	4.0
Other					
• Manganese	mg/L	0.042	0.051	0.048	0.034
• Iron	mg/L	<0.05	0.92	1.00	0.28
• Fluoride	mg/L	0.4	0.5	0.6	0.4
• Nitrite as N	mg/L	<0.010	<0.01	<0.02	<0.010
• Nitrate as N	mg/L	<0.010	<0.01	<0.02	0.012
• Nitrite + Nitrate as N	mg/L	<0.010	<0.01	<0.05	0.012

Chart 5 shows electrical conductivity (EC) measured at private bores during the bore census of 2000 and 2005 versus the base of the bore (Coffey, 2016b). Also shown are laboratory analytical results for samples from the Project borefields and GW036087 (screens 1 to 3), versus the midpoint of their screen intervals. There is a weak overall trend of decreasing EC with depth, to a depth of around 60 m. From measurements available, it appears that EC begins increasing with depth, below 60 m depth. However, the variation in EC in the upper 20 m is significant.

Chart 5 – Borefields Groundwater Quality – Electrical Conductivity versus Depth



Interpreted lateral variation in total dissolved solids in the local area and surrounds is also presented in Green et al (2011). Groundwater is freshest where significant stream bed leakage is thought to be occurring.

As described in Section 4.2.5, a contemporary bore census has been undertaken by ENRS (2019b), on behalf of Clean TeQ. The 2018 bore census included water quality sampling (EC and pH). Salinity ranged from 158 microsiemens per centimetre (µS/cm) to 8,440 µS/cm across the bore census area and averaged 1,613 µS/cm (ENRS, 2019b). This is consistent with previous salinity data recorded in the vicinity of the borefield (Chart 5). Acidity was typically neutral ranging from 5.72 to 8.64 pH units and averaging 6.78 pH units (ENRS, 2019b).

4.2.8 Groundwater Recharge – Surface Water Flows

Surface water flows will be a source of recharge in the vicinity of the borefields. Existing NSW Office of Water flow gauges are located in the Lachlan River at Jemalong (Station 412036) and Mulguthrie (Station 412024), as well as Island Creek (Station 412023) and Bumbuggan Creek (412017) (Figure 7). Flow in Goobang Creek is not monitored.

5. PERFORMANCE MEASURES AND PERFORMANCE INDICATORS

During construction activities, Clean TeQ will assess the Project against the specific water management performance indicators outlined in Table 7.

Table 7 – Water Management Performance Indicators – Construction

Performance Measure	Performance Indicators
Water Management - General • Minimise the use of clean water on-site.	Water use is consistent with the water use priority described in the Water Balance and in accordance with relevant *Water Management Act 2000* approvals.
Mine Water Storages • On-site storages (including mine infrastructure dams, groundwater storage and treatment dams) are suitably designed, installed and/or maintained to minimise permeability.	Water management infrastructure is constructed and maintained generally in accordance with the design described in SWMP.
• Ensure that the floor and side walls of the tailings storage facility, Evaporation Basin and Surge Dam are designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent).	The tailings storage facility and evaporation pond are constructed generally in accordance with the design described in the Water Balance and SWMP.
• Design, install and maintain a seepage interception system in the Tailings Storage Facility embankments in accordance with the DSC guidelines. • Design, install and/or maintain the facilities to meet the requirements of the DSC. • The design of the tailings storage facility should conform to: – DSC3A – Consequence Categories for Dams (DSC, 2015); and – DSC3F – Tailings Dams (DSC, 2012).	The tailings storage facility is designed in consultation with the DSC, and the water management infrastructure constructed and maintained generally in accordance with the design described in the Water Balance and SWMP.
Chemical and Hydrocarbon Storage • Chemical and hydrocarbon products to be stored un bunded areas in accordance with the relevant Australian Standards.	Chemical and hydrocarbon storages will be constructed and maintained in accordance with the relevant Australian Standards (refer SWMP).
Irrigation Area • Manage the irrigation area in accordance with the EPA's *Environmental Guidelines: Use of Effluent by Irrigation*.	The irrigation area is designed and maintained generally in accordance with the design described in the Water Balance and SWMP.

Note: The Water Balance and SWMP are included in Appendices A and B of the WMP.

5.1 Trigger Levels for Investigation

Given the negligible potential for groundwater-related impacts during the initial Project construction activities (i.e. no mining or processing activities or groundwater extraction), the proposed trigger level for investigation will be receipt of a groundwater-related complaint.

Quantitative groundwater trigger levels for potentially adverse groundwater impacts associated with the borefields will be developed using the available baseline data prior to the commencement of the extraction of groundwater from the borefield and will be included in the next version of the GWMP.

5.1.1 Groundwater Drawdown Trigger Levels

Complaint-Based Trigger

Should a groundwater related complaint be received during the initial Project construction activities, Clean TeQ will conduct an investigation and respond in accordance with the procedures described in Section 10.2.

The proposed performance indicator will be that no more than 2 m drawdown impact on water levels at groundwater production bores on privately-owned land is experienced as a result of the Project.

Should analysis of the monitoring results, and modelling if required, confirm that the Project has resulted in a greater than 2 m drawdown impact on in water levels in privately-owned bores, and the assessment is peer reviewed by a specialist, the results will then be reported to DPIE and DoI – L&W and the Contingency Plan enacted (Section 8).

Monitoring / Model Based Triggers

As described in Section 6.2, Clean TeQ commissioned HydroSimulations in 2018 to develop a contemporary numerical groundwater model for the Project borefields in advance of borefield operation. Clean TeQ will revise this GWMP (including the initial triggers), with the results of the contemporary groundwater model in advance of operation of the production bores at the borefields.

5.1.2 Groundwater Quality Trigger Levels

The ANZECC and ARMCANZ (2000) water quality guidelines apply to the quality of both surface waters and groundwaters since they have been developed to protect environmental values relating to above-ground uses such as irrigation and stock use.

ANZECC and ARMCANZ (2000) recommends that wherever possible site-specific data be used to define trigger values for physical and chemical factors which can adversely impact the environment, rather than using default values.

Table 1 of the *NSW Aquifer Interference Policy* (NSW Government, 2012) sets out the minimal impact considerations for aquifer interference activities for groundwater sources including:

> *Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.*

The following beneficial uses were recommended by the National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia for major (or significant) aquifers and have been adopted by the DoI – L&W in *The Groundwater Quality Protection Policy* (Department of Land and Water Conservation, 1998):

- ecosystem protection;
- recreation and aesthetics;
- raw water for drinking water supply; and
- agricultural water and industrial water.

The National Land and Water Resources Audit (Murray Darling Basin Commission, 2005) specified groundwater quality ranges for beneficial use categories based on salinity (Table 8). These salinity-based categories generally align with the beneficial uses within the NSW Groundwater Quality Protection Policy.

Table 8 – Groundwater Quality Categories: Electrical Conductivity

Beneficial Use	Quality Range	Description
Potable	Up to 800 µS/cm (500 mg/L TDS)*	Suitable for all drinking water and uses.
Marginal Potable	800-2,350 µS/cm (500-1,500 mg/L TDS)*	At the upper level, this water is at the limit of potable water, but is suitable for watering of livestock, irrigation and other general uses.
Irrigation	2,350-7,800 µS/cm (1,500-5,000 mg/L TDS)*	At the upper level, this water requires shandying for use as irrigation water or to be suitable for selective irrigation and watering of livestock.
Saline	7,800-22,000 µS/cm (5,000-14,000 mg/L TDS)*	Generally unsuitable for most uses. It may be suitable for a diminishing range of salt-tolerant livestock up to about 6,500 mg/L [~10,150 uS/cm] and some industrial uses.
Highly Saline	> 22,000 µS/cm (>14,000 mg/L TDS)*	Suitable for coarse industrial processes up to about 20,000 mg/L [~31,000 uS/cm].

µScm = microsiemens per centimetre; mg/L = milligrams per litre; TDS = total dissolved solids.

*Approximate EC ranges derived from TDS ranges, with conversion Factor of 1.5625 applied. Source: *National Land and Water Resources Audit* (Murray Darling Basin Commission, 2005).

Each bore will be assigned a beneficial use category in Table 8 based on comparison of the bore census / survey results with the water quality ranges in Table 8. At any privately-owned bore where a monitored EC value is outside the applicable baseline range of its assigned beneficial use category for two successive monitoring rounds, an investigation will be initiated.

Should the investigation confirm that the Project has resulted in the change of the beneficial use category of the privately-owned bore for two successive monitoring rounds, and the investigation is peer reviewed by a specialist, the results will then be reported to DPIE and DoI – L&W and the Contingency Plan enacted (Section 8).

6. GROUNDWATER MANAGEMENT MEASURES

6.1 Mine Site

The groundwater management measures to be implemented at the mine site are outlined in this section.

6.1.1 Water Use

Consistent with the general water management performance measures for the Project (Table 7), Clean TeQ will minimise the use of clean water on-site.

Additional detail on water use at the Project is provided in the Water Balance (Appendix A of the WMP) in accordance with Condition 30(a), Schedule 3 of Development Consent DA 374-11-00.

6.1.2 Mine Water Storages

The following mine water storages will be constructed during the initial construction activities (Figure 2):

- tailings storage facility;
- evaporation pond;
- water storage dam;
- mine water dams and runoff dam; and
- raw water dam.

If a mine water storage is prescribed under the *Dams Safety Act 1978*, Clean TeQ would design, install and/or maintain it to meet the requirements of the DSC.

Additional detail on mine water storages at the Project is provided in the Surface Water Management Plan (Appendix B of the WMP) in accordance with Condition 30(b), Schedule 3 of Development Consent DA 374-11-00.

Tailings Storage Facility

Consistent with the relevant performance measures (Table 7):

- the tailings storage facility will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL);

- the floor and side walls of the tailings storage facility will be designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent);
- a seepage interception system will be designed, installed and maintained in the tailings storage facility embankments in accordance with DSC guidelines;
- the tailings storage facility will be designed, installed and maintained to meet the requirements of the DSC; and
- the tailings storage facility design will conform with:
  - DSC3A – Consequence Categories for Dams (DSC, 2015); and
  - DSC3F – Tailings Dams (DSC, 2012).

Evaporation Pond

Consistent with the relevant performance measures (Table 7):

- the evaporation pond will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL); and
- the floor and side walls of the evaporation pond will be designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent).

Water Storage Dam

Consistent with the relevant performance measures (Table 7):

- the water storage dam will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL);
- the water storage dam will be suitably designed, installed and/or maintained to minimise seepage; and
- the water storage dam will be designed, installed and maintained to meet the requirements of the DSC (if required under the provisions of the *Dams Safety Act 1978*).

Mine Water Dams and Runoff Dam

Consistent with the relevant performance measures (Table 7):

- the mine water dams and runoff dam will be suitably designed, installed and/or maintained to minimise seepage; and

- the runoff dam will be designed, installed and maintained to capture and convey the 100 year, 72-hour ARI rainfall event.

Raw Water Dam

Consistent with the relevant performance measures (Section 5):

- the raw water dam will be suitably designed, installed and/or maintained to minimise seepage; and
- the raw water dam will be designed, installed and maintained to capture and convey the 100 year, 72-hour ARI rainfall event.

6.1.3 Chemical and Hydrocarbon Storages

Consistent with the relevant performance measures (Table 7), chemical and hydrocarbon products will be stored in bunded areas in accordance with the relevant Australian Standards, including AS 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids*.

6.1.4 Irrigation Area

Wastewater generated at the accommodation camp will be collected and treated at an on-site wastewater treatment plant. The wastewater treatment plant will consist of anaerobic and aerobic treatment and final disinfection of treated effluent. The wastewater treatment plant will be installed and operated in accordance with Lachlan Shire Council requirements.

The treated wastewater produced from the wastewater treatment plant will be pumped to the irrigation area via the irrigation water pipeline (Figure 2).

The irrigation application area will be approximately 3.5 hectares (ha) and will be divided into irrigation zones. Up to 100,000 litres per day of treated wastewater will be pumped to the irrigation area. Sprinklers will be used to evenly distribute the treated wastewater at a maximum rate of approximately 3 millimetres per square metre per day. This application rate is conservative and will minimise risk of surface pooling and runoff (True Water Australia, 2018).

True Water Australia (2018) conducted a nutrient balance for the irrigation area and concluded that the irrigation area is of sufficient size for the expected nutrient load (i.e. nutrient loading will not be a limiting factor to irrigation).

Consistent with the relevant performance measure (Table 7), the accommodation camp irrigation area would be managed in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004) and the irrigation rate would be controlled so as not to:

- cause irrigation water runoff from the irrigation area; or
- exceed the capacity of the soil in the irrigation area to effectively absorb the applied nutrient, salt, organic material and hydraulic loads.

6.2 Borefield Numerical Model Review

Predictive numerical modelling was originally undertaken in 2005 (Coffey Geosciences, 2005b). The 2005 study considered information collected during drought conditions that were present at the time, including:

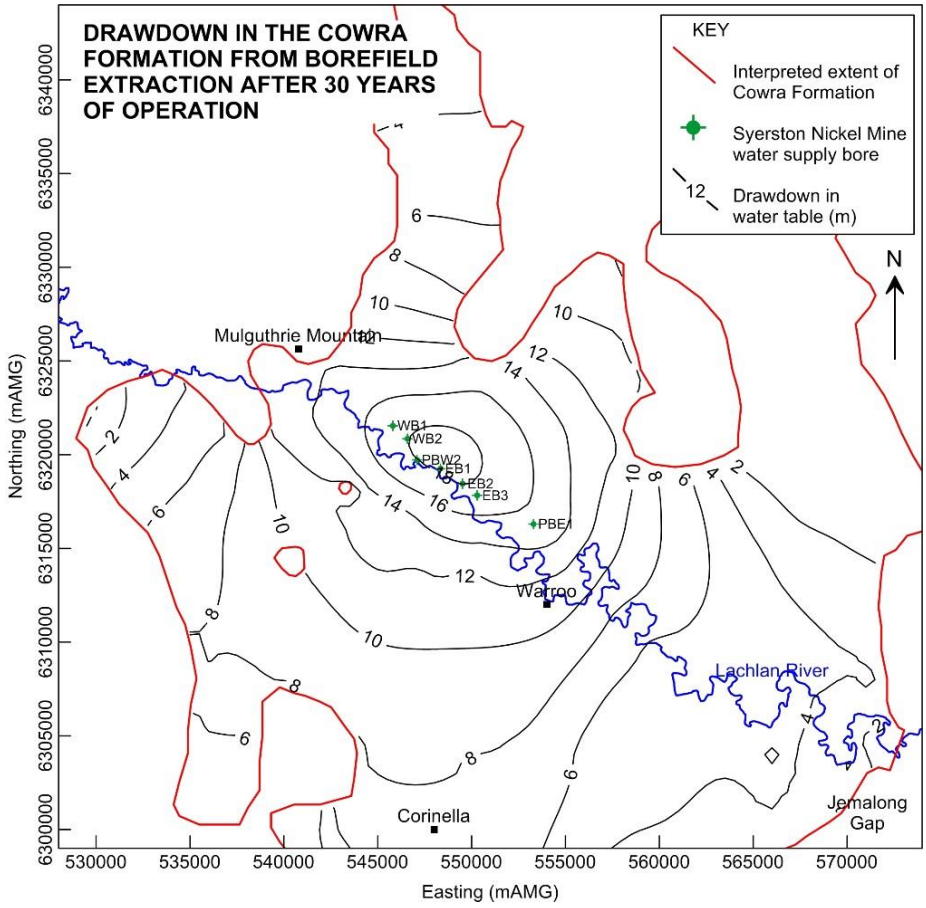
- observed large drawdowns in alluvial media from increased pumping in the Lachlan Formation (due to the onset of drought conditions) had begun to manifest (i.e. the form and character of drawdown responses had not fully developed); and
- groundwater usage data for the 2004/2005 financial year which is amongst the highest usages yet observed for the area.

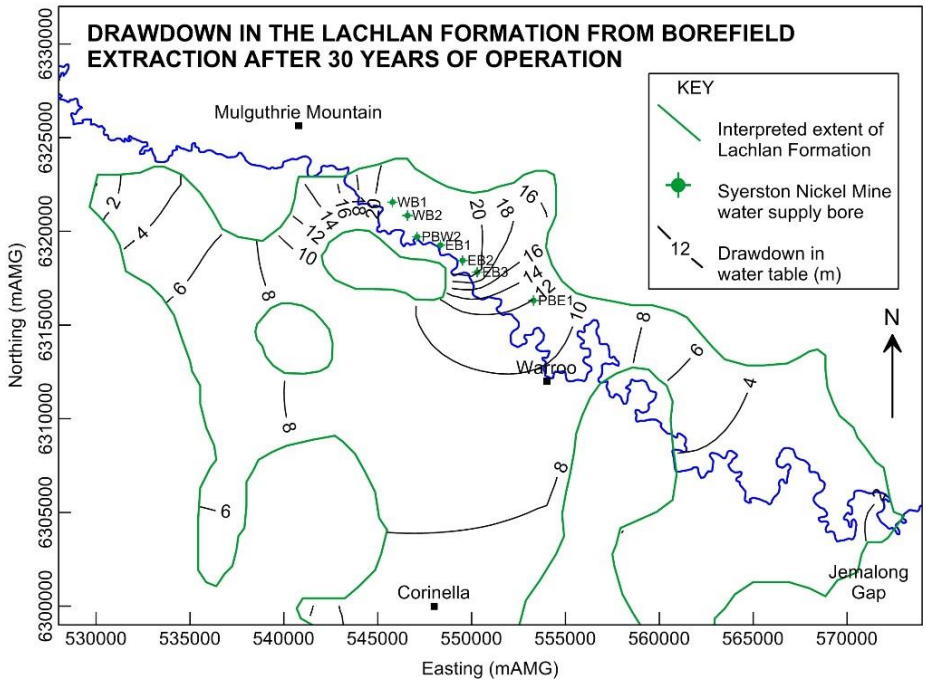
The numerical model used for the 2005 studies was therefore developed using a precautionary approach, and thus conservative for the purposes of impact assessment.

At present, the character of the drawdown caused by pumping from the Lachlan Formation is well represented in monitoring hydrographs, the usage datasets for the 2004/2005 financial year are better understood, additional stream flow data has provided a strong basis for the water balance for the study area, and several independent additional data sets have allowed a reasonably reliable separation of the Cowra Formation into two layers (i.e. Upper and Lower).

Notwithstanding the above, the 2005 modelling results provide a conservative starting point for groundwater management and impact mitigation. Chart 6 shows modelled drawdowns from the 2005 study for the Cowra and Lachlan Formations after 30 years of operation of the borefields.

Chart 6 – Modelled Drawdowns in the Cowra and Lachlan Formations (Coffey Geosciences, 2005b)





Clean TeQ commissioned HydroSimulations in 2018 to develop a contemporary numerical groundwater model for the Project borefields in advance of operation of the borefields. It is noted that Chart 6 is only a conservative starting point and will be superseded by the results of the contemporary groundwater model currently being developed utilising the results of the 2018 bore census (ENRS, 2019b), available government records and other publicly available data.

Clean TeQ will revise this GWMP (including Chart 6), with the results of the contemporary groundwater model construction phase scenario (i.e. interim extraction of up to 900 ML/annum total) in advance of operation of the existing two production bores at the borefields. At this time, additional preventative actions for any landholders predicted to be affected in vicinity of the borefields will be considered and included in this GWMP.

Similarly, this GWMP will be updated in a progressive manner to subsequently include an operational (maximum extraction) phase scenario before exceeding the construction phase extraction volumes of more than 900 ML/year. This will allow for progressive validation of the numerical modelling predictions and an adaptive management approach.

The contemporary numerical groundwater model for the borefields will be reviewed annually and updated at least once every three years, with the model set-up and input parameters progressively refined to improve the prediction of current and future drawdown impacts due to pumping of the borefields and regional usage. Contemporary usage data for private bores will also be obtained where possible, as these remain an important component of validation and future calibration, and for estimating pumping rates for future predictions.

The Water Balance (Appendix A of the WMP) will be updated as required to include a site water balance for each calendar year in accordance with Condition 30(a), Schedule 3 of Development Consent DA 374-11-00.

6.3 Preventative Actions

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, Clean TeQ will assess and manage risks to comply with the criteria and/or performance measures outlined in Schedule 3 of Development Consent DA 374-11-00.

Preventative/adaptive management actions may include:

- construction of the mine water storages consistent with the performance measures (Table 7);
- chemical and hydrocarbon products will be stored in bunded areas in accordance with the relevant Australian Standards, including AS 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids*;
- the accommodation camp irrigation area would be managed in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004);
- minimise the use of clean water on-site;
- the contemporary numerical groundwater model for the borefields (Section 6.2) will be reviewed and updated at least once every three years, with the model set-up and input parameters progressively refined to improve the prediction of current and future drawdown impacts due to pumping of the borefields and regional usage to allow for progressive validation of the numerical modelling predictions and an adaptive management approach;
- rehabilitation of the affected stock and domestic bores by lowering pump intakes and/or deepening of bores or wells to ensure continuity of water supply will be established in consultation and agreement with the affected landowner;
- optimisation of the pumping regime with regard to extraction rate and duration of pumping at the (eastern and western) borefields;
- optimisation of Project water supply requirements for the mine site (including surface water extraction from the Lachlan River); and/or
- identification of additional Project water supply sources.

6.4 Groundwater Users – Management of Complaints

Should a groundwater related complaint be received during the initial Project construction activities, Clean TeQ will conduct an investigation and respond in accordance with the procedures described in Section 10.2.

6.5 Compensatory Action

In accordance with Condition 28, Schedule 3 of Development Consent DA 374-11-00, Clean TeQ will provide a compensatory water supply to anyone whose basic landholder water rights (as defined in the *Water Management Act 2000*) are adversely and directly impacted as a result of the development. This supply will be provided in consultation with DoI – L&W, and to the satisfaction of the Secretary.

The compensatory water supply measures will provide an alternative long-term supply of water that is equivalent to the loss attributable to the development. Equivalent water supply will be provided (at least on an interim basis) as soon as possible after the loss is identified, unless otherwise agreed with the landowner. If Clean TeQ and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

If Clean TeQ is unable to provide an alternative long-term supply of water, then Clean TeQ will provide alternative compensation (e.g. financial compensation) to the satisfaction of the Secretary.

Clean TeQ will revise this GWMP, including the results of the contemporary groundwater model construction phase scenario (i.e. interim extraction of up to 900 ML/annum total) in advance of operation of the existing two production bores at the borefields. At this time, compensatory actions, including a strategy for communication, negotiation, mediation and arbitration, for any landholders predicted to be affected in vicinity of the borefields will be considered and included in the GWMP.

6.6 Groundwater Licensing

In accordance with Condition 26, Schedule 3 of the Development Consent DA 374-11-00, Clean TeQ will ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of Project to match its available water supply.

Water Access Licences

Mine Dewatering

In-pit dewatering is expected to be negligible over the life of the Project (Golder, 2017).

Notwithstanding, Clean TeQ currently holds WAL 28681 in the Lachlan Fold Belt MDB Groundwater Source (Lachlan Fold Belt MDB [Other] Management Zone), for 243 share components under the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* for the mine pit should the deepest areas intercept any groundwater.

Borefields Operation

Clean TeQ currently holds WAL 32068 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 3,154 share components under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012* for the borefields. The borefields will be operated in accordance with the conditions of WAL 32068.

A second WAL 39837 is also held by Clean TeQ for an additional 766 share components in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone).

7. MONITORING PROGRAMS

7.1 Mine Site

Given that in-pit dewatering is expected to be negligible over the life of the Project (Golder, 2017), monitoring of groundwater levels and quality at the mine site is primarily aimed at adding to the baseline datasets and establishing sites for future operational monitoring associated with the potential impact of the tailings storage facility, evaporation pond and water storage dam on the groundwater table and groundwater quality.

Baseline Monitoring

Baseline data collected from the existing groundwater monitoring network (GAM Series) at the mine site (Figure 5) will continue to be recorded prior to the commencement of construction to add to the existing baseline datasets.

Logging of groundwater levels will be continued and data downloaded periodically. The GAM Series monitoring bores will also be monitored six monthly for a suite of groundwater quality parameters including EC, pH, total dissolved solids, major cations, major anions and selected metals.

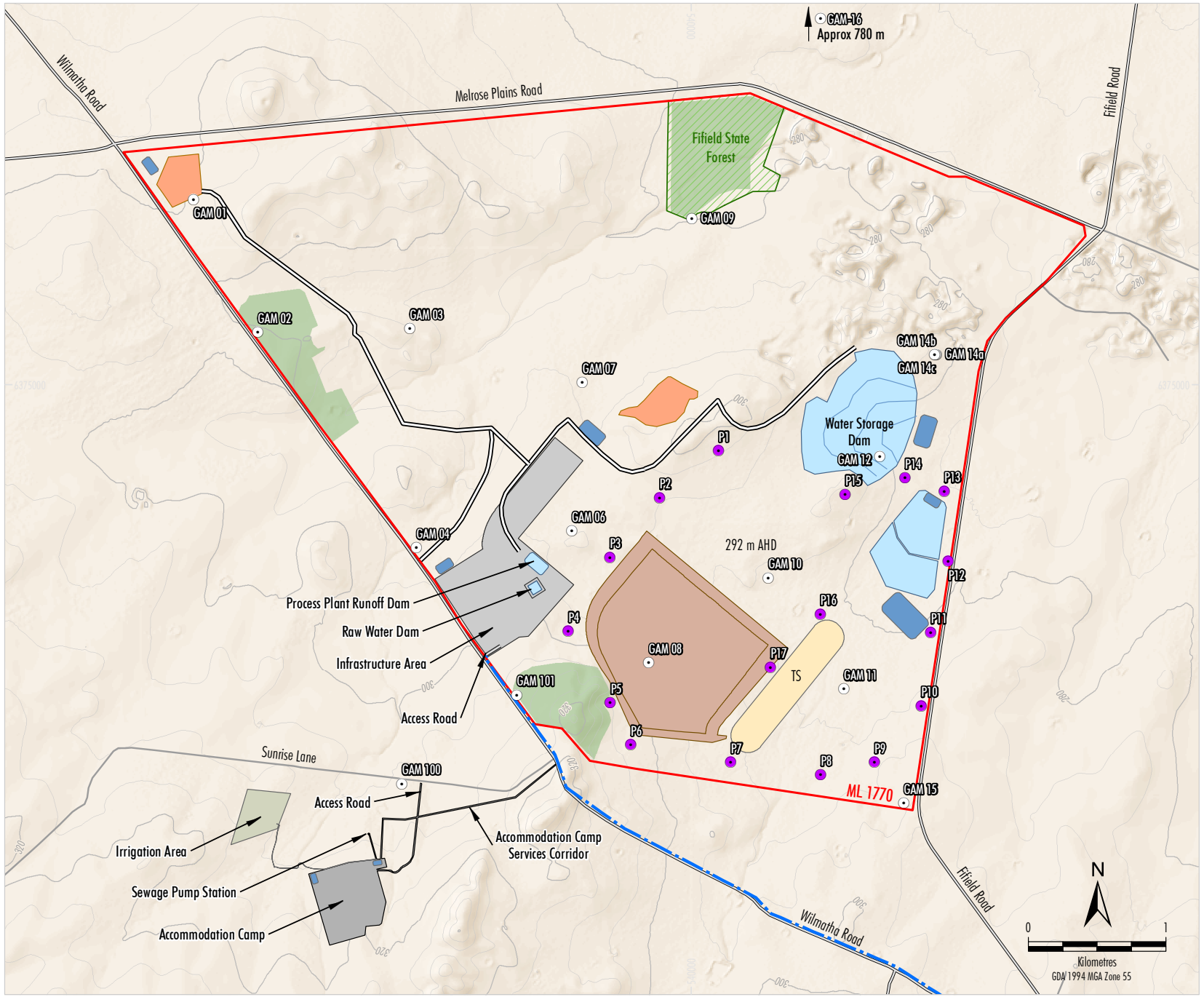
Construction Monitoring

During construction, baseline monitoring will continue to be collected from the existing groundwater monitoring network (GAM Series) (Figure 8). Logging of groundwater levels will be continued and data downloaded periodically.

The monitoring bores will also be utilised to monitor six monthly a suite of groundwater quality parameters including EC, pH, total dissolved solids, major cations, major anions and selected metals (Table 9).

A network of site-specific monitoring piezometers (Figure 8) will also be established during the course of construction for future operational monitoring associated with the potential impact of the tailings storage facility, evaporation pond and water storage dam on the groundwater table and groundwater quality.

A summary of the construction phase mine site groundwater monitoring program is provided in Table 9.



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Tailings Storage Facility
- Borrow Pit
- TS Topsoil Stockpile
- Infrastructure Area
- Water Storage
- Sediment Dam
- Existing Open Woodland to be Maintained
- Water Pipeline
- Groundwater Monitoring Location
- Proposed Piezometer Location

Source: Black Range Minerals (2000); Clean TeQ (2017, 2018); NSW Department of Industry (2018); NSW Land & Property Information (2017)

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Groundwater Monitoring Program - Mine Site

Figure 8

CTL-17-03 MP 2018_GWMP_203G

Table 9 – Mine Site Groundwater Monitoring Program

Monitoring Bore[1]	Parameter	Frequency
GAM Series (GAM-1, GAM-2, GAM-3, GAM-4, GAM-6, GAM-7, GAM-8, GAM-9a, GAM-10, GAM-11, GAM-12, GAM-14, GAM-14a, GAM-14b, GAM-15, GAM-100, GAM-101)	Water Level	Daily
	Water Quality (EC, pH, TDS, total alkalinity as $CaCO_3$, total anions, total cations, hardness, ammonia as N, nitrate as N, nitrite as N, sulphate as SO_4, carbonate alkalinity as $CaCO_3$, Na, K, Ca, Mg, Cl and total and dissolved Al, As, Cd, Cu Co, Cr, Fe Mn, Ni, Pb, Zn)	Six Monthly
Piezometer Series (P1 to P15) (once constructed)	Water Level	Daily
	Water Quality (EC, pH, TDS, total alkalinity as $CaCO_3$, total anions, total cations, hardness, ammonia as N, nitrate as N, nitrite as N, sulphate as SO_4, carbonate alkalinity as $CaCO_3$, Na, K, Ca, Mg, Cl and total and dissolved Al, As, Cd, Cu Co, Cr, Fe Mn, Ni, Pb, Zn)	Six Monthly

[1] Refer to Figure 8.

Operations Monitoring

The groundwater monitoring program for operations will be developed in a subsequent revision of this GWMP, including review and refinement of the existing groundwater monitoring network.

Notwithstanding the above, it is expected that during the first few years of operation, the existing network of groundwater bores at the mine site will continue to be monitored (logged) and samples collected periodically for quality analysis (e.g. EC, pH, total dissolved solids, major cations, major anions and selected metals). Thereafter, sampling may be reduced as required subject to review through the Annual Review process.

7.2 Borefields

The objectives of the groundwater monitoring program for the borefields are:

- to assess the usage, status and maintenance requirements of the production bores;
- to assess the quality of groundwater supplied to the mine site;
- to assess groundwater usage by others in the vicinity of the borefields;
- to identify potential groundwater impacts related to the Project;
- to identify when and what remedial action may be required to maintain access to groundwater for existing groundwater users, if impacts of pumping from the borefields become significant; and
- to obtain aquifer and surface water flow data for ongoing review and refinement of the groundwater model.

Baseline Monitoring

Baseline data collected from the existing groundwater monitoring network (MW-W1, ISMW01, ISMW02 and MW-E1) at the borefields (Figure 6) will continue to be recorded prior to the commencement of extraction at the borefields to add to the existing baseline datasets.

Construction Monitoring

During the initial construction activities (i.e. before the extraction of groundwater), the collection of baseline data from the existing groundwater monitoring network (MW-W1, ISMW01, ISMW02 and MW-E1) at the borefields (Figure 6) will continue. A summary of the borefields groundwater monitoring program is provided in Table 10.

Table 10 – Borefield Groundwater Monitoring Program

Monitoring Bore[1]	Parameter	Frequency
MW-W1, ISMW01, ISMW02 and MW-E1	Water Level	Continuous
	Water Quality (pH, EC, redox potential, temperature and dissolved oxygen)	Six Monthly

[1] Refer to Figure 6.

Consistent with the Secretary's approval for the progressive submission of environmental management plans, the monitoring program for the extraction phase of construction will be included in subsequent revisions of this GWMP.

Once extraction of water from the borefields has commenced during construction, based on the recommendations of HydroSimulations (in prep.), it is expected that the groundwater monitoring program will be progressively expanded to include:

- measurement of the groundwater level (with data-logging equipment) in the paired monitoring well adjacent to each the production bores;
- continuous measurement of groundwater usage at the flow meters equipped at the production bores;
- *in-situ* field measurements of groundwater quality at the production bores on a monthly basis for pH, EC, redox potential, temperature and dissolved oxygen;
- monthly measurement of groundwater levels in proposed piezometers and regional monitoring bores; and
- measurement of groundwater usage by neighbouring licensed irrigation bores and users (where access is available and metered).

Five piezometers (A to E) (Figure 9) will be progressively developed during the construction phase to add to existing borefield monitoring sites ISMW01 and ISMW02. At each production bore, a nearby monitoring piezometer screened in the Lachlan Formation will be used for monitoring (Piezometers A, B, D and E, ISMW01 and ISMW02). Piezometer C will be located approximately midway between the two groups of production bores, and will also include piezometers screened in the Upper Cowra and Lower Cowra formations.

The regional monitoring bores during the construction phase are expected to consist of 14 existing monitoring sites, including 12 NSW government monitoring sites (Figure 9).

In addition to the above, the following monitoring is proposed to obtain aquifer recharge and surface water data for ongoing review and refinement of the groundwater model, including:

- meteorological monitoring data from BoM Stations 50052 (Condobolin Agricultural Research and Advisory Station) and 50020 (Waroo); and
- surface flow from existing gauging stations on the Lachlan River (Figure 9) to monitor daily flows.

Additional detail on this component of the monitoring program will be included in subsequent revisions of this GWMP.

Operations Monitoring

The groundwater monitoring program for operations will be developed in a subsequent revision of this GWMP, including review and refinement of the existing groundwater monitoring network. Notwithstanding the above, it is expected that the construction stage monitoring program will continue and be expanded progressively during operations to include four additional regional groundwater monitoring sites (RB1 to RB4) (Figure 9 and Table 11).

LEGEND

- Water Pipeline
- Borefield Infrastructure Corridor *
- Borefield Location
- Production Bore (not constructed)
- Production Bore (constructed)
- Existing Borefield Monitoring Piezometer
- Proposed Borefield Monitoring Piezometer
- Regional Monitoring Bore (Existing)
- Regional Monitoring Bore (Proposed) ^
- Surface Water Flow Gauge

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

^ Indicative Location Only – Location to be confirmed in consultation with Natural Resources Access Regulator and relevant landholders.

Source: Ivanplats Syerston (2005); NSW Land & Property Information (2017); NSW DPI - Water (2018) NSW Imagery: Esri, DigitialGlobe (2017)

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Groundwater Monitoring Program - Borefields

Figure 9

CTL-17-03 MP 2018_GWMP_207D

Table 11 – Proposed Water Level Monitoring – Borefields [At Full Development]

Monitoring Bore	Screened Formation	Frequency
Project Borefield Monitoring		
Existing Sites		
ISMW01	Lachlan	Continuous
ISMW02	Lachlan	Continuous
Proposed Sites		
Piezometers A, B, D and E	Lachlan	Continuous
Piezometer C	Upper Cowra Lower Cowra Lachlan	Continuous
Regional Monitoring		
Existing Sites		
GW025165	Lower Cowra	Monthly
GW025167	Upper Cowra	Monthly
GW036083	Upper Cowra Lower Cowra	Monthly
GW036085	Lower Cowra	Monthly
GW036087	Lower Cowra Lachlan	Monthly
GW036088	Lachlan	Monthly
GW036089	Lower Cowra Lachlan	Monthly
GW036090	Lachlan	Monthly
GW036526	Cowra Lachlan	Monthly
GW036528	Upper Cowra	Monthly
GW036550	Lower Cowra	Monthly
GW036554	Upper Cowra	Monthly
MW-E1	Lachlan	Monthly
MW-W1	Lachlan	Monthly
Proposed Sites (Operations)		
RB1	Upper Cowra Lower Cowra Lachlan	Monthly
RB2	Upper Cowra Lower Cowra Lachlan	Monthly
RB3	Upper Cowra Lower Cowra Lachlan	Monthly
RB4	Upper Cowra Lower Cowra Lachlan	Monthly

8. CONTINGENCY PLAN

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, Clean TeQ will assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures.

In the event a water management performance measure for the Project (detailed in Section 5) may not have been met or a performance indicator is considered to have been exceeded, Clean TeQ will implement the following Contingency Plan:

- The Clean TeQ Environmental Superintendent will report the likely exceedance in accordance with Section 10.1.
- Clean TeQ will apply adaptive management (Section 8.1).
- Clean TeQ will identify an appropriate course of action with respect to the identified potential impacts or environmental consequences (if any), in consultation with specialists and relevant government agencies, as necessary. For example, contingency measures, such as, but not limited to, those described in Section 8.2.
- Clean TeQ will submit the proposed course of action to the DPIE for approval.
- Clean TeQ will implement the approved course of action to the satisfaction of the DPIE.

8.1 Adaptive Management

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, where any exceedance of the criteria and/or performance measures outlined in Schedule 3 of Development Consent DA 374-11-00 occurs, at the earliest opportunity Clean TeQ will:

- take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation and submit a report to the DPIE describing these options and preferred remediation measures; and
- implement remediation measures as directed by the Secretary.

8.2 Specific Contingency Measures

Specific contingency measures for an exceedance of the water management performance measures may include:

- The conduct of additional monitoring (e.g. increase in monitoring frequency or additional sampling), which may inform further specific contingency measures.

- Provision of equivalent water supply or compensation for an impacted privately-owned bore (refer Section 6.5).
- The provision of a suitable offset (e.g. water infrastructure improvement works such as replacing open channels with pipelines) if there was an environmental consequence and/or adverse groundwater impacts were to result.
- Obtain additional entitlements for the Project under the *Water Management Act 2000* if additional water supply is required.
- Adjust the scale of Project operations to match the available Project water supply if additional water supply is required and additional entitlements under the *Water Management Act 2000* are not available.

Clean TeQ will also implement any preferred contingency measures identified to address an incident as directed by the Secretary (Sections 8.1 and 10.1).

9. REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

9.1 Annual Review

In accordance with Condition 5, Schedule 5 of Development Consent DA 374-11-00, Clean TeQ will review the environmental performance of the Project by the end of March each year (for the previous calendar year) to the satisfaction of the Secretary.

In relation to water management, the Annual Review will (where relevant):

- describe the development that was carried out in the relevant calendar year, and the development that is proposed to be carried out during the following calendar year;
- include a comprehensive review of the monitoring results and complaints records of the development over the past year, which includes a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the Project Environmental Impact Statement (Black Range Minerals, 2000) and subsequent environmental assessments;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the development;
- identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the development.

The Annual Review will be made publicly available on the Clean TeQ website.

9.2 Independent Environmental Audit

In accordance with Condition 10, Schedule 5 of Development Consent DA 374-11-00, within one year of the commencement of the development after 6 May 2017, and every 3 years thereafter (unless the Secretary directs otherwise), Clean TeQ will commission and pay the full cost of an independent environmental audit of the Project. The independent environmental audit will be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary.

The independent environmental audit will assess the environmental performance of the Project and review the adequacy of this GWMP. If necessary, appropriate measures or actions to improve the environmental performance of the Project or this GWMP will be recommended.

The independent environmental audit, and Clean TeQ's response to the recommendations in the audit, will be made publicly available on the Clean TeQ website, in accordance with Condition 12, Schedule 5 of Development Consent DA 374-11-00.

10. REPORTING PROTOCOLS

In accordance with Condition 4(g), Schedule 5 of Development Consent DA 374-11-00, Clean TeQ has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in detail in Clean TeQ's Environmental Management Strategy.

In accordance with Condition 9, Schedule 5 of Development Consent DA 374-11-00, Clean TeQ will provide regular reporting on the environmental performance of the Project on the Clean TeQ website. The Annual Review will be made publicly available on the Clean TeQ website to address this requirement.

10.1 Incident Reporting

An incident is defined as a set of circumstances that causes or threatens to cause material harm to the environment and/or breaches or exceeds the limits or performance measures/criteria in Development Consent DA 374-11-00.

In the event that review of groundwater monitoring data indicates an incident has occurred, the incident will be reported in accordance with Condition 8, Schedule 5 of Development Consent DA 374-11-00. Clean TeQ will notify the Secretary and any other relevant agencies including the relevant Council immediately after it becomes aware of the incident. Clean TeQ will also notify any affected landholders of any incident that has caused, or threatens to cause, material harm to the environment.

Within seven days of the date of the incident, Clean TeQ will provide the Secretary and any other relevant agencies with a detailed report on the incident and such further reports as may be requested. The report will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe reasonable and feasible options to address the incident and identify the preferred option to address the incident (Section 8.1).

10.2 Complaints

Clean TeQ will maintain a Community Complaints Line (tel: 1800 952 277) and email address (community@cleanteq.com) for the sole purpose of receiving community contacts and complaints. The Community Complaints Line number will be available on the website and included in Clean TeQ's advertising and community communication tools. The Community Complaints line will be staffed 24 hours a day, seven days a week during construction and operations. Clean TeQ will respond to callers on the next business day. If the issue is urgent a member of the leadership team will be contacted immediately.

Clean TeQ has developed a procedure that outlines its commitment to receiving, resolving and recording complaints received from the community. Detailed records of each complaint resolution are kept in Clean TeQ's record management systems.

Complaints will be investigated within 24 hours of receipt. The cause of the complaint will be analysed and actions to resolve the complaint taken as soon as possible. In complex cases where resolution will take more than 48 hours, Clean TeQ will commit to update the community member regularly until the complaint is resolved.

In accordance with Condition 12(a), Schedule 5 of Development Consent DA 374-11-00, a complaints register will be made available on the Clean TeQ website and updated monthly.

10.3 Non-Compliances with Statutory Requirements

A protocol for managing and reporting non-compliances with statutory requirements has been developed as a component of Clean TeQ's Environmental Management Strategy and is described below.

Compliance with all approvals plans and procedures is the responsibility of all personnel (staff and contractors) employed on or in association with Clean TeQ and the Project.

The Clean TeQ Environmental Superintendent will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non-compliance.

As described in Section 10.1, Clean TeQ will report incidents in accordance with Condition 8, Schedule 5 of Development Consent DA 374-11-00 and in accordance with the protocol for industry notification of pollution incidents under Part 5.7 of the POEO Act.

Clean TeQ will notify the Secretary and any other relevant agencies including the relevant Council immediately after the authorised person becomes aware of the incident which causes or threatens to cause material harm to the environment. Within seven days of the date of the incident, Clean TeQ will provide the Secretary and any other relevant agencies with a detailed report on the incident and such further reports as may be requested.

A review of compliance with all conditions in Development Consent DA 374-11-00, Mining Lease 1770 and all other approvals and licences will be undertaken prior to (and included within) each Annual Review (Section 9.1).

Additionally, in accordance with Condition 10, Schedule 5 of Development Consent DA 374-11-00, an independent environmental audit (Section 9.2) will be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary to assess whether Clean TeQ is complying with the requirements in Development Consent DA 374-11-00, and any other relevant approvals, EPLs, and/or mining leases.

10.4 Exceedances of Impact Assessment Criteria and/or Performance

A protocol for managing and reporting exceedances of impact assessment criteria and/or performance criteria is provided is Section 8.

11. REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – The Guidelines*. National Water Quality Management Strategy. October 2000.

Black Range Minerals (2000) *Syerston Nickel Cobalt Project Environmental Impact Statement – Volume 1 Main Report.* October 2000.

Coffey (2016a) *Syerston Nickel Cobalt Project Groundwater Assessment: Data Analysis*. 9 December 2016.

Coffey (2016b) *Syerston Nickel Cobalt Project Water Supply Options Study*. 3 August 2016.

Coffey (2018a) *Clean TeQ Sunrise Project Baseline Groundwater Monitoring Report*. 27 August 2018.

Coffey (2018b) *Clean TeQ Sunrise Project Modification 4 – Response to EA Groundwater Submissions*. 22 May 2018.

Coffey (2018c) *Clean TeQ Sunrise Project – Sunrise Borefield Groundwater Level Monitoring*. 20 November 2018.

Coffey Geosciences Pty Ltd (2005a) *Groundwater Bore Survey - February 2005, Warroo, Jemalong, Wide Plans Area, NSW*. Report E12945/01-HL prepared for Ivanplats Syerston. April 2005.

Coffey Geosciences Pty Ltd (2005b) *Groundwater Supply Modelling Study, Syerston Nickel Mine, Warroo, NSW.* Report E12945/1-AY. November 2005.

Dams Safety Committee (DSC) (2012) *DSC3F – Tailings Dams.* Dated June 2012.

Dams Safety Committee (DSC) (2015) *DSC3A – Consequence Categories for Dams.* Dated June 2010 and updated in November 2015.

Department of Environment and Climate Change (DECC) (2008a) *Managing Urban Stormwater: Soils and Construction Volume 2A – Installation of Services*. January 2008.

Department of Environment and Climate Change (DECC) (2008b*) Managing Urban Stormwater: Soils and Construction Volume 2C – Unsealed Roads.* January 2008.

Department of Environment and Climate Change (DECC) (2008c) *Managing Urban Stormwater: Soils and Construction Volume 2E – Mines and Quarries*. June 2008.

Department of Land and Water Conservation (1998) *The NSW Groundwater Quality Protection Policy*.

Department of Primary Industries (DPI) Fisheries NSW (2013) *Policy and Guidelines for Fish Habitat Conservation and Management.* June 2013.

Department of Primary Industries (DPI) Office of Water (2012) *Controlled Activities on Waterfront Land – Guidelines for Riparian Corridors on Waterfront Land.* July 2012.

Environment & Natural Resource Solutions (ENRS) (2019a) *Groundwater Bore Census Clean TeQ Sunrise Project Mine Site Bore Census – Fifield*.

Environment & Natural Resource Solutions (ENRS) (2019b). *Groundwater Bore Census Clean TeQ Sunrise Project Borefield Bore Census – Bedgerabong, Jemalong, Ootha, and Warroo.*

Fairfull, S. and Witheridge, G. (2003) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.* NSW Fisheries, January 2003.

Golder Associates (2000a) *Regional and Local Hydrogeology Impacts of the Proposed Syerston Nickel Mine, Fifield New South Wales.* March 2000.

Golder Associates (2000b) *Hydrogeological Impacts of the Tailings Storage Facility of the Proposed Syerston Nickel Mine, Fifield New South Wales.* March 2000.

Golder Associates (2017) *Syerston Project Modification 4 Water Management Assessment*.

Green, D., Petrovic, J., Moss, P. and Burrell, M. (2011) *Water Resources and Management Overview: Lachlan Catchment.* NSW Office of Water, Sydney.

Landcom (2004) *Managing Urban Stormwater: Soils and Construction Volume 1.* March 2004.

Murray Darling Basin Commission (2005) *National Land and Water Resources Audit.*

NSW Government (2012) *NSW Aquifer Interference Policy.*

Williams B.G. (1993) *The shallow groundwater hydrology of the Jemalong – Wyldes Plains Irrigation Districts.* NSW Department of Agriculture.

ATTACHMENT 1

Mine Site Water Quality Results

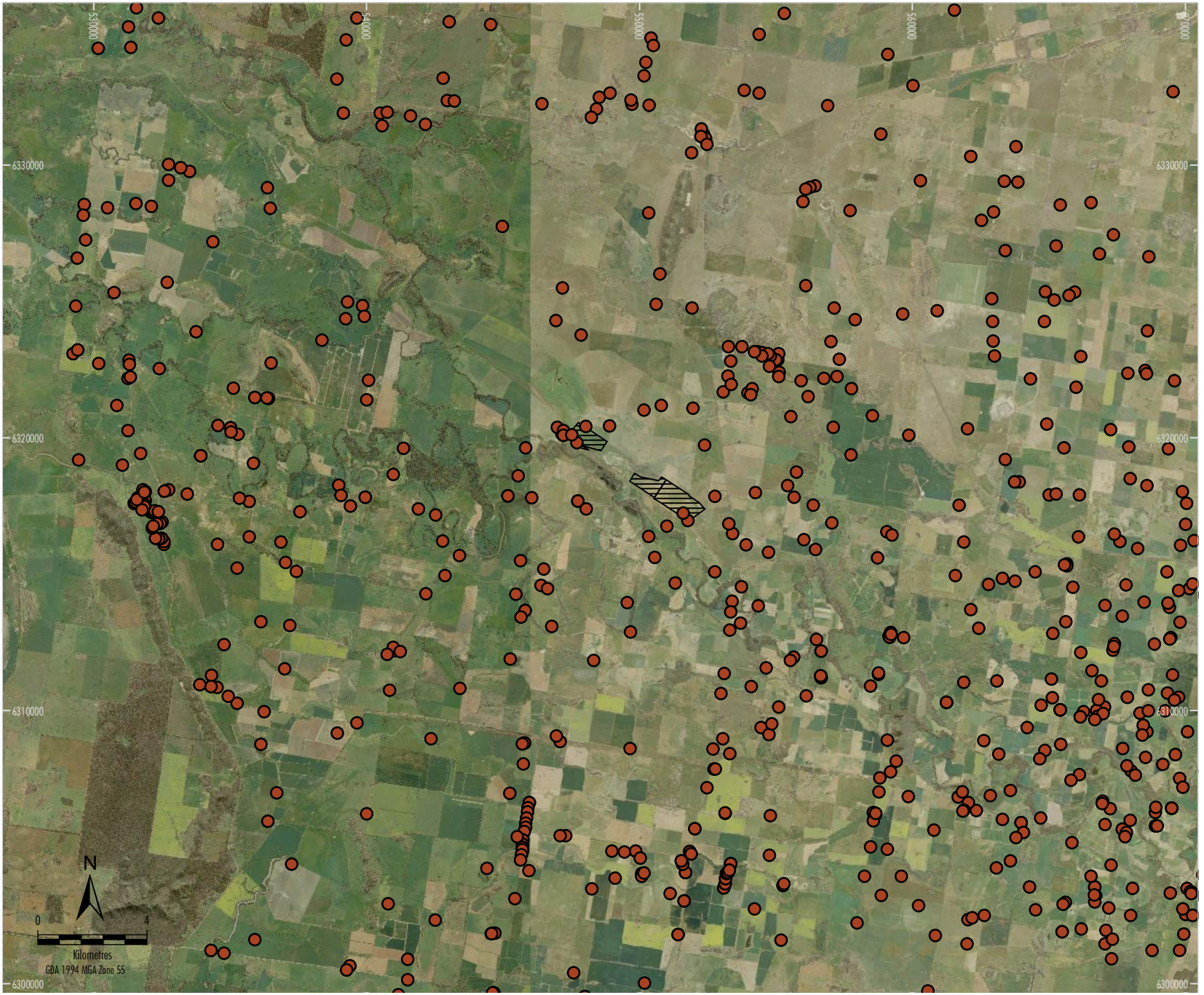
Table LR1 - Analytical Results - June 2018

						Sample ID	Andersons Pit	GAM1	GAM2	GAM3	GAM4	GAM6	GAM7	GAM8	GAM10	GAM11	GAM12	GAM14C	GAM15	GAM16	GAM100	GAM101
						Sample type	Surface water	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
						Date sampled	07-Jun-18	07-Jun-18	07-Jun-18	08-Jun-18	07-Jun-18	12-Jun-18	07-Jun-18	13-Jun-18	12-Jun-18	07-Jun-18	13-Jun-18	13-Jun-18	12-Jun-18	08-Jun-18	08-Jun-18	08-Jun-18
Analytical Group	Analyte	Units	LOR	ANZECC 2000 Primary Industry (Livestock)	Australian Drinking Water Guidelines 2011 Health (NHMRC)	ANZECC 2000 Freshwater 95%																	
Physical Parameters	Lab Electrical Conductivity	µS/cm	1				140	340	822	1620	1460	1480	1180	10400	5780	14800	1400	2070	4230	5430	6320	6910
	Lab Total Dissolved Solids	mg/L	10	2000 [6]	600 [1]		81	214	452	812	851	763	588	6020	3090	10300	798	934	2420	3540	3980	4080
	Field pH	Units	0.1		6.5 - 8.5 [1]	6.5 - 7.5 [5]	8.9	6.7	8.3	7.0	7.2	8.0	8.8	7.0	8.7	6.8	8.6	7.3	7.3	6.9	7.2	8.9
	Field Redox	mV	1				97	198	135	257	97	151	107	230	191	141	91	96	86	165	248	144
	Field Temperature	°C	0.1				16.6	18.6	17.2	17.8	20.9	19.3	18	17.1	18.5	18.8	18.1	19	17.2	17.1	16.9	18.2
Nutrients	Ammonia as N	mg/L	0.01		0.5 [1]	0.9 [4]	0.16	0.02	-	-	-	-	-	-	-	<0.01	-	-	-	-	-	-
	Kjeldahl Nitrogen Total	mg/L	0.1				0.7	0.4	-	-	-	-	-	-	-	<0.2	-	-	-	-	-	-
	Nitrate (as N)	mg/L	0.01	400	50	0.7	<0.01	1.3	-	-	-	-	-	-	-	2.33	-	-	-	-	-	-
	Nitrite (as N)	mg/L	0.01	30	3		<0.01	<0.01	-	-	-	-	-	-	-	<0.01	-	-	-	-	-	-
	Nitrite + Nitrate as N	mg/L	0.01				<0.01	1.3	-	-	-	-	-	-	-	2.33	-	-	-	-	-	-
	Nitrogen (Total)	mg/L	0.1			0.25 [5]	0.7	1.7	-	-	-	-	-	-	-	2.3	-	-	-	-	-	-
	Total Phosphorus as P	mg/L	0.01			0.02 [5]	<0.01	0.02	-	-	-	-	-	-	-	<0.02	-	-	-	-	-	-
Major Cations and Anions	Calcium (Filtered)	mg/L	1	1000			4	12	57	28	75	66	2	111	90	347	46	54	114	161	13	16
	Magnesium (Filtered)	mg/L	1				8	<1	55	200	86	66	58	251	286	475	8	132	178	339	67	38
	Potassium (Filtered)	mg/L	1				10	2	2	1	2	6	4	20	14	19	3	4	7	12	24	17
	Sodium (Filtered)	mg/L	1				6	54	43	47	84	123	147	1780	725	2000	223	164	517	399	1380	1440
	Alkalinity (Hydroxide) as CaCO3	mg/L	1				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Alkalinity (Bicarbonate) as CaCO3	mg/L	1				65	75	412	1010	553	236	348	949	788	814	137	655	856	620	1530	704
	Alkalinity (Carbonate) as CaCO3	mg/L	1				<1	<1	23	<1	<1	<1	56	<1	9	<1	<1	<1	<1	<1	<1	167
	Alkalinity (Total) as CaCO3	mg/L	1				65	75	435	1010	553	236	404	949	796	814	137	655	856	620	1530	871
	Chloride	mg/L	1				6	30	51	57	170	332	173	2110	1350	4210	218	295	708	1420	1060	1420
	Sulfate as SO4	mg/L	1	1000			<1	41	12	10	31	75	14	2080	437	1550	248	40	561	160	419	584
	Cations Total	meq/L	0.01				1.37	3	9.29	19.9	14.5	14.2	11.4	104	59.9	144	12.7	20.8	43	53.6	66.8	67
	Anions Total	meq/L	0.01				1.47	3.2	10.4	22	16.5	15.6	13.2	122	63.1	167	14	22.2	48.8	55.8	69.2	69.6
	Ionic Balance	%	0.01				-	3.22	5.53	4.93	6.33	4.73	7.61	7.81	2.57	7.52	4.93	3.36	6.26	1.99	1.76	1.92
Metals (Dissolved for groundwater (field filtered) and total for surfacewater)	Aluminium	mg/L	0.01	5	0.2 [1]	0.055	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aluminium (Filtered)	mg/L	0.01	5	0.2 [1]	0.055	-	0.08	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.03	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.08
	Arsenic	mg/L	0.001	0.5	0.01	0.013 [3]	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arsenic (Filtered)	mg/L	0.001	0.5	0.01	0.013 [3]	-	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.006	0.002	<0.001	<0.001	0.001	0.012
	Boron	mg/L	0.05	5	4	0.37	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Boron (Filtered)	mg/L	0.05	5	4	0.37	-	<0.05	0.08	0.11	0.11	0.1	<0.05	0.13	0.16	0.13	0.28	0.22	0.13	0.18	0.14	0.07
	Cadmium	mg/L	0.0001	0.01	0.002	0.0002	<0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium (Filtered)	mg/L	0.0001	0.01	0.002	0.0002	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0037	0.0002	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	1	0.05 [2a]	0.0033 [2b]	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chromium (Filtered)	mg/L	0.001	1	0.05 [2a]	0.0033 [2b]	-	<0.001	0.026	0.009	0.015	0.002	0.006	<0.001	0.002	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.009
	Cobalt	mg/L	0.001	1			<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cobalt (Filtered)	mg/L	0.001	1			-	<0.001	<0.001	0.001	<0.001	0.003	<0.001	0.008	<0.001	0.002	<0.001	0.003	0.006	<0.001	0.01	<0.001
	Copper	mg/L	0.001	0.4	2	0.0014	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper (Filtered)	mg/L	0.001	0.4	2	0.0014	-	0.009	0.012	0.007	0.009	0.013	0.008	0.098	0.246	0.003	0.005	0.011	0.007	0.007	0.007	0.008
	Iron	mg/L	0.05		0.3 [1]		0.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Iron (Filtered)	mg/L	0.05		0.3 [1]		-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	<0.05	<0.05	0.19	<0.05	<0.05	<0.05
	Lead	mg/L	0.001	0.1	0.01	0.0034	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lead (Filtered)	mg/L	0.001	0.1	0.01	0.0034	-	0.001	0.005	<0.001	0.005	0.01	0.006	<0.001	0.011	<0.001	<0.001	0.015	0.002	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001		0.5	1.9	0.028	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manganese (Filtered)	mg/L	0.001		0.5	1.9	-	0.006	0.013	<0.001	0.003	0.129	0.009	0.052	0.032	0.035	0.094	0.057	0.193	0.002	0.652	0.039
	Mercury	mg/L	0.0001	0.002	0.001	0.0006	<0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mercury (Filtered)	mg/L	0.0001	0.002	0.001	0.0006	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.001	1	0.02	0.011	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nickel (Filtered)	mg/L	0.001	1	0.02	0.011	-	0.005	0.006	0.014	<0.001	0.101	0.001	0.01	0.143	0.002	<0.001	0.004	0.002	0.002	0.012	0.002
	Silver	mg/L	0.001		0.1	0.00005	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Silver (Filtered)	mg/L	0.001		0.1	0.00005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Vanadium	mg/L	0.01				<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vanadium (Filtered)	mg/L	0.01				-	<0.01	0.03	<0.01	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	0.02
	Zinc	mg/L	0.005	20	3 [1]	0.008	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zinc (Filtered)	mg/L	0.005	20	3 [1]	0.008	-	0.008	0.026	0.008	0.006	0.029	<0.005	0.021	0.054	<0.005	0.01	0.022	0.013	0.007	0.009	0.006

Notes:
- = not analysed
ANZECC = Australia and New Zealand Environment and Conservation Council
NHMRC = National Health and Medical Research Council
LOR = Limit of Reporting
1. Aesthetic guideline value (ADWG 2011)
2a. Chromium guideline value as Cr VI (ADWG 2011)
2b. Chromium trigger value as Cr III, low reliability indicative interim working level (IIWL) (ANZECC 2000)
3. Arsenic trigger value as As V (ANZECC 2000)
4. Ammonia trigger value at pH 8. For changes in trigger values with pH refer to Section 8.3.7.2 (ANZECC 2000)
5. ANZECC 2000 default trigger values for physical and chemical stressors for south east Australia for slightly disturbed ecosystems. Upland river values adopted (> 150 m altitude)
6. TDS guideline depends on livestock. No adverse effects expected on animals as follows:
Poultry < 2000 mg/L
Dairy cattle < 2500 mg/L
Pigs, horses, beef cattle < 4000 mg/L
Sheep < 5000 mg/L

ATTACHMENT 2

Bore Census (2018) and Registered Bore (2019) Records for Borefields and Surrounds



LEGEND

Registered NSW PINNEENA Groundwater Bore

Potential Project Borefield Location

Source: NSW Department of Primary Industries, Office of Water (2014)
Ortho: NSW Department of Finance, Services and Innovation (2017)

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Registered Bore (PINNEENA) Records for Borefield and Surrounds

CTL-16-02_BC_Pinneena_Records_201A