



Appendix H

Surface water impact assessment

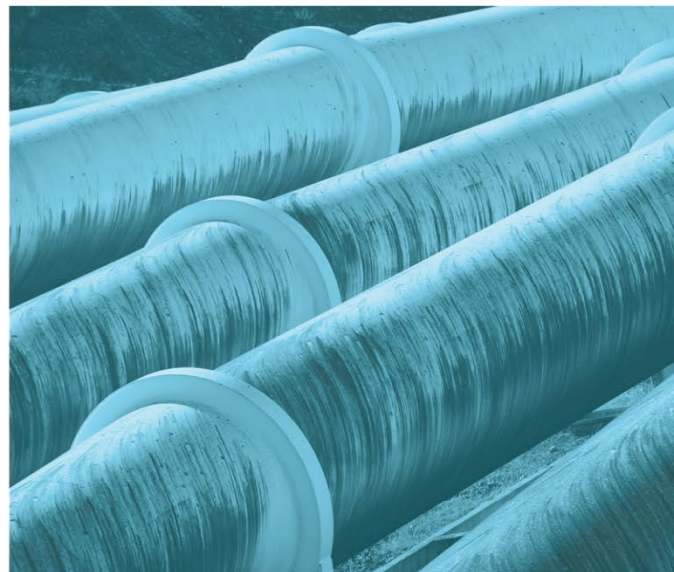




Balranald Minerals Sands Project - Modification of Consent (SSD-5285)

Surface water assessment

Prepared for Iluka Resources Limited
May 2022





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Balranald Minerals Sands Project - Modification of Consent (SSD-5285)

Surface water assessment

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28 April 2021

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28 April 2021

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1 Introduction

EMM Consulting Pty Limited (EMM) was commissioned by Iluka Resources Limited (Iluka) to undertake a Surface Water Assessment (SWA) of the proposed modification (MOD1) to the approved Balranald Mineral Sands Project (the Balranald Project) in south-western New South Wales (NSW).

The purpose of this SWA is to assess the predicted environmental impacts of the proposed modification against the predicted impacts of the approved project as follows:

- loss of surface water catchment area;
- site inundation risk;
- interference with flooding;
- water quality effects due to mine affected runoff and mine water discharges; and
- site water balance.

This report will support a modification report which will be submitted to the NSW Department of Planning, Infrastructure and Environment (DPIE) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Project background

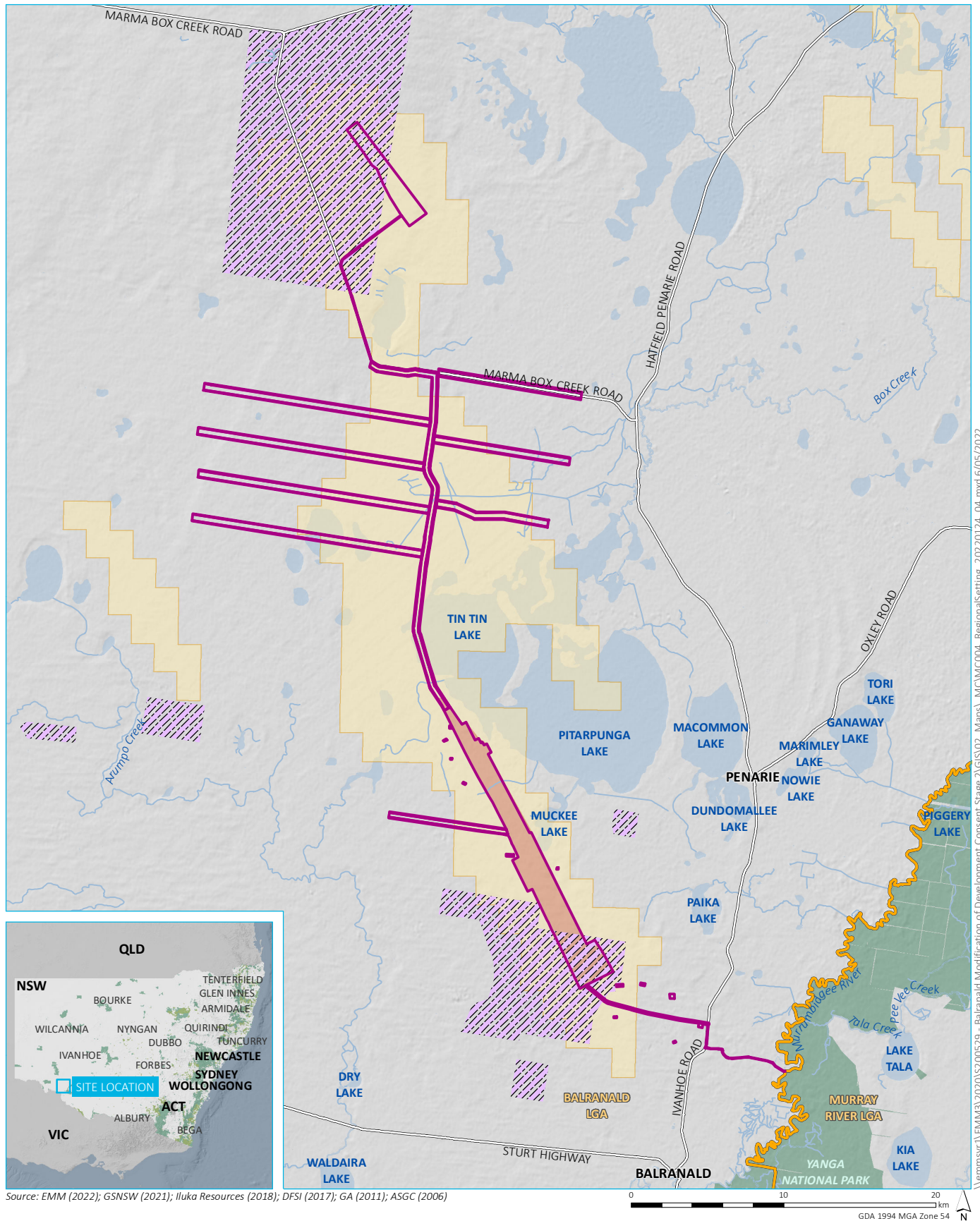
Iluka has approval to develop a mineral sands mine in south-western (NSW), known as the Balranald Project. It includes construction, mining, primary processing, and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean deposits, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald (Balranald town), respectively.

An environmental impact statement (EIS) was prepared and submitted in 2015 to accompany a State significant development (SSD-5285) application under Part 4 of the EP&A Act for an open cut, truck and shovel mining method. Development consent was granted by DPIE under Part 4 of the EP&A Act on 5 April 2016. The Balranald Project also included undertaking a bulk sampling activity at the West Balranald mine to test the removal of ore using underground mining methods.

The regional setting and approved EIS project area are shown on Figure 1.1.

Since development consent was granted in April 2016, Iluka has undertaken the approved bulk sampling activity involving the extraction of mineralised material or ore, from depth within the approved disturbance area of the West Balranald mine.

The outcome of the bulk sampling activities confirmed the effectiveness of the underground mining method, validated key elements of the mining unit design and have been used to help guide the proposed modification to inform the potential suitability (ie commerciality and reduced environmental impacts) of underground mining as an alternative method for resource extraction for the Project.



KEY

- EIS Approved Balranald Project Area (SSD-5285)
- Exploration Licence (EL7450)
- Mining Lease (ML1736)
- Southern Mallee Conservation Area (2015)
- Major road
- Watercourse/drainage line
- Waterbody
- NPWS reserve

Local government area

INSET KEY

- NPWS reserve
- State forest

Regional Setting and EIS Approved Balranald Project Area (SSD-5285)

Balranald Mineral Sands Project
Modification of consent
Figure 1.1

1.2 Description of modification

The proposed MOD1 would involve:

- continuing underground mining within a portion of the approved disturbance footprint of the West Balranald deposit pursuant to the consent (ie mining area); and
- development of approved mineral processing infrastructure within a proposed new area of disturbance (ie surface infrastructure).

The construction of infrastructure would be undertaken to support the construction and operation for proposed underground mining, including mineral processing infrastructure, access roads, upgrade of external roads and intersections, gravel extraction, monitoring infrastructure, accommodation facility, road transport of ore offsite for downstream processing and other infrastructure as required.

The majority of this infrastructure would be required regardless of the mining method (ie open cut as approved under the development consent, or underground). For all other land located outside of the proposed modification area, ie other areas of the West Balranald mine and the Nepean mine, Iluka proposes no change to the currently approved open cut mining method at this stage.

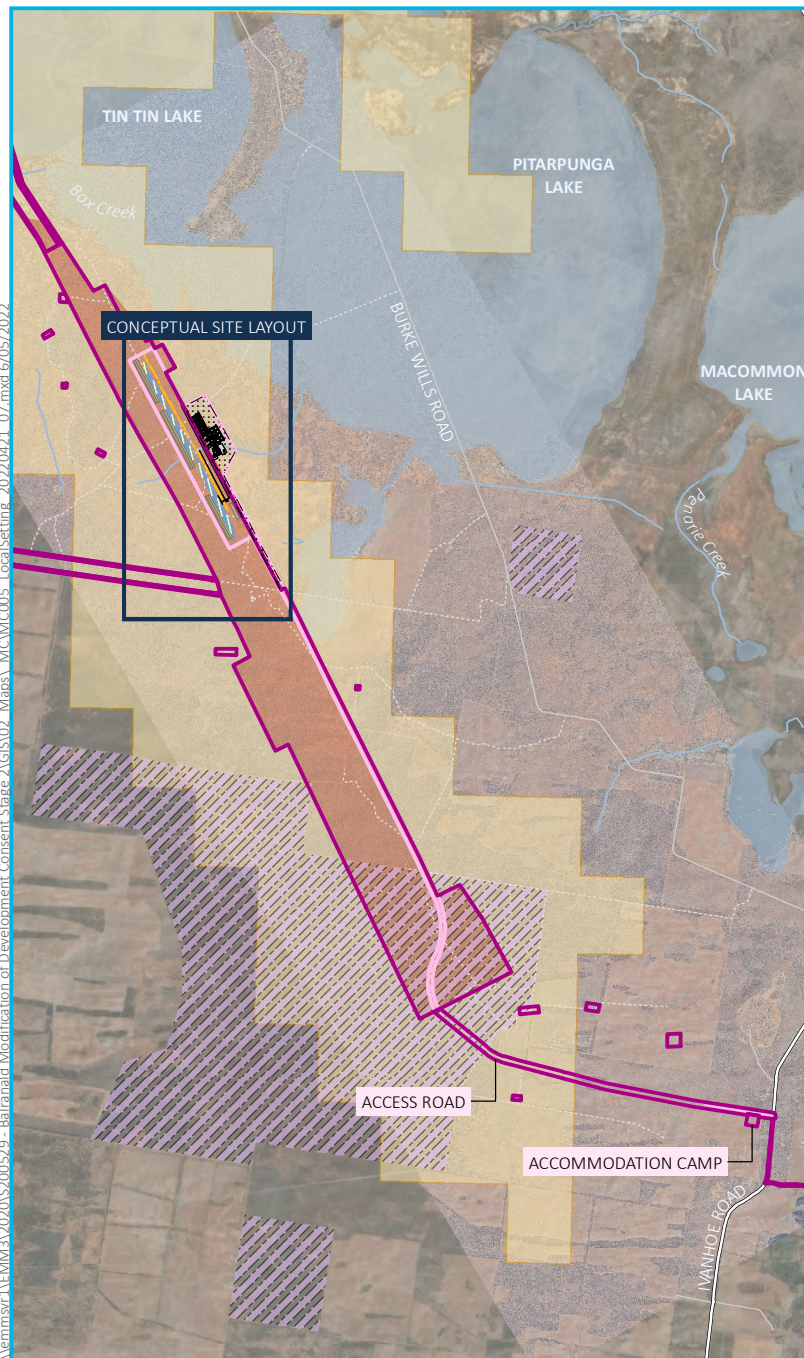
The underground mining process would involve:

- clearing the footprint directly above the mining area – the area will be stripped of topsoil, subsoil and non-saline overburden to a nominal depth of 2 metres (m);
- surface placement of treated sand tails and overburden/subsoil ahead of mining into the space created by the above stripping;
- underground mining of the ore;
- processing of the mined ore to separate the heavy mineral concentrate (HMC) from sand tails, sand fines and oversize;
- stockpiling of the HMC;
- backfilling of sand fines underground;
- replacement of subsoil and topsoil for rehabilitation and final landform; and
- environmental monitoring activities (including groundwater, geochemistry, subsidence, air quality and noise).

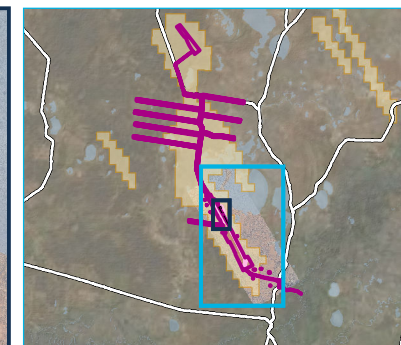
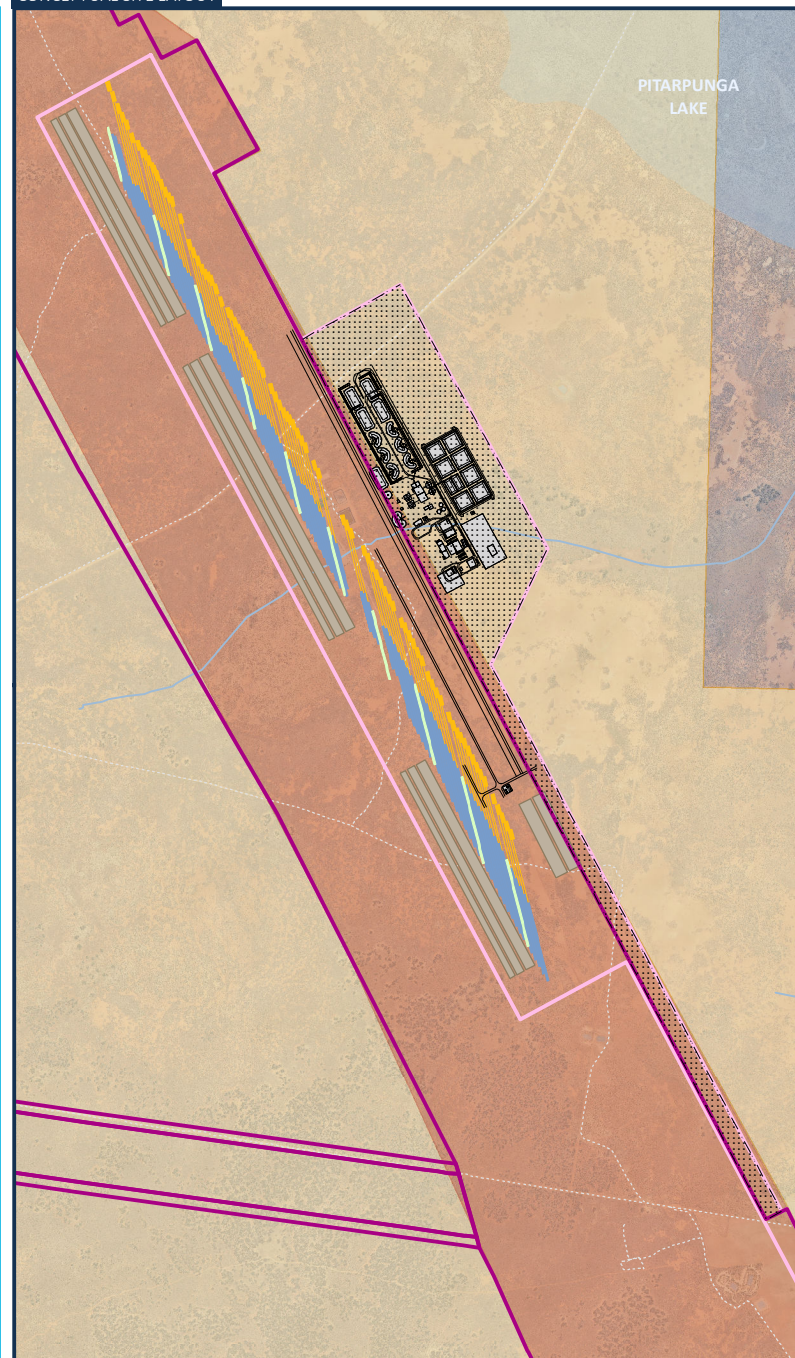
Ore is expected to be produced and processed at a rate no greater than approved under the development consent. The processing plant on site will produce a HMC to generate two primary product streams; magnetic HMC and non-magnetic HMC.

The product would be stockpiled and transported off-site for downstream processing with underground mining operations to be undertaken for a period of 6 years.

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CONCEPTUAL SITE LAYOUT



KEY

- EIS Approved Balranald Project Area (SSD-5285)
- Proposed modification study area
- Proposed modification extension to Balranald Project Area boundary
- Processing area infrastructure
- Subsoil stockpile
- Drill pad and string to underground stope
- Underground stope
- Underground pillar
- Major road
- Minor road
- Existing track
- Watercourse/drainage line
- Waterbody
- Southern Mallee Conservation Area (2015)
- Exploration Licence (EL7450)
- Mining Lease (ML1736)

Proposed modification and conceptual site layout

Balranald Mineral Sands Project
Modification of consent
Figure 1.2

2 Existing environment

2.1 Existing environment description

2.1.1 Regional setting

The Murrumbidgee and Murray Rivers are the major permanent surface water features in the vicinity of the MOD1 project area, shown in Figure 2.1. These rivers provide key water resources for large populations within the Murray-Darling Basin (MDB) including town water supplies, agricultural and the environmental supplies.

The Murrumbidgee River is about 13 km south-east of the project area, and flows in a south-westerly direction, to its confluence with the Murray River about 60 km to the south-west of the MOD1 Project Area. The Lachlan River terminates at the Great Cumbung Swamp, approximately 42 km east of the MOD1 project area, further upstream this is a major permanent surface water feature. During very high flood events the Lachlan River can flow into the Murrumbidgee River.

There are a number of non-permanent waterways and lakes within the broader Balranald Project area that contribute to the Lachlan and Murrumbidgee River distributor systems. The ephemeral waterways branch off from the main river channels, carrying water away from rivers during high flows and facilitating floodplain inundation.

Flows within the Lachlan, Murrumbidgee and Murray Rivers are regulated by major dams in their headwaters, and by local regulating structures such as Balranald Weir and the Paika levee, which divert water for irrigation purposes. A number of ancient lakes that would be otherwise dry (eg Waldaira, Yanga and Paika Lakes) are artificially filled from river flows (CEWO, 2020).

The main waterway in the MOD1 project area is Box Creek, an ephemeral watercourse and a distributary of the Lachlan River lying approximately 3.5 km to the north-west of the MOD1 project area. Almost all of the MOD1 project area is located within the Box Creek catchment. Box Creek is ephemeral and only flows during and immediately following heavy local rainfall or large flooding events in the Lachlan River; flow has only occurred in Box Creek on several occasions in the last 60 years (WRM, 2015).

Tin Tin, Pitarpunga and Muckee Lakes previously functioned as overflow lakes via Box Creek but have been predominantly dry for at least the last few hundred to thousand years. These dry lakes may receive water from Box Creek infrequently during flood events. The southern end of the West Balranald deposit is approximately 10 km to the north of the Murrumbidgee River. The confluence of the Murrumbidgee and the Murray rivers is approximately 30 km to the south-west of the deposit. The proximity of the West Balranald deposit to the Murrumbidgee and Murray Rivers necessitates the SWA considers these significant water bodies. The Lachlan River meets the Murrumbidgee River approximately 42 km north-east of Balranald (at the Great Cumbung Swamp), although it contributes flows only periodically in very high flow events.

2.1.2 Riparian environments

The Great Cumbung Swamp Area, a 16,000 hectare (ha) swamp located 45 km ENE of the MOD1 project area, is listed in the Directory of Important Wetlands in Australia (DAWE, 2021). The Swamp Area is a series of dry lakes and associated lunettes that supports large areas of reeds and riverine woodland species on the surrounding floodplain. The reed bed, the core of the Great Cumbung Swamp, provides drought refuge and supports a large number of waterbirds, some of which are considered vulnerable at State level (DPIE, 2020). The Great Cumbung Swamp joins the Murrumbidgee River to the south and becomes part of the Lower Murrumbidgee (Lowbidgee) Floodplain.

Yanga Lake, a 1,000 ha ephemeral waterbody located 35 km SSE from the MOD1 project area and 8 km south from Balranald, is also listed in the Directory of Important Wetlands in Australia (DAWE, 2021). Yanga Lake is located within Yanga National Park, and receives environmental water from the Murrumbidgee River at the direction of environmental water holders. When inundated, the lake can provide habitat for native water birds and fish species.

The Lowbidgee floodplain, on the lower reaches of the Murrumbidgee River catchment to the south-west of the Cumbung Swamp, comprises permanent and intermittent rivers, streams, and creeks as well as saline to brackish lakes and marshes. These surface water features support freshwater marshes and ponds, and shrub and tree dominated wetlands (Hardwick & Maquire, 2012). The wetlands support some of the largest water bird breeding colonies in Australia. The Lowbidgee floodplain is listed as a Nationally Important Wetland in the Directory of Important Wetlands of Australia; subsequently it is subject to a number of national and international agreements to protect its ecological assets.

Riparian environments are not considered further in this surface water assessment as surface water runoff in the vicinity of the project would not reach these features (see Section 2.1.5).

2.1.3 Geomorphology

The MOD1 project area lies in the Murray Basin, an extensive low lying, intra-cratonic sedimentary basin of Cainozoic age (60 million years before present (BP)) covering part of NSW, Victoria and South Australia (Brown and Stephenson 1991). The Murray Basin forms part of the larger Murray Darling Basin (MDB), which is divided into the northern Basin (Darling system) and the southern Basin (Murray system). It sits within the continental crust and the stratigraphic sequences are dominated by consolidated sand, silt, clay, and lime-rich sediments, formed by marine, deltaic, fluvial and aeolian depositional environments. Landforms in the project area have formed in either the Pleistocene period (approximately 2.5 million to 12,000 years BP) or the Holocene period (approximately 12,000 years to the present).

2.1.4 Surface water quality

The Murrumbidgee and Murray Rivers in the vicinity of the MOD1 project area contain fresh water supplies that are frequently used for purposes such as town water supply and irrigation however this is not considered further in this surface water assessment as no water will be discharged to these rivers.

2.1.5 Site drainage

Due to the dry climate, flat landscape, and large areas of permeable soils, there is little locally derived runoff in the MOD1 project area and no permanent surface water sources. Extremely heavy local rainfall events are capable of filling local depressions, including dry relic beds and creating temporary flow in drainage features, such as Box Creek.

During Lachlan River flood conditions, Merrowie Creek (Figure 2.1) may receive flood waters. If flood conditions are high and sustained, flood waters may traverse Merrowie and Middle creeks to Tarwong Lake, located 96 km NE from the MOD1 project area. From Tarwong Lake, flood waters may flow along Box Creek for approximately 150 km, through a number of typically dry ephemeral lakes before reaching Muckee, Pitarpunga and Tin Tin Lakes.

Muckee, Pitarpunga and Tin Tin Lakes lie to the north and east of the MOD1 project area. If these lakes become full (they are typically dry), water will drain to the Box Creek outlet of Tin Tin Lake to the west of the MOD1 project area and flow south to Arumpo Creek and then to the Murrumbidgee River, approximately 30 km south-west of the MOD1 project area.

The majority of the MOD1 project area drains into dry lakes or depressions; very little to no local runoff enters Box Creek (WRM, 2015) (cf Figure 4.1).

2.1.6 Surface water groundwater interactions

In the MOD1 project area there is limited recharge of groundwater from direct rainfall due to low rainfall and high evaporation rates meaning that rainfall which wets the soil profile typically evaporates or is transpired by vegetation or crops. The Loxton-Parilla Sands and the Olney Formation is recharged via through flows from areas to the east of the MOD1 project area.

The ancient and dry lakes in the vicinity of the MOD1 project area (ie Tin Tin, Pitarpunga and Muckee lakes) with relatively lower topography and apparent surface salinisation likely experience evaporative losses from the watertable and form localised groundwater discharge features.

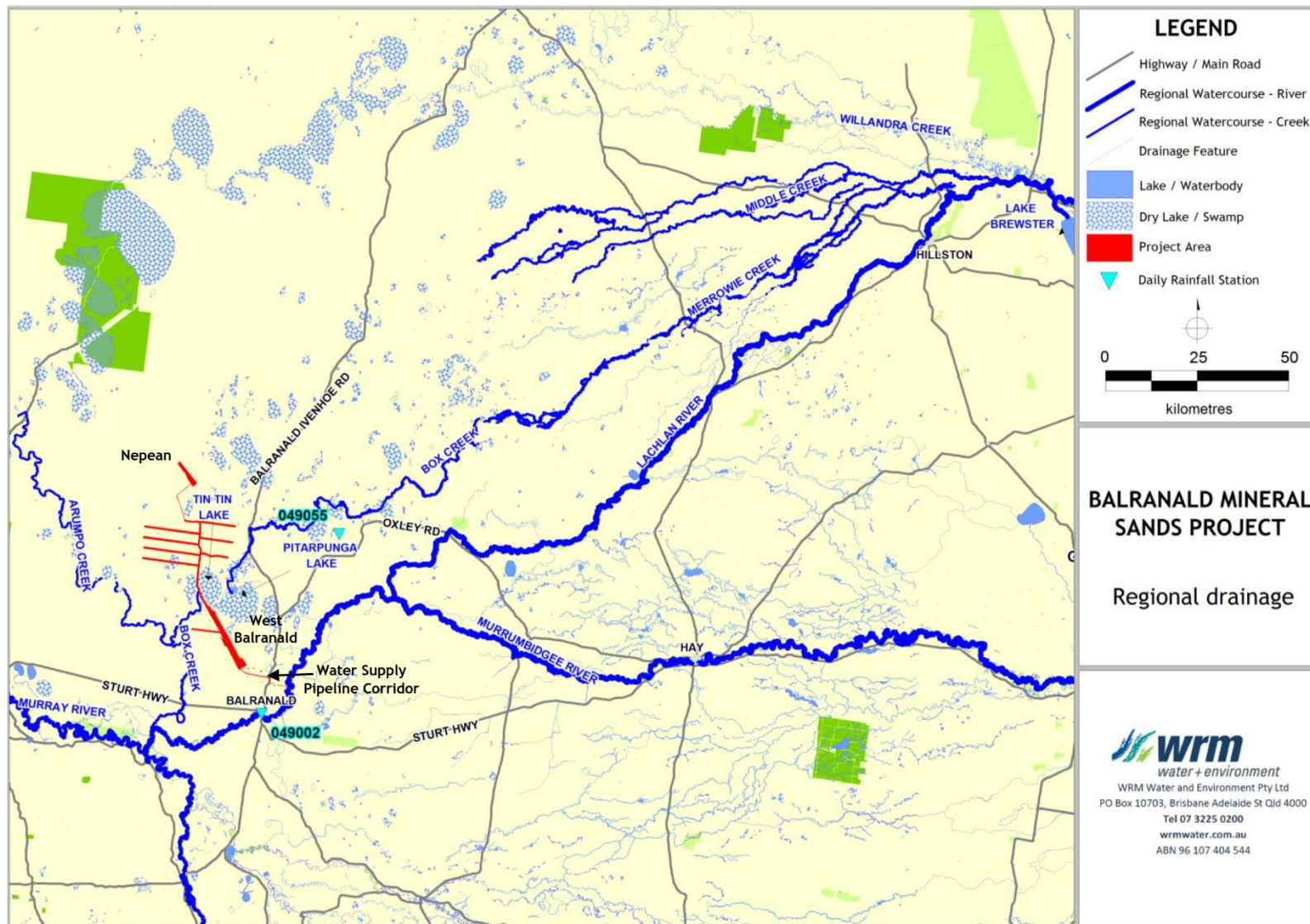


Figure 2.1 Regional surface water features and approved activities project area (WRM, 2015)

3 Summary of the 2015 SWMR

The 2015 Surface Water Management Report (SWMR) prepared by WRM in 2015 examined predicted surface water impacts of the approved Balranald Project (SSD-5285) as summarised below.

3.1 Water management strategy

The Balranald Project approved strategy for the management of water is based on the separation of water from different sources based on anticipated water quality, as follows:

- Saline groundwater dewatered from the Loxton Parilla Sands. Some saline groundwater would be used to satisfy mine water demands and reinjected into the Loxton Parilla Sands. Brackish water would also be sourced from the Lower Renmark Aquifer.
- Mine affected water, comprising runoff and groundwater inflow to the pit collecting in the active mining area at the West Balranald mine, runoff from saline overburden (SOB) and potentially acid forming (PAF) material stockpiles and runoff from the mining unit plant (MUP) area and processing area (including run of mine (ROM) pad, and tailings and mining by-product stockpiles).

Management would include:

- seepage, groundwater, and surface runoff inflows to the active mining area would be collected in onsite storages and used preferentially to satisfy mine site water demands; and
- runoff from the MUP area and processing area, and the SOB and PAF stockpiles would also be collected in onsite storages and used to satisfy mine site water demands.
- Sediment laden water, comprising runoff from the active mining area at the Nepean mine, and runoff from non-saline overburden (NSOB), topsoil and subsoil stockpiles. Surface runoff from NSOB stockpiles and the active mining area and ROM pad at the Nepean mine would be captured and treated in sediment dams and used for dust suppression (or released from the site via spillway during certain rainfall events).

Surface water runoff from undisturbed areas would be diverted, wherever possible, around areas disturbed by mining and released from the site, minimising the capture of clean surface runoff.

Raw water for use in dust suppression on NSOB stockpiles, soil stockpiles, rehabilitated areas, and haul roads, and to supply filtered water demands would be pumped from the Murrumbidgee River via the water supply pipeline. Potable water would be trucked to the site and stored.

Sewage would be managed in two ways:

- for areas with high density of personnel (ie process plant area and accommodation facility), a package waste treatment system would be used, which would require occasional pumping out of sludge; and
- for ablutions located in areas with low or infrequent use, untreated waste would be collected in septic tanks which would be emptied by tanker as required.

3.1.1 Water supply pipeline

A water supply pipeline is approved to be constructed to supply water from the Murrumbidgee River for operation of the Balranald Project. The water supply pipeline would supply raw water from the Murrumbidgee River that would be filtered and used for plant/domestic purposes. Any remaining water would be utilised for dust suppression in sensitive areas (ie NSOB stockpiles and haul roads). Runoff from the Nepean mining area would also supplement non saline dust suppression.

3.1.2 Water storage infrastructure

Water used in processing operations is approved to be managed by various dams and structures as outlined in Table 3.1. All dams are to be lined to prevent leakage.

Table 3.1 **Approved water storage infrastructure**

Dam	Description
Settling dam	Settling dam would collect runoff water from the processing area. It allows for settling of solids before transfer to the process water dam and recycling within the processing area.
Process water dam	Process water dam would be the primary water supply for the processing plant. It would receive water from the settling dam and hypersaline groundwater from the dewatering system. The process water pumps are supplied from this dam. Receives overflows from settling dam via gravity. Also supplies saline water dust suppression demand.
Mining Unit Plant (MUP) dam	MUP dam would receive dewatering flows from West Balranald mine and transfers of excess water from process water dam. It would supply water to the MUP. The MUP dam would also collect runoff from the Run Of Mine (ROM) pad, stockpile pads containing Potential Acid Forming (PAF) materials, sand tails stacking pad, which are potentially acid forming. The pH of the MUP dam would be continuously monitored and lime dosing would be done on occasion to maintain a pH > 4.5.
Process area runoff dam	Captures runoff from the processing area. Water is transferred to the settling dam.
Tailings storage facility	Receives modified co-disposal (ModCod) slurry consisting of sand and thickener underflow mixture (or slimes). It would contain all direct rainfall and resulting runoff that occurs within the TSF area. Water is decanted from the TSF and returned to the settling dam for reuse in the processing plant.
Groundwater retention dams	Two groundwater retention dams would store hypersaline groundwater extracted from the Loxton Parilla Sands by the dewatering bores. Groundwater would be treated with UV light prior to being reinjected.
Non-saline water dam	Constructed to hold imported raw water from the Murrumbidgee pipeline.
Runoff collection drains and dams	Constructed to capture runoff from the Non Saline Overburden (NSOB), topsoil and subsoil stockpiles. Will function as sediment basins and would be designed as part of the Erosion and Sediment Control Plan (ESCP) for the Balranald Project, which would be developed as part of detailed design.

3.1.3 Water demand

Water demands for the approved project are summarised in Table 3.2.

Table 3.2 **Approved operation phase water demands**

Demand	Groundwater / mine affected runoff (ML/year)	Raw river water (ML/year)	Trucked potable (ML/year)
Dust suppression			
Overburden / ore removal, saline overburden rehabilitation, mine access road, haul roads, service roads	380		
Soil and non-saline rehabilitation, light vehicle roads		310	
Process water			
Process plant demand (PCP, WCP, WHIMS)	15,075		
MUP demand	4,160		
ISP demand		100	
Wash down bays		10	
Workforce consumption			
Personnel – potable			5
Personnel – toilet and non-drinking		10	
TOTAL DEMAND	19,615¹	450	5

3.2 Predicted impacts

Predicted potential impacts to the surface water environment described in the Surface Water Management Report (WRM 2015) were:

- loss of catchment area that drains into Box Creek, Pitarpunga, and Tin Tin lakes due to capture of run off within onsite storages and the pit;
- interference with flood flows along Box Creek, Pitarpunga, and Tin Tin lakes and their tributaries;
- potential for runoff from the project area to become contaminated with elevated salinity, low pH, heavy metals, fuels, oils, or grease due to interaction with:
 - saline groundwater;
 - stockpiles, overburden or acid forming materials;
 - MUP area and processing areas; and
 - mine voids.
- overflow of the mine water management system during large rainfall events resulting in the release of sediment laden water or saline water; and

¹ The majority of the 19,615 ML/year water demand (approximately 90%) would be injected off-path within the injection borefield

- reduction in regional water availability associated with abstraction of water from the Murrumbidgee River and potential use from other external sources.

Each of these potential impacts was proposed to be addressed as outlined below.

3.2.1 Loss of catchment area

During the operational phase of the approved Balranald Project, the maximum catchment area draining to the mine water management system was predicted to be 194.3 ha, less than 1% of the total Box Creek catchment area (WRM, 2015). The loss of 1% of the catchment area was considered insignificant, especially considering the ephemeral nature of Box Creek and the lack of reliance by environmental and human users on this system.

Upon completion of operations, the final void remaining at the West Balranald mine was proposed to have a contributing catchment area of 52.1 ha (WRM, 2015), consisting of the surface area of the void itself (Figure 3.1). The invert level of the final void would be above the pre-mining depth to groundwater, in the Loxton Parilla Sands. The amount of runoff that could be potentially captured within the final void would be limited by diversion works. The small volume of runoff expected to collect in the void would either evaporate or infiltrate through the floor of the void into the Loxton Parilla Sands. The maximum volume of water predicted to accumulate in the West Balranald mine final void was 34 ML (WRM, 2015). It was estimated that rainfall runoff in the void would take approximately two weeks to evaporate under average evaporation rates.

3.2.2 Site inundation

Flood modelling indicated that parts of the Balranald site could be inundated by flooding of Muckee Lake during a greater than 1 in 100 AEP flood in Box Creek (Figure 3.1).

3.2.3 Interference with flooding

The majority of the mine infrastructure for both the West Balranald and Nepean mines was proposed to be located outside the predicted Box Creek and associated lakes flood extent area. A small part of the West Balranald mine could be inundated by floodwater originating from Muckee Lake. Parts of the Nepean access road and injection borefields are located within the flood extent of Box Creek and Tin Tin Lake. For the access road and reinjection field to be inundated there would need to be a flood well in excess of a 1 in 100 AEP (WRM, 2015).

Mine infrastructure located in areas subject to flooding were not expected to impact flooding. The access road would be constructed at the existing ground level and would not be expected to impact predicted flood levels, velocities, or flow distributions. The injection bores have a small diameter and likely present an insignificant obstruction to any flood flows, and these bores would not be damaged by flood flows. If a major flood event occurred (comparable to a 1 in 100 AEP) then the Nepean access road and borefield may be temporarily inundated with water. A small bund wall would be sufficient to protect the West Balranald mine from flooding, if required.

3.2.4 Mine affected runoff

It was assessed that it was possible for runoff water quality to be affected by chemicals, natural elements or undergo physiochemical changes (ie increased EC or lowered pH), and cause contamination to possible receptors, including groundwater, soils and vegetation. However, for this to occur surface water would need to be present and in contact with a contaminating agent, and the surface water would then need to come into contact with a receptor. This was considered an unlikely scenario due to the lack of surface water in the Balranald project area and the implementation of a water management plan which would control all project water.

Surface water runoff from undisturbed areas was proposed to be diverted, where possible, around areas disturbed by mining and released from the site before it has the potential to become contaminated.

Surface water runoff from disturbed areas was to be captured, stored, and treated as part of the mine water management program. No runoff from disturbed areas was to be released from the site.

3.2.5 Mine water overflow

With the mine water management system designed to divert surface runoff around the mine site, the annual probability of overflow from mine water management ponds was predicted to be smaller than 1%.

3.2.6 Regional surface water availability

It was proposed that surface water delivered via the pipeline would be purchased from the high security registered water license market under the Murrumbidgee River Water Sharing Plan (Murrumbidgee WSP, 2016).

The WSP 2015 describes access licenses volumes as per Table 3.3. The proposed river water demand of 450 ML/year represents approximately 0.1% of total high security water shares, or 0.02% of general security water shares.

Water trading following the trading rules described in the WSP is not expected to affect river flow regime or ecology. The volumes proposed for MOD1 are minor in the context of the total volumes licensed and would not be expected to distort prices for other water users.

Table 3.3 Murrumbidgee WSP license volumes (Murrumbidgee WSP, 2016)

License type	Share component (Volume available at 100% allocation) ¹
Regulated river high security	418,000 ML/year
Regulated river general security	1,892,000 ML/year
Murrumbidgee Irrigation	243,000 ML/year
Coleambally Irrigation	130,000 ML/year
Local water utility	24,000 ML/year
Domestic and stock	35,000 ML/year

1. Values rounded to the nearest 1,000 ML/year

2. The draft 2020 revision to the WSP describes the same unit share totals, other than high security shares which were reduced to 382,516 (Draft Murrumbidgee WSP, 2020).

3.3 Approved mitigation measures

3.3.1 Mine affected runoff and mine water overflow

It was proposed that a water management plan would detail management measures to mitigate impacts to water resources during construction and operation of the Balranald Project, and would describe:

- a program for monitoring flow events in Box Creek to collect baseline water quality and flow data;
- rainfall forecasting and the development of site water balances to identify when storages may be vulnerable to overtopping;
- a procedure for maintenance and inspection of on-site water management structures such as drains, culverts, bunds, sediment dams, dewatering bores, re-injection borefield and the TSF;
- a fuel/chemical spill management plan; and
- undertake controlled discharge from sediment dams with suspended solids concentration lower than the ANZECC (2000) aquatic ecosystem guideline value.

3.3.2 Site inundation

The possible inundation at the West Balranald mine resulting from overflow from Muckee Lake during a greater than 1 in 100 AEP flood in Box Creek would be managed via the construction of a small bund within the project area to prevent floodwater interacting with operations.

3.3.3 Loss of catchment area

During operations, surface water runoff from undisturbed areas would be diverted, wherever possible, around areas disturbed by mining and released from the site, minimising the capture of clean surface runoff.

Upon completion of operations, the final void remaining at the West Balranald mine was proposed to have a contributing catchment area of 52.1 ha (WRM, 2015), consisting of the surface area of the void itself (Figure 3.1).

3.4 Existing SSD-5285 conditions of consent

The approved Balranald Project is subject to the following conditions of consent related to surface water.

3.4.1 NSW Development Consent

The project was approved by the NSW Minister for Planning, subject to conditions. The following conditions relate to surface water:

- **Water Supply**

The applicant shall ensure that it has sufficient water for all stages of development, and if necessary, adjust the scale of mining operations to match its available water supply.

- **Water Pollution**

Unless an Environment Protection Licence (EPL) authorises otherwise, the Applicant shall comply with Section 120 of the *Protection of the Environment and Operations Act 1997* (POEO Act).

- **Water Management Performance Measures**

The applicant shall comply with the performance measures in Table 3.4, to the satisfaction of the Secretary.

Table 3.4 Water management performance measures

Feature	Performance measure
Water management – General	Minimise the use of clean water (ie water not in contact with disturbed areas) on site. Minimise the need for make-up water from external supplies.
Construction and operation of infrastructure	Design, install and maintain erosion and sediment controls generally in accordance with the series <i>Managing Urban Stormwater: Soils and Construction</i> including <i>Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads</i>. Design, install and maintain infrastructure within 40 m of watercourses generally in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land (DPI 2007)</i>, or its latest version. Design, install and maintain any creek crossings generally in accordance with the <i>Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013)</i> and <i>Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003)</i>, or their latest versions.
Clean water diversion & storage infrastructure	Design, install and maintain the clean water system to capture and convey the 100 year ARI flood. Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.
Sediment dams	Design, install and/or maintain the dams generally in accordance with the series <i>Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries</i> .
Mine water storages	Design, install and/or maintain mine water storage infrastructure to ensure no discharge of mine water or saline 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, where practicable.
Flood mitigation	Design, install and maintain flood mitigation measures including bunds to exclude flows from inundating the mining areas for all flood events up to and including the Probable Maximum Flood level. Manage any residual downstream impacts in an appropriate manner.
Overburden emplacements	Design, install and maintain emplacements to encapsulate and prevent any off-site migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material. Design, install and maintain emplacements to prevent off-site migration of saline groundwater seepage.
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.

- **Water Management Plan**

Prior to carrying out any development on site, the Applicant shall prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:

(a) be prepared in consultation with DPIE Water and the EPA;

(b) include a:

(i) Site Water Balance, that:

- includes details of:

sources and security of water supply, including contingency planning for future reporting periods;

water use and management on site; and

reporting procedures, including the preparation of a site water balance for each calendar year.

- investigates and implements all reasonable and feasible measures to minimise clean water use and to recycle water.

(ii) Surface Water Management Plan, that includes:

- baseline data on water flows and quality in the watercourses that could be affected by the development (if available);

- a detailed description of the water management system on-site, including the:

clean water diversion systems;

erosion and sediment controls; and

mine water management system, including a description on the measures that would be implemented to manage drilling fluids and muds.

- detailed plans, including design objectives and performance criteria for the:

emplacement areas for tailings, acid forming and potentially acid forming materials, and saline and sodic materials;

reinstatement of drainage lines on the rehabilitated areas of the site; and

final void.

- surface water assessment criteria, including trigger levels for investigating any potentially adverse impacts associated with:

the water management system;

surface water users supplies;

downstream surface water quality; and

downstream flooding impacts.

- a program to monitor and report on:
 - the effectiveness of the water management system;
 - surface water flows and water quality (if any);
 - downstream flooding impacts;
- reporting procedures for the results of the monitoring program; and
- a plan to respond to any exceedances of the surface water assessment criteria, and mitigate any adverse impacts of the development.

3.4.2 NSW Environment Protection License

The following conditions relating to surface water were included in the EPL:

Pollution of waters

Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the POEO Act.

3.4.3 Commonwealth EPBC Act referral 2012/6509

No conditions relating to surface water were imposed by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval.

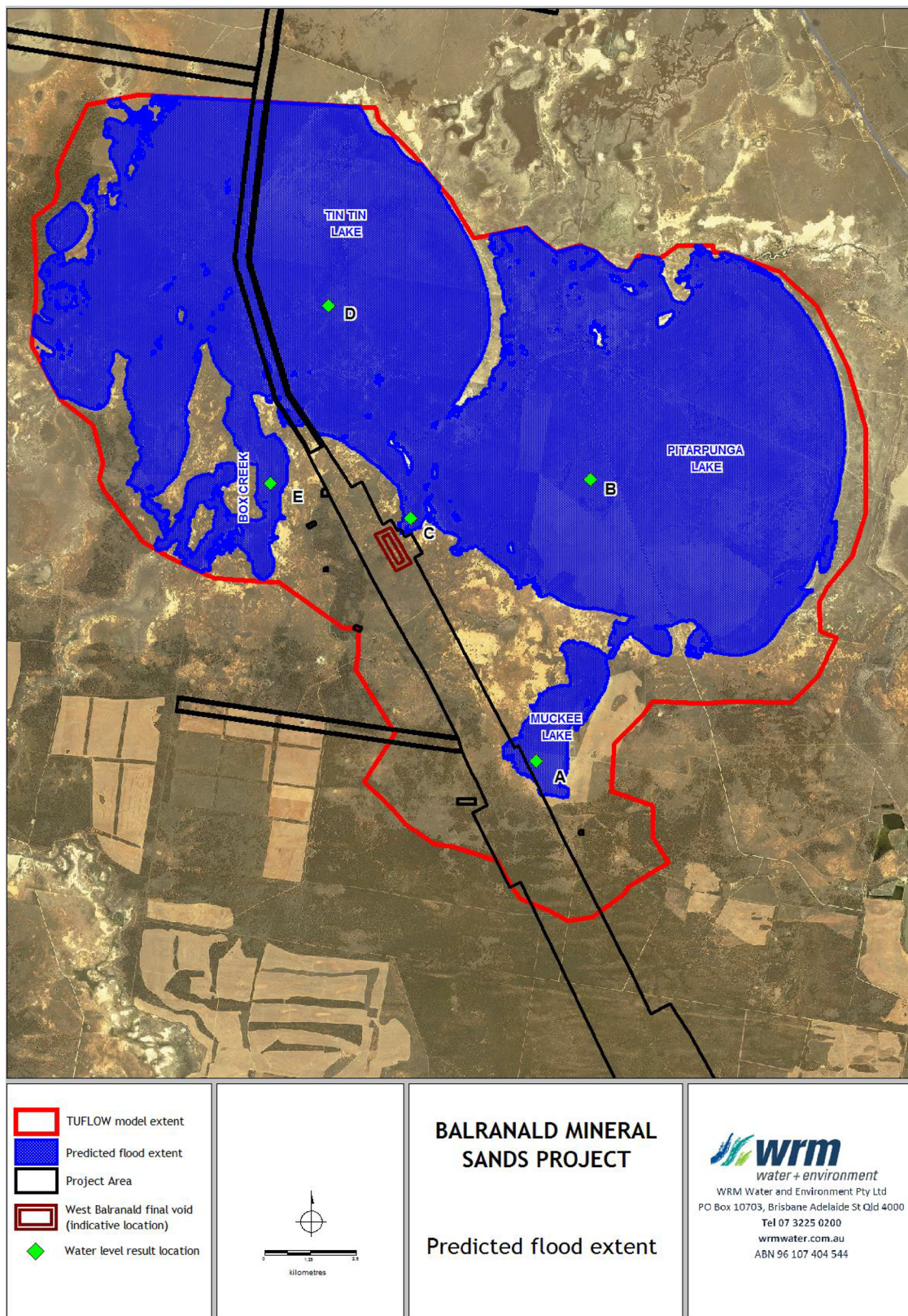


Figure 3.1 Approved project predicted Box Creek 1% AEP flood extent (WRM 2015)

4 Proposed modification

4.1 Assessment methodology

The proposed modification assessed:

- Proposed activities:
 - the surface disturbance area; and
 - site water demands and proposed water sources (ie water balance).
- Predicted impacts.
- Proposed mitigation (ie water management strategy).

The results of the flood model prepared for the EIS were used for assessing the flooding aspects of the proposed modification; new modelling was not undertaken.

4.2 Proposed activities

4.2.1 Surface disturbance area

The proposed above ground activities are shown in Figure 1.2 and include:

- construction and operation of mineral processing infrastructure;
- stockpiling of topsoil, subsoil and overburden;
- construction of drill pads and operation of mining infrastructure; and
- construction and use of mining access tracks and haul road.

4.2.2 Site water demand and proposed water sources

Project water demands with the proposed modification are described in Table 4.1.

The largest component of the water balance is the mining water supply. It is proposed that 3,400 ML/year would be used to mobilise ore, with the majority (2,865 ML/year) of this then recovered. The total water imports to the site per year would be approximately 1,216 ML hypersaline groundwater, 153 ML/year brackish groundwater, and 5 ML/year potable water.

At the time of preparing this report, a decision to construct and operate the approved fresh water supply pipeline from the Murrumbidgee had not been determined by Iluka. If constructed the Murrumbidgee water supply would supplement a portion of the brackish groundwater and potable water demands.

As the MOD1 project site is located in a low rainfall area, rainfall is not expected to influence the water balance.

Table 4.1 Proposed operational phase water demands and sources (ML/year)

Demands		Sources				
Water use	Volume	Hyper saline groundwater	Brackish groundwater	Ore body groundwater	Floc and reagents	Potable water truck
		Imported	Imported	Recovered with ore	Imported	Imported
Mining						
Mining water supply	3,400	536	-	2,864		-
Processing	714	616	68	-	26	-
Water in Tails	689					
Water in Product	26					
Site operation						
Dust suppression	85	-	85	-	-	-
Evaporation from dams	60	64	-	-	-	-
Potable use	15	-	-	-	-	15
Total demand	4,274	1,216	153	2,864	26	15

4.3 Predicted impacts

Potential impact pathways to the surface water environment due to the proposed MOD1 are unchanged from the approved Balranald Project EIS, and are as follows:

- Loss of catchment area.
- Site inundation.
- Interference with flooding.
- Mine affected runoff.
- Mine water overflow.
- Reduction in regional water availability.

Each of these potential impacts would be of a lesser magnitude with the underground mining method and are addressed below.

4.3.1 Loss of catchment area

The loss of catchment area associated with Box Creek for MOD1 will be no more than for the approved Balranald Project.

The Balranald Project would result in 52 ha of the Box Creek catchment area being lost to the voids associated with open cut mining. As MOD1 will involve underground mining technique, this will limit the loss of catchment area to banded areas within the Project area, such as stockpile areas and the processing infrastructure.

After completion of mining, it is expected that catchment areas would effectively be no different to pre-mining catchment areas.

4.3.2 Site inundation

Flood modelling indicates that part of the haul road could be inundated by flooding of Muckee Lake via Box Creek (Figure 4.2). The access road would be constructed with culverts at local low points to allow runoff to pass under the road. During large floods, flood waters may pass over the road.

Parts of the MOD1 project area may be affected by local flooding (Figure 4.1). MOD1 mining infrastructure may require bund walls to exclude unaffected runoff from the site.

4.3.3 Interference with flooding

Interference with flooding effects will reduce with the proposed MOD1.

The majority of the mine infrastructure is proposed to be located outside the predicted Box Creek and associated lakes flood extent area.

Mine infrastructure located in areas subject to flooding is not expected to impact movement of flood waters as:

- the access road would be constructed at the existing ground level, with culverts at local low points to allow runoff to pass under the road. During large floods, flood waters may pass over the road; and
- surface runoff would be diverted around mine infrastructure, drill pads and stockpiles through the use of surface diversion channels and bunds.

4.3.4 Mine affected runoff

Mine affected runoff effects will not change with the proposed MOD1.

It may be possible for runoff water quality to be affected by chemicals, natural elements or undergo physiochemical changes (ie increased EC or lowered pH), and cause contamination to possible receptors, including groundwater, soils and vegetation. However, for this to occur surface water would need to be present and in contact with a contaminating agent, and the surface water would then need to come into contact with a receptor. This is considered an unlikely scenario due to the lack of surface water in the MOD1 project area and the implementation of a water management plan which will detail the control of project related water.

Surface water runoff from undisturbed areas would be diverted, where possible, around areas disturbed by mining and released from the site before it has the potential to become contaminated.

Surface water runoff from disturbed areas (ie stockpiles, drill pads, and the mineral processing infrastructure area) would be captured, stored and treated as part of the mine water management program.

No run-off from disturbed areas would be released from the site.

4.3.5 Mine water overflow

The probability of mine water overflow is not expected to change with the proposed MOD1.

The revised water balance predicts that the annual probability of overflow from mine water management ponds is smaller than 1% as:

- ponds will have sufficient freeboard that a 1% AEP storm would not cause ponds to fill and overtop; and

- process water flows into and between ponds would be pumped, with pump shut-off in the case of failure or high water level conditions.

4.3.6 Regional water availability

If the proposed pipeline from the Murrumbidgee River is constructed, it would be used to supply part or all of the 'brackish water' demand and potable water demand for MOD1 (see Table 4.1). During site operations it is expected that these demands would total 158 ML/year, representing 0.04% of the total high security water licenses, or 0.01% of general security licenses.

It is proposed that, if required, licenses to extract this volume would be obtained via water trading following the rules described in the Water Sharing Plan (WSP). Water trading following the trading rules described in the WSP is not expected to affect river flow regime or ecology. The volumes proposed are minor in the context of the total volumes licensed and would not be expected to distort prices for other water users.

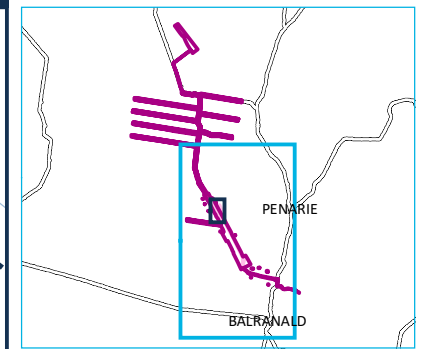
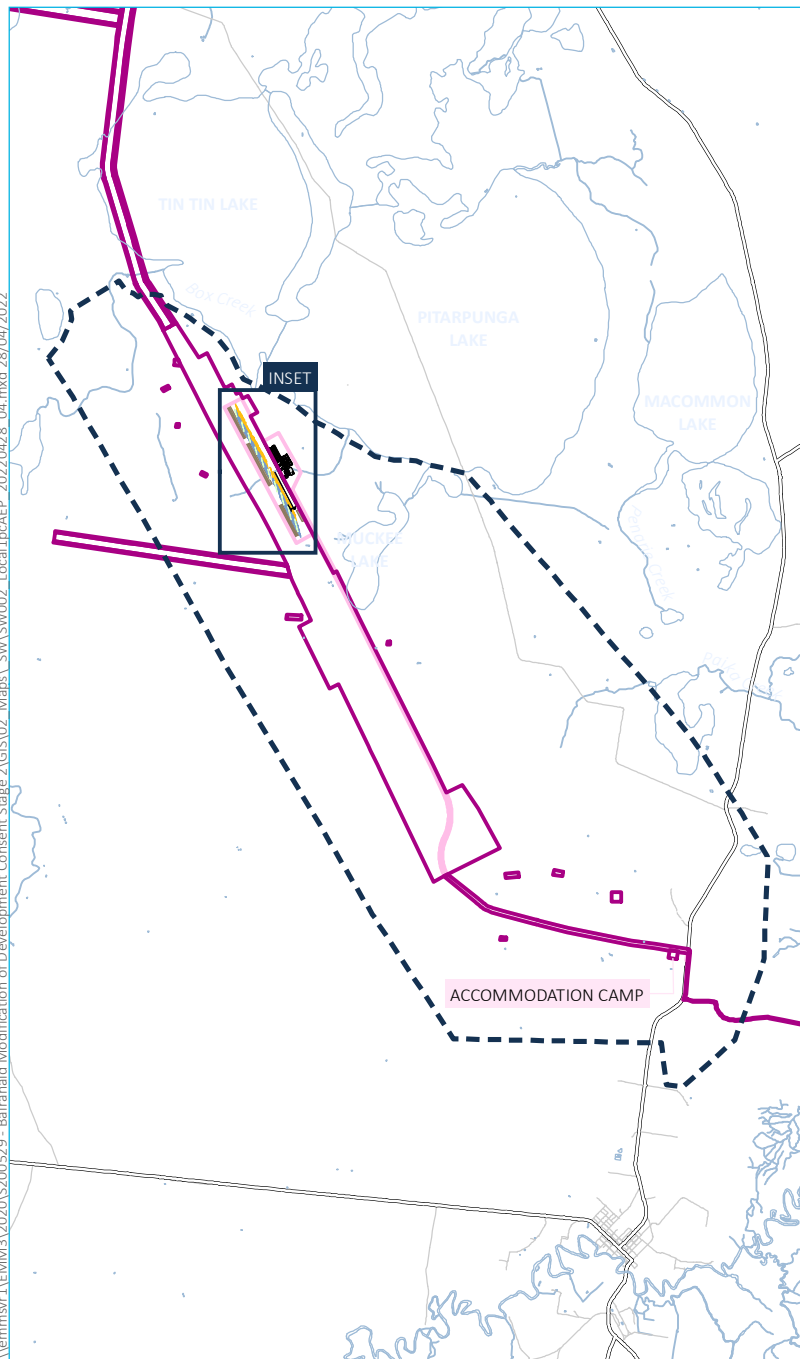
4.4 Proposed mitigation measures

The proposed mitigation measures for the MOD1 are essentially the same as for the approved Balranald Project, including:

- a water management plan to detail management measures to mitigate impacts to water resources during construction and operation, and would describe:
 - a program for monitoring flow events in Box Creek to collect baseline water quality and flow data;
 - rainfall forecasting and the development of site water balances to identify when storages may be vulnerable to overtopping;
 - a procedure for maintenance and inspection of on-site water management structures such as drains, culverts, bunds, sediment dams;
 - a fuel / chemical spill management plan; and
 - controlled discharge allowances from sediment dams with suspended solid concentrations lower than the ANZG (2018) aquatic ecosystem guideline value.
- the access road would be constructed at the existing ground level, with culverts at local low points to allow runoff to pass under the road. During large floods, flood waters may pass over the road; and
- surface water runoff from undisturbed areas would be diverted, wherever possible, around areas disturbed by mining and released from the site, minimising the capture of clean surface runoff.

A procedure for maintenance and inspection of water management structures would not be required for the tailing storage facility (TSF), as this facility is not required for MOD1.

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- KEY**
- EIS Approved Balranald Project Area (SSD-5285)
 - Proposed modification study area
 - Major road
 - Minor road
 - Existing track
 - Watercourse/drainage line
 - Waterbody
 - Limit of reporting
 - Local 1% AEP rainfall runoff flood extent
 - > 0.15 m
 - Indicative site layout
 - Processing area infrastructure
 - Subsoil stockpile
 - Drill pad and string to underground sto
 - Underground sto
 - Underground pillar

Local 1% AEP rainfall runoff
flood extent

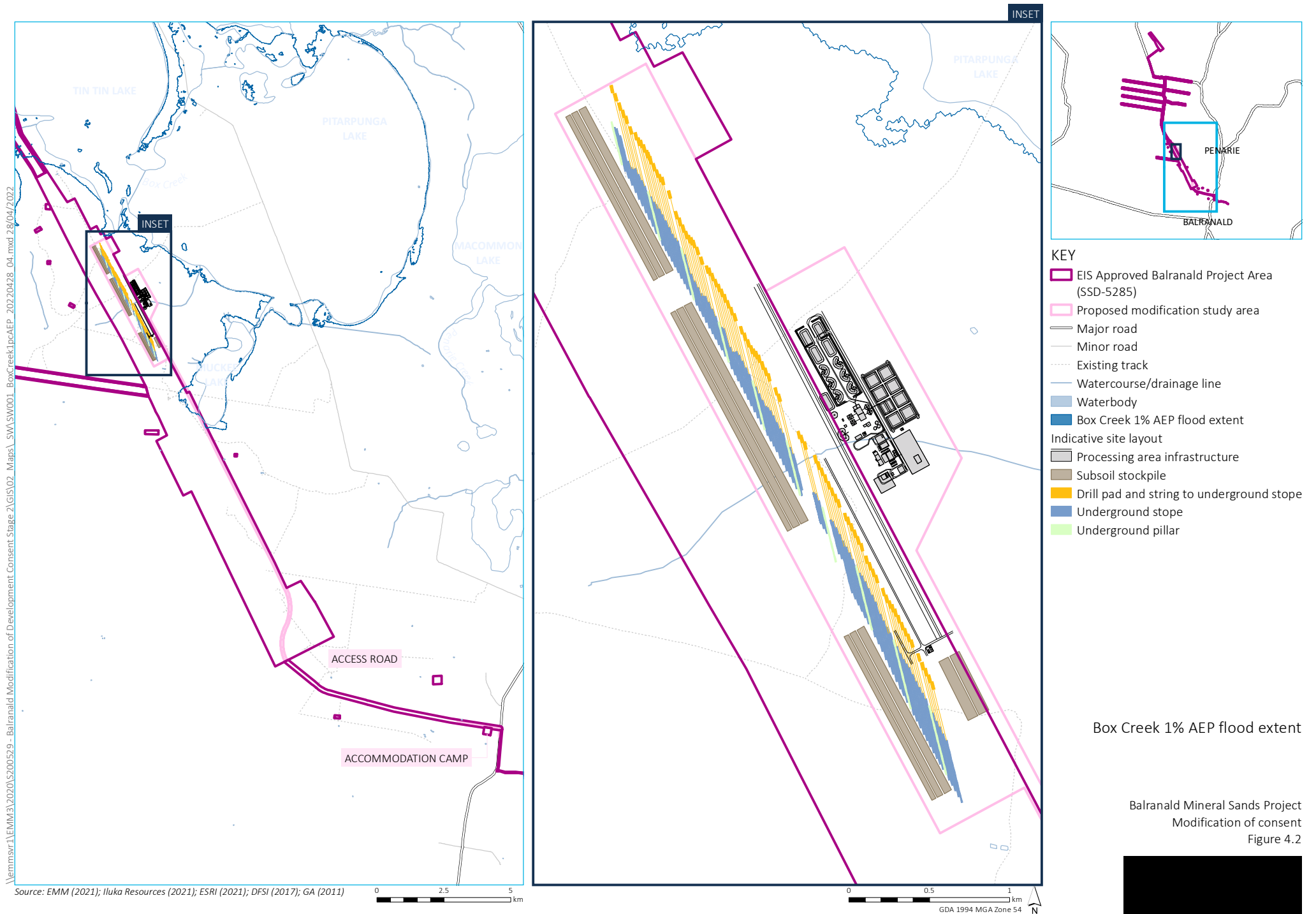
Balranald Mineral Sands Project
Modification of consent
Figure 4.1

Source: EMM (2021); Iluka Resources (2021); ESRI (2021); DFSI (2017); GA (2011)

0 2.5 5
km

0 0.5 1
km
GDA 1994 MGA Zone 54





5 Conclusion

The magnitude and/or extent of the potential surface water impacts for proposed MOD1 is within the impact levels assessed for the approved Balranald Project. The mitigation and management measures for the approved Balranald Project are expected to be effective and appropriate for the proposed modification.

6 References

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