



Balranald Mineral Sands Project

NSW Environmental Impact Statement

Prepared for Iluka Resources Limited
May 2015

Executive Summary





Executive Summary

ES1 Introduction

ES1.1 Project overview

Iluka Resources Limited (Iluka) proposes to develop a mineral sands mine in south-western New South Wales (NSW), known as the Balranald Mineral Sands Project. The Balranald Project 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, respectively.

Ore extracted from the Balranald Project would be processed on-site to produce heavy mineral concentrate (HMC) and ilmenite, which will be transported by road to Victoria. Processing of HMC would be undertaken at Iluka's existing mineral separation plant (MSP) at Hamilton (the Hamilton MSP). From the Hamilton MSP, HMC products will continue to be transported by rail to Portland or other ports within Victoria. Ilmenite would be transported by road to a proposed rail loading facility in Manangatang, Victoria. From here, it would be loaded into wagons or containers to be railed to port facilities in Victoria.

By-products from the Hamilton MSP would be managed within Iluka's existing Victorian operations or returned by road to the Balranald Project for management within the mine void.

Disturbance associated with mining will be progressively rehabilitated.

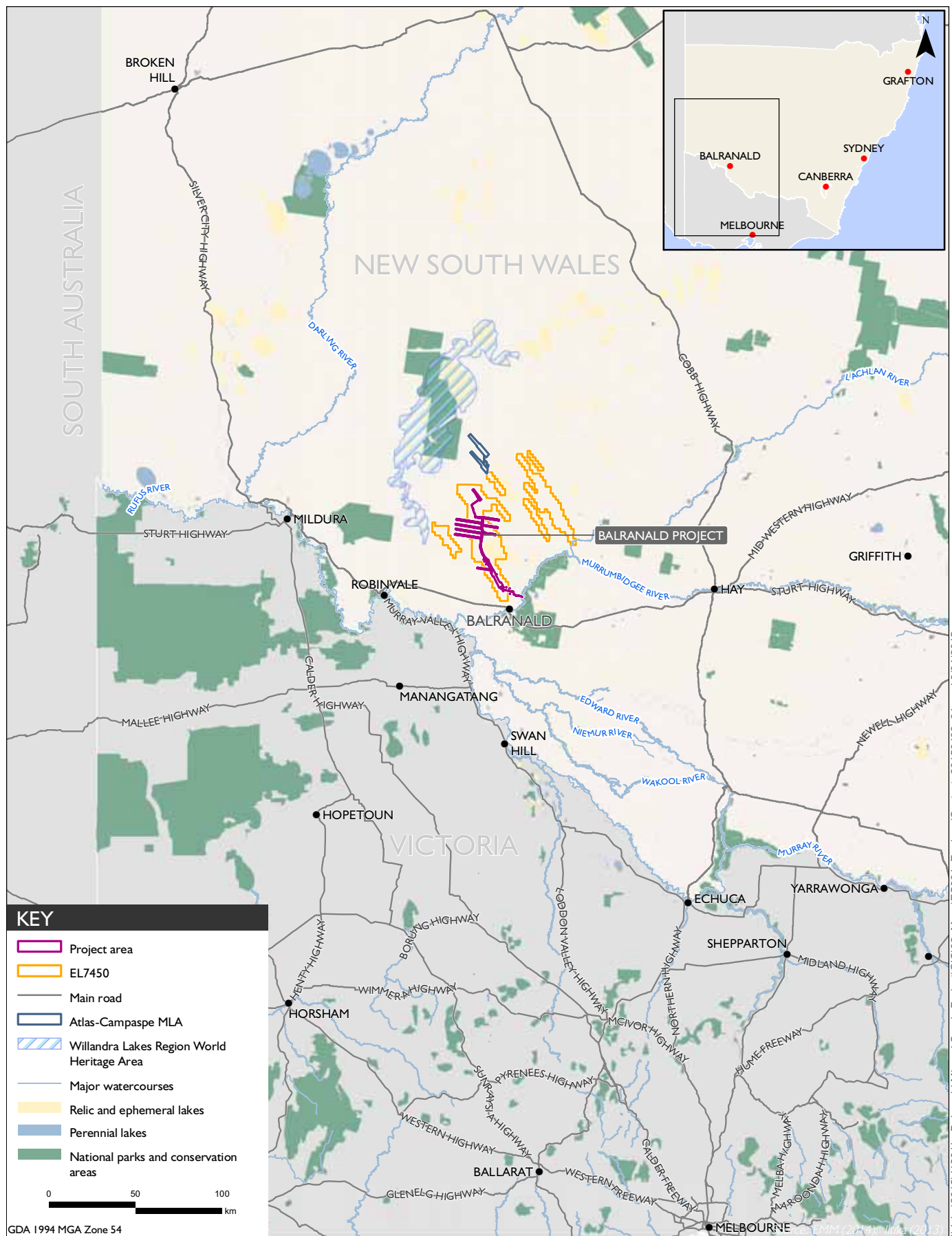
The Balranald Project includes groundwater management infrastructure, a workforce accommodation facility, and a fresh water supply pipeline from the Murrumbidgee River. The Balranald Project would also generate the need for other infrastructure subject to separate approvals in both NSW and Victoria.

The location of the Balranald Project in a regional and local context can be seen in Figures ES1 and ES2.

ES1.2 Need for the Balranald Project

HMC produced at Iluka's Murray Basin operations is processed at the Hamilton MSP in Victoria. The MSP has a capacity of approximately 0.5 million tonnes (Mt) per annum. Operation of the MSP currently relies largely on HMC feed from the WRP mine however HMC from Eucla Basin has also been processed and blended with HMC from the Murray Basin. Unless a new source of HMC feedstock for the Hamilton MSP is provided following exhaustion of HMC feedstock from the WRP mine, the MSP is likely to either be fed from an alternative interstate mine (eg HMC from Eucla Basin), placed into care and maintenance or closed.

The Balranald Project has been identified as the most likely main source of HMC for the Hamilton MSP (due to its proximity and value) following completion of feedstock from the WRP mine.



ES1.3 Approvals required

The Balranald Project requires a number of approvals in NSW and Victoria, as well as approval from the Commonwealth.

Development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is generally required for all aspects of the Balranald Project except a transmission line required for the supply of power. The transmission line will require an approval under Part 5 of the EP&A Act the Balranald Project.

Part 4, Division 1 of the EP&A Act relates to State significant development (SSD). The Balranald Project is deemed to be a SSD due to the provisions of *State Environmental Planning Policy (State and Regional Development) 2005* (State and Regional Development SEPP) which deems mineral sands mining to be developments of State significance.

An environmental impact statement (EIS) is required to accompany an application for SSD. The NSW Minister for Planning, or delegate, is the consent authority.

This EIS has been prepared to address specific requirements provided in the Secretary's environmental assessment requirements (SEARs) for the SSD application, issued on 2 December 2014. It is intended to inform government authorities and other stakeholders about the Balranald Project, and the measures that will be included to mitigate, manage and/or monitor potential impacts and the resultant social, economic and environmental impacts, both positive and negative.

An approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required for the Balranald Project (with the exception of the transmission line which will be subject to a separate EPBC Act referral process). A separate EIS will be prepared in accordance with Part 8 of the EPBC Act.

ES2 Site and surrounds

ES2.1 Project location

The project area is located in the Murray Basin in south-western NSW, near Balranald town. The Balranald-Ivanhoe Road connects the project area to the Sturt Highway, south of the project area, at Balranald town. The Sturt Highway links Balranald to Mildura and Robinvale to the west, and Hay and Wagga Wagga to the east.

The project area and surrounding land is zoned for primary production under the *Balranald Local Environment Plan 2010* (Balranald LEP). Land uses in and surrounding the project area are primarily agricultural, and include sheep grazing and grain crops. Small-scale gypsum mining and charcoal farming is also undertaken on nearby properties.

ES2.2 Climate

The project area is characterised by hot dry summers and cold winters. Climatic data from the Bureau of Meteorology's (BoM) weather station at Balranald town indicates that monthly mean minimum temperature ranges from 3.5°C to 16.4°C and the monthly mean maximum temperature ranges from 15.7°C to 33°C.

The median annual rainfall is 324.8 mm. Rainfall generally occurs throughout the year with the highest median rainfall over spring and the lowest median rainfall over summer.

ES2.3 Geology

The project area is located in the centre of alluvial sediments of the Murray Basin. Within the project area the basal unit, which directly overlies the basement rocks (comprising Proterozoic and Palaeozoic rocks) is the Olney Formation. The Olney Formation sediments are predominantly continental, but the marginal marine Geera Clay interfingers through the middle sequence at the project area.

At the project area, the Olney Formation is overlain by the Loxton-Parilla Sands Formation, which is in turn, overlain by the Shepparton Formation. The Loxton-Parilla Sands is a thick sequence of marine sands that contains the target mineral deposits. The Shepparton Formation comprises fluio-lacustrine unconsolidated clays and silts.

The West Balranald and Nepean deposits are contained within a lower marine sequence in the Loxton-Parilla Sands Formation.

ES2.4 Hydrogeology

The Murray Basin is a large closed groundwater basin with regional aquifer systems, confining layers and permeability barriers to groundwater flow. Locally in the vicinity of the project area, there is limited recharge from direct rainfall and some limited recharge from surface water systems, with most recharge to the area occurring via through flow from the east.

Consistent with topographic gradients, hydraulic gradients are very gentle in the central and western Murray Basin, and the broad flow direction in all aquifers is from east to west. However, the basement structure influences the groundwater flow direction in the project area causing a slightly north northwest trend in flow. This is most pronounced in the deeper Olney Formation. The horizontal hydraulic conductivity in both the Shepparton Formation and Loxton-Parilla Sands is variable, due to the depositional environments and volume of clay; continual lateral flow through formations is not common.

There is an upwards hydraulic gradient from the Olney Formation and Geera Clay to the Loxton-Parilla Sands and Shepparton Formation based on pressure head differences observed on-site and reported in the literature. Heads in the Shepparton Formation and Loxton-Parilla Sands are mostly similar, although results of hydrogeological pumping and injection trials indicate that the two units are poorly connected and therefore vertical flow is limited.

Groundwater quality within the Murray Basin is variable, with fresher water near the basin margins to the east. Quality becomes poorer in a westerly direction (down gradient) and within the project area is typically highly saline. Salts originate from the marine depositional environment and are enhanced by low precipitation and high evaporation rates as well as long groundwater residence times. The water quality of the Shepparton Formation and Loxton-Parilla Sands is comparable, and is characterised by high salinity, neutral pH, low dissolved metals and Na-Cl type dominance.

The salinity of the Shepparton Formation and Loxton-Parilla Sands are similar, and these formations have the highest EC measurements (averaging 48 and 56 millisiemens per centimetre (mS/cm), respectively) which is equivalent to the EC of sea water (53 to 60 mS/cm). The EC is lower in the Olney Formation with an average EC of 9.3 mS/cm.

ES2.5 Surface water

The Lachlan, Murrumbidgee and Murray rivers are the major permanent surface water features in the vicinity of the project area. The Lachlan River flows south-west terminating at Great Cumbung Swamp approximately 42 km east of the project area.

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 are artificially filled.

Permanent surface water flows are confined to the major rivers and their associated backwaters and billabongs which are outside of the project area. The catchments within the project area do not contribute to flows of the major permanent surface water features in the vicinity of the project area, except under extreme flood conditions.

Dry relic lake beds occur to the north east and east of the West Balranald mine and are subject to agricultural activities including cropping and grazing.

Local drainage is poorly defined with the exception of the dry relic lake beds, and Box Creek downstream of the confluence with Arumpo Creek. Under existing conditions it is likely that any runoff from the project area would drain via shallow overland sheet flow, before being captured by the dry lakes or depressions evident in the topography.

ES2.6 Land ownership

Land ownership in and near the project area includes Western Lands Lease (WLL), freehold and other land tenures. Outside Balranald town, properties are typically large rural land holdings, and homesteads and dwellings are sparsely located.

ES3 Project description

ES3.1 Project schedule

The Balranald Project will have a life of approximately 15 years, including construction, mining, backfilling of all overburden material, rehabilitation and decommissioning.

Construction of the Balranald Project will commence at the West Balranald mine, and is expected to take about 2.5 years. Operations will commence at the West Balranald mine in Year 1 of the operational phase, which will overlap with approximately the last six months of the construction. The operational phase would include mining and associated ore extraction, processing and transport activities, and would be approximately nine years in duration. This would include completion of backfilling overburden into the pits at both the West Balranald and Nepean mines. Construction of infrastructure at the Nepean mine will commence in approximately Year 5 of the operational phase, with mining of ore starting in Year 6, and being complete by approximately Year 8.

Rehabilitation and decommissioning is expected to take a further two to five years following Year 9 of the operational phase.

ES3.2 Project area

All development for the Balranald Project that is the subject of the SSD application is within the project area. The project area is approximately 9,964 ha, and includes the following key project elements, described in subsequent sections:

- West Balranald and Nepean mines;
- West Balranald access road;
- Nepean access road;
- injection borefields;
- gravel extraction;
- water supply pipeline (from the Murrumbidgee River); and
- accommodation facility.

Within the project area, the land directly disturbed for the Balranald Project is referred to as the disturbance area. For some project elements in the project area, a larger area has been surveyed than would actually be disturbed. This enables some flexibility to account for changes that may occur during detailed design and operation. The project area and disturbance area for each project element are in Table ES.1.

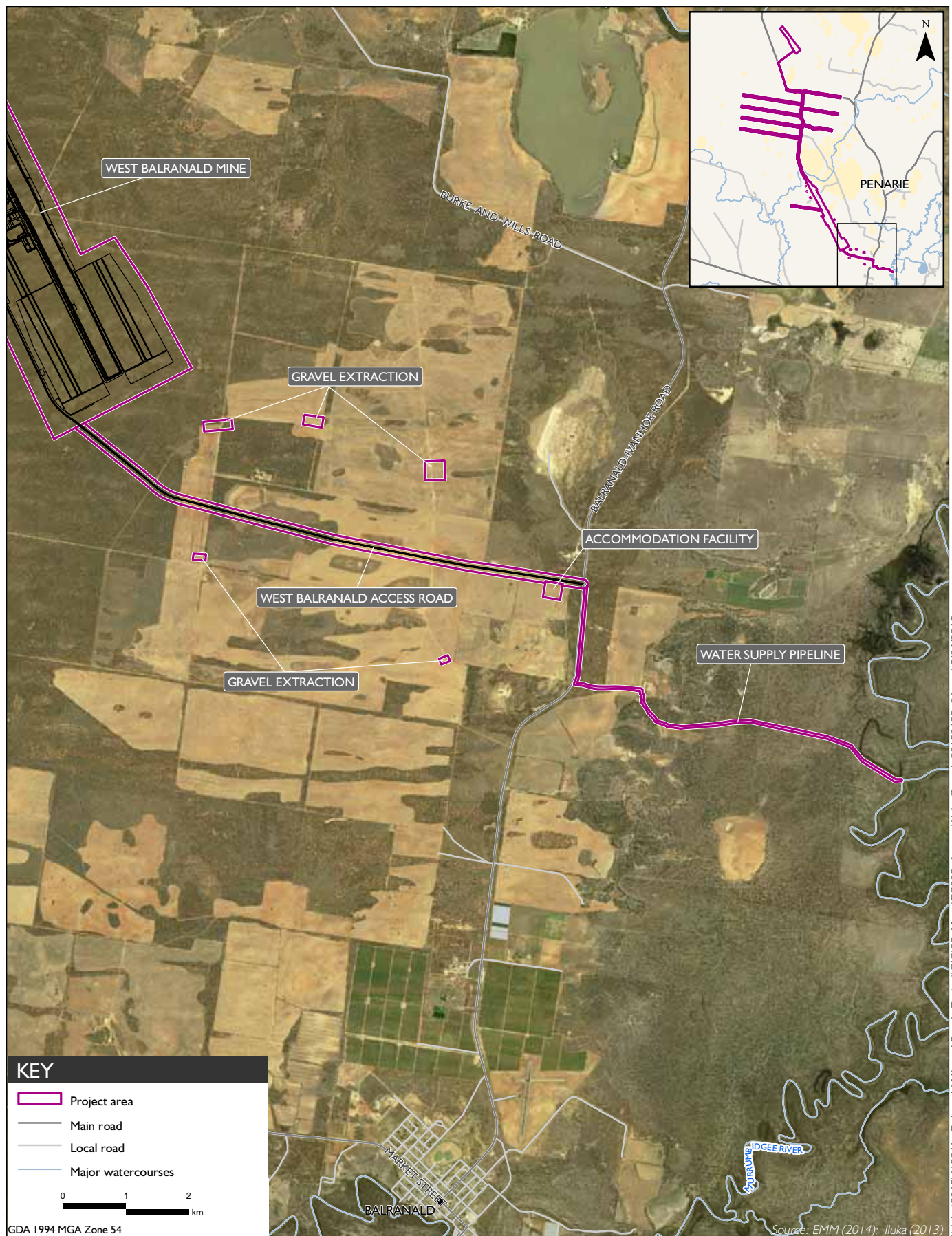
Table ES.1 Project area and disturbance area

Project element	Project area (ha)	Disturbance area (ha)
West Balranald mine	3,059	3,059
Nepean mine	805	805
West Balranald access road	128	52 ¹
Nepean access road	173	156 ²
Injection borefields	5,721	1,214 ³
Gravel extraction	42	42
Water supply pipeline	29	11 ⁴
Accommodation facility	7	7
Total	9,964	5,346

Notes:

1. 60 m wide corridor within project area.
2. 40-50 m wide corridor within project area.
3. 100 m wide corridors within project area.
4. 15 m wide corridor within project area.

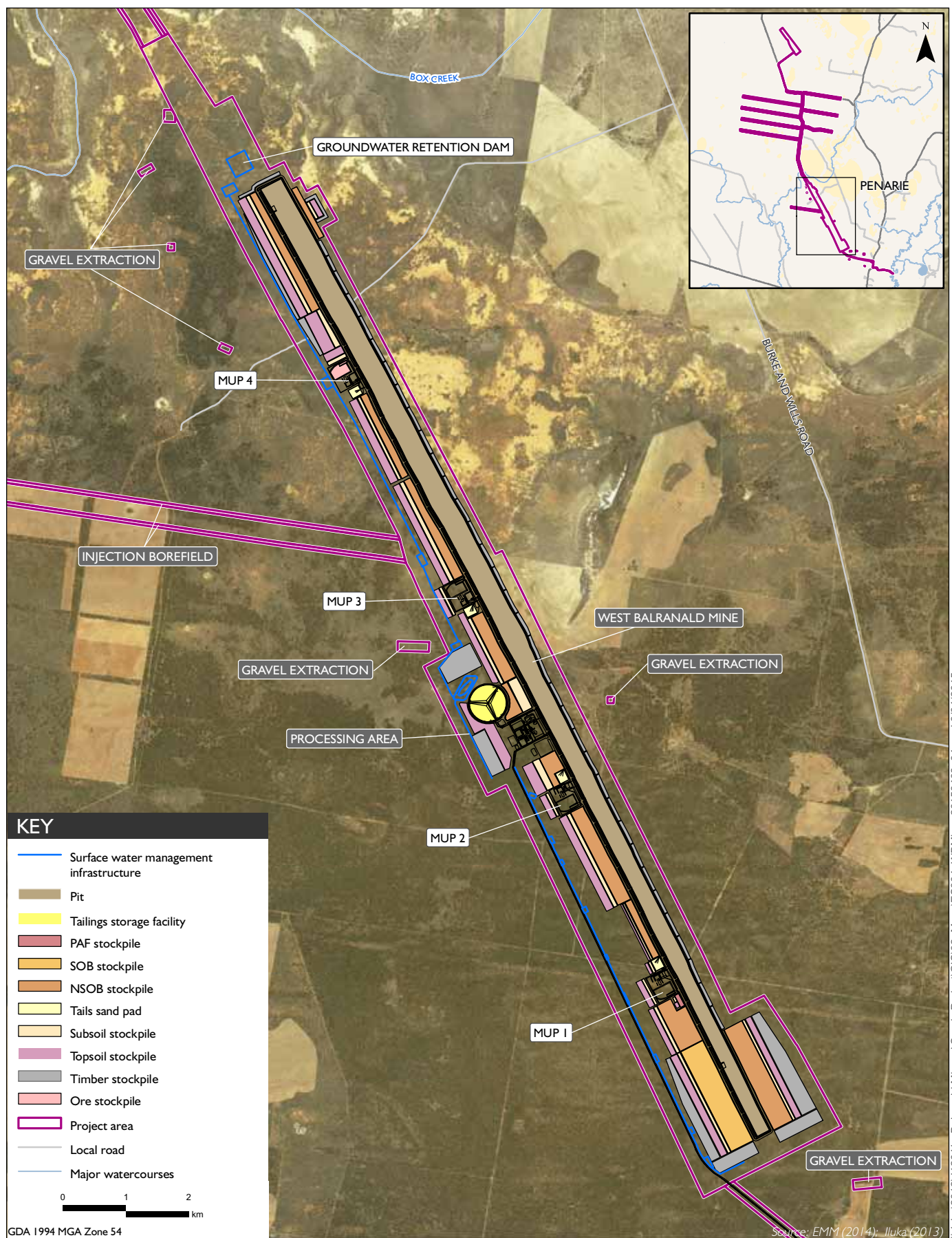
The project area can be seen in Figure ES2. Plans of the Balranald Project showing the project elements can be seen in Figures ES3 to ES6.



West Balranald access road, water supply pipeline and gravel extraction areas

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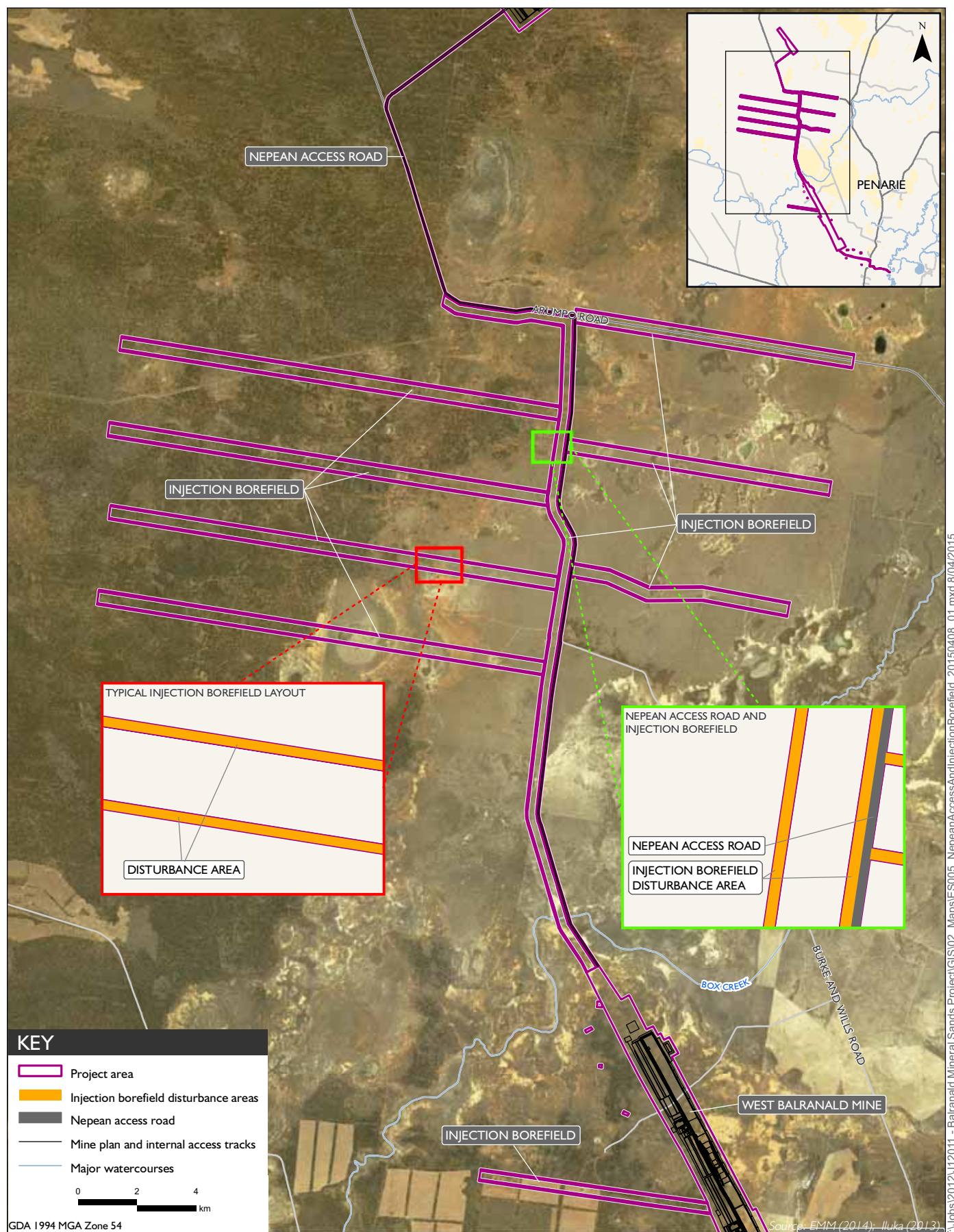
Figure ES3

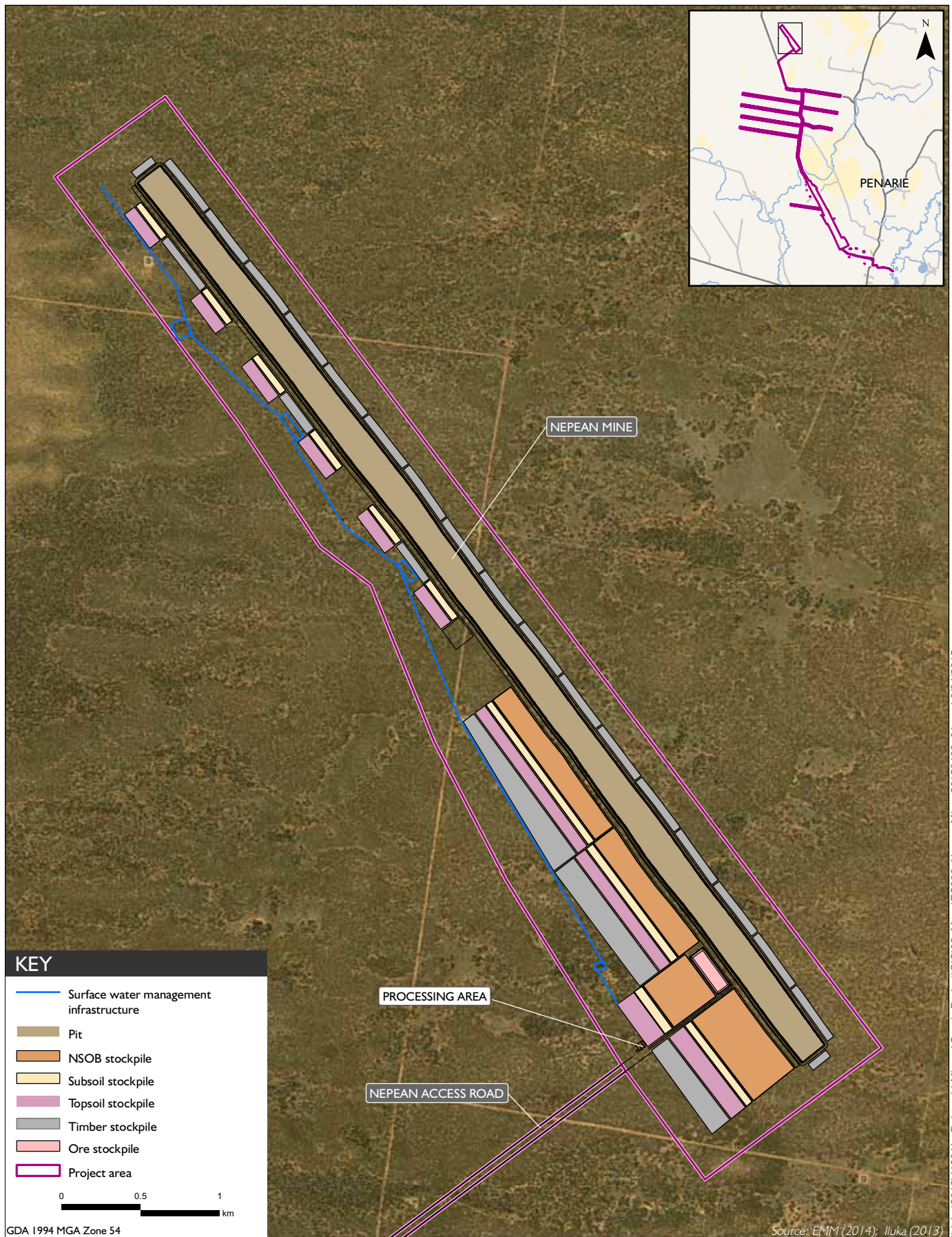


West Balranald mine and gravel extraction areas

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Figure ES4





ES3.3 West Balranald and Nepean mines

The West Balranald and Nepean mines include:

- open cut mining areas (ie pit/mine void) that would be developed using conventional dry mining methods to extract the ore;
- soil and overburden stockpiles;
- ore stockpiles and mining unit plant (MUP) locations;
- a processing area (at the West Balranald mine), including a mineral processing plant, tailings storage facility (TSF), maintenance areas and workshops, product stockpiles, truck load-out area, administration offices and amenities;
- groundwater management infrastructure, including dewatering, injection and monitoring bores and associated pumps and pipelines;
- surface water management infrastructure;
- services and utilities infrastructure (eg electricity infrastructure);
- haul roads for heavy machinery and service roads for light vehicles; and
- other ancillary equipment and infrastructure.

The location of infrastructure at the West Balranald and Nepean mines would vary over the life of the Balranald Project according to the stage of mining.

ES3.4 Injection borefields

The Balranald Project requires a network of injection borefields in the project area for the return of hypersaline groundwater to the Loxton Parilla Sands aquifer. Within each borefield, infrastructure is generally located in two 50 m wide corridors (approximately 350 m apart) and typically comprises:

- a network of pipelines with a graded windrow on either side;
- access roads for vehicle access during construction and operation;
- rows of injection wells, with wells spaced at approximately 100 m intervals; and
- a series of water storage dams to store water during well development.

ES3.5 Access roads

There are two primary access roads within the project area to provide access to the Balranald Project:

- West Balranald access road – a private access road to be constructed from the Balranald Ivanhoe Road to the West Balranald mine.
- Nepean access road – a route comprising private access roads and existing public roads. A private access road would be constructed from the southern end of the West Balranald mine to the Burke and Wills Road. The middle section of the route would be two public roads, Burke and Wills Road and Arumpo Road. A private access road would be constructed from Arumpo Road to the Nepean mine.

The West Balranald access road would be the primary access point to the project area, and would be used by heavy vehicles transporting HMC and ilmenite. The Nepean access road would primarily be used by heavy vehicles transporting ore mined at the Nepean mine to the processing area at the West Balranald mine.

During the initial construction phase, existing access tracks through the project area from the local road network may also be used temporarily until the West Balranald and Nepean access roads and internal access roads within the project are established.

ES3.6 Accommodation facility

An accommodation facility would be constructed for the Balranald Project workforce. It would operate throughout the construction and operation phases of the project. It would be located adjacent to the West Balranald mine near the intersection of the West Balranald access road with the Balranald Ivanhoe Road.

ES3.7 Water supply pipeline

A water supply pipeline would be constructed to supply water from the Murrumbidgee River for operation of the Balranald Project.

ES3.8 Gravel extraction

Gravel would be required during the construction and operational phases of the Balranald Project. Local sources of gravel (borrow pits) have been included in the project area to provide gravel during the construction phase. During the construction phase, gravel would be required for the construction of the West Balranald access road, internal haul roads and service roads, and hardstand areas for infrastructure. Processing operations, such as crushing and screening activities (if required) would also be undertaken at the borrow pits. Gravel for the operational phase would be obtained from external sources.

ES4 Strategic framework

The NSW Government has recognised the importance and need for investment within regional NSW to assist with growth and diversification of the NSW economy. The *NSW 2021: A Plan to Make NSW Number One* (NSW Government 2011) aims to guide policy and budget decisions over the ten year period to 2021. The plan is based around four strategies:

- rebuild the economy;
- return quality services;
- renovate infrastructure; and
- strengthen the local environment and communities.

Work has been undertaken to localise NSW 2021 through consultation with local communities to identify local priorities for action at the regional level. A regional action plan for the Murray-Lower Darling, in which Balranald LGA and town is located, was prepared in December 2012 (the Murray-Lower Darling Regional Action Plan).

The Regional Action Plan was underpinned by community consultation which included holding regional forums to hear directly from communities. These forums were aimed at identifying regional issues and priorities how the State Government could assist in delivering those priorities. The key priorities identified by communities within the Murray-Lower Darling Regional Action Plan include:

- being prosperous and economically diverse;
- providing quality education and training opportunities;
- being recognised for its strong communities; and
- being well-connected with increased access to transport services.

Specifically in relation to being prosperous and diversification of the economy, the Murray-Lower Darling Regional Action Plan states:

The Murray-Lower Darling region has a strong economy based on agriculture, forestry, the services sector, tourism and the training sector. There are further opportunities to grow the economy and increase regional business investment through the expansion of manufacturing, food processing, logistics industries and the new mineral sand mining industry in the west of the region.

Expansion of these industries will increase local employment opportunities, including for young people. Delivery of education and training services to support these industries will be required to ensure local people have the skills required to take advantage of new employment opportunities.

Accordingly, mineral sands mining within the Murray Basin has been recognised by the NSW Government as a key industry which will help grow and diversify the NSW economy and provide increased employment opportunities.

ES5 Stakeholder consultation

The development of strong relationships with stakeholders is an important aspect of Iluka's business. Throughout the development of a project, Iluka strives to build and maintain these relationships by demonstrating the values of commitment, integrity and responsibility.

In accordance with these values, Iluka developed two comprehensive stakeholder engagement strategies in support of:

- community consultation; and
- government consultation.

A range of formal and informal stakeholder engagement methods (ie tools, events) were employed by Iluka in support of the engagement strategies, including:

- face-to-face meetings;
- workshops;
- community office;
- newsletters and targeted updates (ie resident's update);
- fact sheets and other guidance material;
- drop-in sessions;
- Iluka participation in community events;
- information available on the Iluka website;
- media articles and advertising; and
- meetings with BSC.

Consultation processes have evolved with time, both in the content delivered and the responses provided by stakeholders. Consultation completed up to mid-2013 was characterised by high-level project briefings and limited or no stakeholder responses; effectively an awareness and educative process. From mid-2013 onwards, Iluka began providing detailed concept and impact information to stakeholders who were subsequently able to raise specific issues for Iluka to consider and address.

Aboriginal stakeholders have been consulted in accordance with relevant guidelines from the Office of Environment and Heritage (OEH), including extensive participation by registered Aboriginal parties (RAPs) in field surveys.

Iluka will continue to work closely with stakeholders to help inform the Balranald Project's final design and management and ensure the Balranald Project meets the reasonable expectations of all stakeholders.

Iluka will seek to undertake further consultation activities to complement the EIS approvals process and complete the detailed engagement exercises with the individual stakeholders and groups identified.

ES6 Environmental impact assessment

ES6.1 Assessment approach

As with any resource project, the economic viability of mining is inherently sensitive to market conditions and commodity prices. Such sensitivities and costs can affect critical aspects of the Balranald Project; an example of this is overall pit design, with pit dimensions (including width and length) varying depending on product pricing and market conditions. Accordingly, there is a need for ongoing design optimisation depending on market conditions in the lead up to, and over the life of the Balranald Project.

The ongoing process of mine optimisation may result in changes during detailed design, including:

- overall extent (width and length) of the pit within the mining area;
- location and volume of overburden and soil stockpiles within the direct disturbance area;
- location and layout of infrastructure within the processing area;
- location of groundwater dewatering and injection infrastructure;
- location of other infrastructure such as internal haul roads and services infrastructure; and
- avoidance of environmental constraints (eg Aboriginal heritage items, significant vegetation).

As a result, there is a need to provide flexibility in the design of the Balranald Project in any planning approvals. Accordingly, to allow for this flexibility, the adopted environmental impact assessment approach is conservative, providing the ability for some project elements and infrastructure to be relocated within the project area during detailed design in the assessment of environmental, social and economic impacts of the Balranald Project.

The approach for the environmental impact assessments considered the principles of avoid, mitigate, and compensate. That is:

- where features with high significance were identified that could be avoided, Iluka revised the project design to avoid impacts to these area by relocating infrastructure (such as internal roads, soil and overburden stockpiles, ancillary infrastructure etc); and
- where features could not be avoided and would be directly impacted, it was assumed that these would be impacted, and the EIS prepared on this basis with identification management, mitigation and offsetting.

ES6.2 Noise

A noise assessment was prepared by EMM taking into account the SEARs and relevant policies and guidelines.

Both unattended long-term and attended short-term noise monitoring were undertaken at sites representative of the most sensitive receptors to characterise the existing noise environment.

Noise predictions were undertaken using quantitative noise modelling for construction and operational scenarios using conservative worst-case assumptions.

The noise assessment shows that during adverse weather conditions for all assessment periods and all stages of the mine life, two assessment locations are predicted to experience noise levels above the project specific noise level (PSNL) of 35 dB(A). Of these, one is predicted to experience noise levels greater than 40 dB(A). Assessment locations where noise levels are predicted to be more than 5 dB above PSNL are entitled to voluntary acquisition upon request. Iluka therefore intends to enter into an amenity agreement or acquire this property.

A privately owned land assessment has identified two land parcels that fall into the likely acquisition criteria over the life of the Balranald Project. The project area physically spans over the majority of these two land parcels and this land would be subject to acquisition and/or compensation agreements irrespective of the noise impact assessment.

A low frequency assessment identified that low frequency noise impacts from the Balranald Project are considered unlikely, however, Iluka will monitor and manage operating noise levels, which will include provisions for low frequency noise identification.

Potential sleep disturbance impacts from operational maximum noise level events have been assessed and are expected to satisfy the relevant criteria for all assessment locations.

A 24 hour construction noise assessment identifies that most assessment locations satisfy the required noise management levels (NMLs), with the exception being one location where noise levels are predicted to be marginally above the out of hours NML and sleep disturbance criteria. This is generated by West Balranald to Nepean mine haul road construction. It is expected that with appropriate management and mitigation that noise levels can be managed to below the NMLs over a 24 hour construction period.

Predicted operational and construction road traffic noise levels satisfy relevant noise criteria and guidelines at all assessment locations for all assessed roads.

ES6.3 Air quality

An air quality assessment was undertaken by Environ taking into account the SEARs and relevant policies and guidelines.

Like the noise assessment, air quality predictions were undertaken using quantitative modelling for construction and operational scenarios using conservative worst-case assumptions.

The key air emissions associated with the Balranald Project are fugitive particulate matter. Emission inventories for three key mine stages were developed based on United States (US) EPA emission estimation documentation. Air emissions were quantified for all mobile mining equipment (haul trucks, dozers, etc), ore handling and processing, and wind erosion.

Emissions of total suspended particulates (TSP), particulate matter less than 10 microns in aerodynamic diameter (PM₁₀), particulate matter less than 2.5 microns in aerodynamic diameter (PM_{2.5}), a range of trace metal/metalloid pollutants, and respirable crystalline silica (RCS) were quantified for conceptual mine plans for Years 1, 4, and 8 of mining operations. These were used to assess the temporal and spatial variations of potential air quality impacts over the life of the Balranald Project.

The calculated annual emissions were input into the USEPA regulatory AERMOD model, populated with site-specific terrain, land use and modelled meteorological input data, in order to undertake atmospheric dispersion modelling. Meteorological modelling was undertaken using a combination of prognostic and diagnostic models (TAPM and CALMET) to derive hourly site-representative meteorological data for use in the dispersion simulations. This method is termed as CALMET Hybrid modelling method within this assessment. Meteorological modelling results were verified based on observations from regional BoM automatic weather stations.

The air quality assessment provides a conservative (upper bound) estimate of the potential air quality impacts associated with the Balranald Project. Emission reductions associated with management measures to be implemented by the Balranald Project were taken into account where the control effectiveness of measures could be quantified.

Ground level concentrations and dust deposition rates associated with Years 1, 4 and 8 of mining operations were predicted to be within the impact assessment criteria for all assessment locations.

Trace metal/metalloid and RCS concentrations were predicted to comply with relevant impact assessment criteria for Years 1, 4 and 8 of mining operations.

ES6.4 Greenhouse gases

A greenhouse gas (GHG) assessment was undertaken by Environ taking into account the SEARs.

To evaluate GHG emissions from the Balranald Project and determine its contribution to NSW and Australian annual GHG emissions, emissions were estimated based on information provided by Iluka and relevant GHG emission factors.

GHG emissions were calculated for:

- direct emissions produced from sources within the boundary of the Balranald Project and as a result of Iluka's activities (Scope 1 emissions); and
- indirect emissions generated in the wider economy as a consequence of Iluka's activities, but which are physically produced by the activities of another organisation indirectly (Scope 2 and 3 emissions).

The relative significance of GHG emissions from the Balranald Project is qualitatively evaluated by considering the magnitude of such emissions compared to total GHG emissions released within NSW, nationally and globally. The key findings of the assessment are as follows:

- annual GHG emissions calculated from Year 1 to Year 8 of the Balranald Project (from direct and indirect emissions) were estimated to be between 0.32 million tonnes (Mt) and 0.63 Mt of carbon dioxide equivalent per year (CO₂-e/yr);
- indirect emissions (Scope 2 and Scope 3) are the major contributors of the Balranald Project's GHG emissions;
- of the indirect emissions, downstream product transport to the international market on average accounts for 80% of indirect emissions;
- direct emissions generated by the Balranald Project represent between 0.04% and 0.055% of total annual NSW emissions, 0.011% to 0.015% of Australian emissions and between 0.00013% and 0.00017% of global emissions; and

- indirect emissions generated by the Balranald Project represent between 0.063% and 0.081% of annual NSW emissions, 0.018% to 0.023% of Australian emissions and between 0.0005% and 0.0012% of global emissions.

ES6.5 Biodiversity

A biodiversity assessment was prepared by Niche Environment and Heritage (Niche) in accordance with the SEARs and relevant standards and guidelines. The assessment was based on extensive surveys of the project area and its surrounds undertaken between October 2011 and December 2014.

Eleven native vegetation communities were identified within the project area with two additional vegetation types were created to recognise highly modified vegetation communities. None of the vegetation types within the disturbance area are listed as threatened ecological communities (TEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or EPBC Act. As such, no significant impact will occur to any TEC will occur as a result of the proposed development.

The project has evolved during the course of the ecological investigations and a suite of measures have been designed to avoid, minimise and mitigate adverse impacts on biodiversity. However, residual impacts remain for vegetation and threatened species habitat, with the project progressively clearing 5,160.4 ha of native vegetation. A further 186.1 ha of exotic pasture will be progressively cleared for the project. Significant impacts were identified for six fauna species; the Grey-crowned Babbler; Malleefowl; Little Pied Bat; Jewelled Gecko; Mallee Worm-lizard and Western Blue-tongued Lizard. These species are all listed under the TSC Act and the Malleefowl is also listed under the EPBC Act.

The project also has the potential for indirect impacts including dust, noise, sedimentation or erosion in adjacent bushland and weed invasion. However, the impact assessment has used a conservative approach and incorporated buffers into the disturbance area, which will remain largely unaffected over the life of the project, to quantify and assess such impacts.

Residual impacts will be compensated through a Biodiversity Offset Package. Preliminary calculations presented in the EIS indicate that in the order of 28,000 ha of offsets would be required. A Biodiversity Offsets Strategy has been included in this assessment and the requirements of the Biodiversity Offset Package have been identified using the BioBanking Credit Calculator and in accordance with the EPBC Act Offset Assessment Guide. The Biodiversity Offset Package will meet the calculated requirements in accordance with NSW and Commonwealth policy, and is currently being prepared in consultation with relevant government agencies and other relevant stakeholders.

ES6.6 Aboriginal heritage

An Aboriginal heritage assessment was prepared by Niche in accordance with the SEARs and relevant standards and guidelines.

Five organisations and persons were registered as Aboriginal parties to the Balranald Project for the purposes of OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, including:

- Balranald Local Aboriginal Land Council.
- Kay Dowdy (nee Murray).
- Balranald Aboriginal Health Service (BAHS), Daniel Kelly Snr representing Mutthi-Mutthi Nations.
- Ali Maher National Koorie Site Management.
- Paul Charles Kullila Site Consultants.

The cultural heritage survey was conducted over three field programs between 2012 and 2014. The field programs involved a total of 535 person days of survey.

A total of 548 Aboriginal sites were identified across all archaeological investigations for the Balranald Project. These sites were added to the Balranald Project Aboriginal Heritage Database.

Approximately 76% of the identified Aboriginal sites (417) of these sites are located in or within 100 m of the project area. Three hundred and eighty three (383) Aboriginal sites are located within the project area and 256 Aboriginal sites were located within the disturbance area.

An assessment of significance was undertaken for individual sites and the project area. The project area has social significance to the Aboriginal community because it contains archaeological sites and traditional resources that establish a link between the past and present Aboriginal use of the land.

The project area contains landscapes which have high and moderate archaeological value, but for the most part contains landscapes that are of low archaeological value. The high and moderate value areas include the Box Creek distributary stream of the Lachlan River (at the northern end of the West Balranald mine) and areas of relict lake fringes and depressions associated with the northern injection borefields. These parts of the project area are significant because they may reveal important details about how and when Aboriginal people lived in this area, and how Aboriginal settlement of the area relates to, and informs what is known of Aboriginal history in adjoining areas, including the Willandra Lakes Region World Heritage Area (WLRWHA). In particular the areas of high and moderate significance within the project area may provide a story of how people have utilised the area, and how this utilisation relates to the active and inactive phases of Box Creek's history and the episodic filling history of the lakes as the availability of water changed from the terminal Pleistocene to the present. As well as providing information about the chronology and nature of Aboriginal settlement of the region, the project area may also provide additional information on the local and regional use and distribution of resources, such as raw materials for making stone tools.

An impact assessment was completed for the sites and management and mitigation measures considered. As a result of the archaeological investigation the following recommendations were made:

- preparation of an Aboriginal Cultural Heritage Management Plan;
- surface salvage collection and management of areas based on risk rating for sites directly disturbed as a result of the Project; and
- development of an archaeological research and salvage excavation program.

ES6.7 Water resources

i Introduction

A water assessment has been prepared by EMM to assess potential impacts of the Balranald Project on water resources and groundwater dependent ecosystems (GDEs) in and surrounding the project area. The assessment relies on a number of water-related technical studies, including but not limited to:

- a surface water assessment prepared by WRM;
- a groundwater assessment prepared by Jacobs; and
- a GDE assessment prepared by CDM Smith.

The water assessment and the water-related technical studies were undertaken in accordance with the SEARs and relevant standards and guidelines.

ii Surface water

Although the project area is located in the Murray Darling Basin and nearby to the major inland rivers of the Murrumbidgee, Murray and Lachlan, there are no direct surface water impacts to these major rivers. Within the project area itself, there is an absence of permanent surface water sources, there are no surface water users, and no surface water related infrastructure. The impacts associated with surface water are mostly related to extreme rainfall events, but the implementation of mitigation measures would reduce risks to acceptable levels.

The proposed water management system is adequately configured and designed to prevent long term inundation of the West Balranald mine pit and surrounding project area. Long term catchment modelling, incorporating the mine water management system, indicates that this system is capable of handling both the wettest and driest periods on record at the project area for each of the selected years of mine life. There is a less than a 1% chance of uncontrolled release of mine affected water during any year of mine life during Year 1 and 4.

The use of external water will be minimised by sourcing all processing water from the mine water management system and saline water extracted from the dewatering borefield. No external water will be required to supply these demands, and hence these demands will have no impact on regional water availability.

Water balance modelling indicates that the Balranald Project would source the majority of the required water from dewatered groundwater with make-up water supplied via on-site sources (ie rainfall runoff, and groundwater inflow to the pit). Mine affected water will be reused to supply the MUP, processing plant and saline water dust suppression demands. The dewatering borefield production rates are predicted to exceed the net makeup water demands at all stages of mine life.

Raw water for use in dust suppression of sensitive areas and to supply filtered water demands will be pumped from the Murrumbidgee River. Water will be purchased from the market under the relevant water sharing plan and is therefore within the sustainable limits of this system and therefore no net impact on regional water availability. The only other source of external water will be potable drinking water trucked into the project area.

iii Groundwater

The minimal impact thresholds outlined in the Aquifer Interference Policy (AIP) were used to assess the potential impacts to groundwater resulting from the Balranald Project. Groundwater is classified as 'less productive', based on the high salinity levels. The minimal considerations for less productive groundwater systems were adopted for this assessment.

A regional groundwater model (BAL2.0) was developed by Jacobs to simulate groundwater behaviour under the proposed mining conditions, including dewatering abstraction and reinjection conditions. This was used to inform the design of the dewatering systems and to quantify impacts to the groundwater regime. The numerical model is based on extensive site investigations undertaken over a number of years, a good compilation of data used to describe the hydrostratigraphy, recharge and discharge features and groundwater flow directions, and a sound conceptual hydrogeological model.

The total volume to be abstracted during the construction phase from the Olney Formation is 300 ML over a three year period. The residual drawdown at two abstraction bores is less than 0.2 m. Abstraction from a bore near the processing plant creates a localised drawdown impact, with the 0.2 m drawdown contour constrained to a small area within the footprint of the West Balranald disturbance area.

The model predicts an average dewatering rate of 746 L/s for the six years of mining at West Balranald and an average of 95 L/s during the two years of backfilling. A drawdown cone extends the length of the West Balranald mine during mining and the whole duration of post mining modelling (ie 100 years). In the Shepparton Formation the 0.2 m groundwater drawdown curve extends to approximately 10 km laterally from the strike of the deposit. In the more transmissive Loxton-Parilla Sands the 0.2 m drawdown curve extends to approximately 15 km laterally from the deposit. The 0.2 m drawdown cone does not extend to the Murray or Murrumbidgee rivers, and therefore does not induce additional inflow from these surface water systems. Predicted drawdown impacts in the Olney Formation at the end of mining are evident only for a high dewatering case.

Model-predicted drawdown in the Shepparton Formation and Loxton-Parilla Sands 100 years after cessation of groundwater-affecting activities are similar and some residual drawdown remains. While the magnitude of drawdown reduced following the ceasing of abstraction the extent of the 0.2 m drawdown contour continues to expand outward.

The model predicts an average dewatering rate of 100 L/s for the 1.5 years of mining at the Nepean deposit, with a peak monthly dewatering rate of 186 L/s. Dewatering rates are predicted to increase over the life of the Nepean mining operation, due to the pit deepening further below the pre-mining water table as it advances northward.

Model predicted groundwater drawdown in the Shepparton Formation and Loxton-Parilla Sands at the end of mining the Nepean deposit is localised, with the 2 m drawdown cone extending no more than 2 km from the mine in both units. These small predicted impacts are consistent with expectations given the shallow depth of the mine below the water table. No residual impact of dewatering (ie drawdown) is evident at Nepean deposit 100 year after mining has commenced.

Within a 60 km radius of project area there are 113 private landholder bores, predominantly utilising groundwater for stock and domestic purposes registered on NOW's groundwater database (as extracted in January 2015). The majority of the bores are screened in the Shepparton Formation.

Assessment of the predicted groundwater level fluctuations indicates that there are no instances where the maximum change in pre mining groundwater level exceeds 2 m in any nearby registered landholder bore, therefore there is no requirement for 'make good' provisions in accordance with the AIP.

Injection rates peak at about 1,300 L/s. Modelling indicates that piezometric pressure heads in the Loxton-Parilla Sands increase by more than 5 m above the pre-mining levels. The impact of this on the overlying Shepparton Formation is managed by ensuring water pressures remain 3 m below ground surface. In addition, clay layers and relatively poor hydraulic connection between the two aquifers will also minimise potential water level mounding within the Shepparton Formation.

The water quality of the injected water is similar to the groundwater within the receiving environment in both the Loxton Parilla Sands and overlying Shepparton Formation (should upward leakage occur).

Model predicted mounding in the Shepparton Formation and Loxton-Parilla Sands 100 years after cessation of groundwater-affecting activities indicates mounding of up to 1 m at the off-path borefield. Following the ceasing of reinjection the 0.2 m mounding curve continues to expand, predominantly to the north and east.

iv Groundwater dependant ecosystems

Ecosystems that rely on groundwater are important environmental assets and typically occur where groundwater is at or near the land surface. The vegetation types in the project area are typically hardy, resilient species that periodically rely on groundwater and are not considered to be GDEs. The water sharing plan that applies to the project area (the Murray Darling Basin Porous Rock Water Sharing Plan) does not list any high priority GDEs within the local area.

The neighbouring water sharing plan, the Lower Murrumbidgee Groundwater Water Sharing Plan, identified two high potential GDEs, the Great Cumbung Swamp and terrestrial vegetation along the Lower Murrumbidgee floodplains and prior streams. Neither the Great Cumbung Swamp, or the terrestrial vegetation along the Lower Murrumbidgee floodplains and prior streams are considered to be a GDE, are vulnerable to project-related impacts due to the distance of these ecosystems from the project area. The Great Cumbung Swamp is also hydraulically up gradient from the project area. Supporting documentation for the Lower Murrumbidgee Groundwater Water Sharing Plan speculates that the groundwater dependence of the terrestrial vegetation along the floodplains and prior streams is minimal, noting they are dependent mainly on surface water flows.

ES6.8 Soil resources

A soil resource assessment was prepared by EMM to address the requirements of the SEARs and the requirements of relevant standards and guidelines.

The assessment included a field survey of approximately 4,000 ha of the West Balranald and Nepean mine areas and provides an assessment of the soils to be permanently altered by mining at the West Balranald and Nepean mines (3,794 ha).

The soil survey identified six main soil types (or orders) at West Balranald corresponding with 12 soil colour variations (sub-orders) which is consistent with the significant transition in landscape and vegetation from south to north within the project area. The Nepean mine area was found to be more homogenous than West Balranald with only three soil types and three variants identified.

Hypercalcic Calcarosols are the dominant soil type at both the West Balranald and Nepean mine areas. Red Kandosol is the second most extensive soil type in the Nepean mine area, with Brown Sodosol being the second most common in the West Balranald mine area. Red Dermosol and Grey Vertosol are the least extensive soil types found across the mine areas.

Characteristics of the predominant soils in the project areas include:

- very shallow topsoils with very low organic matter levels;
- significant levels of carbonates, notably in the Calcarosols;
- moderately to strongly alkaline at depth;
- sodicity and salinity levels are high to extreme in most of the clayey soils (eg Sodosols and Dermosols) but lower in the sandy/loamy soils (eg Kandosols); and
- poorly drained and highly infertile.

A land and soil capability (LSC) assessment was undertaken for the project which describes the inherent physical capacity of the land and soil to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources. The LSC assessment found that the project area mainly contains land classed as LSC 6, which is low capability land. Other parts of the project area contains some LSC 5 and 4 land, although this is in the minority. Land and soil capability LSC 6 land is generally described as:

Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.

Assessed land suitability outcomes generally reflect the current and historical uses of the land, being primarily used for low productivity grazing on mainly chenopod (saltbush and bluebush) pasture or uncleared. There is no cropping undertaken on the land, although there is some potential for cropping on the LSC 4 land.

An assessment of the suitability of topsoil and subsoil resources for mine rehabilitation has found that most soils would not be suitable for stripping for reuse (based on standard criteria) due to the predominantly unsuitable soil structure combined with the very shallow topsoil and salinity and sodicity limitations noted above. However, it is considered that most soils can be successfully stripped to predetermined depths and reinstated on the final landforms for subsequent establishment of vegetative cover given appropriate stripping, handling and re-establishment techniques.

ES6.9 Land use

The SEARs required an assessment of the compatibility of the Balranald Project with other land uses. Land uses are primarily agricultural in the vicinity of the project area. Accordingly, an agricultural impact statement (AIS) was prepared for the Balranald Project by EMM.

Whilst the project area is 9,964 ha, the purpose of an AIS is to assess the agricultural impact of a project on agricultural resources. For this reason the assessment firstly focuses on the soil assessment area (3,794 ha) within the project area, and the potential agricultural production within this area using a conservative assessment (ie total removal of these areas from agricultural production for the life of the project). Secondly the assessment quantifies potential agricultural production of the soil assessment area excluding the area covered by Southern Mallee Conservation Areas (SMCAs), which cover a total of 1,067 ha within the soil assessment area, given that these areas are not available at present for agricultural production.

The AIS indicates that the soil assessment area of 3,794 ha has a potential annual gross margin of \$55,521 from a Merino ewe enterprise (on LSC 5/6 and LSC 6 land) combined with a wheat cropping enterprise (LSC 4 land), whilst the area of actual agricultural disturbance has the potential to generate a potential gross margin of \$47,472 per annum from the same Merino ewe enterprise combined with a wheat cropping enterprise. In addition there is the 'opportunity' enterprise of mustering feral goats for sale with an annual gross margin of \$4,553 for the soil assessment area and \$2,727 across the area of actual agricultural disturbance. The post-mining potential gross margin for the soil assessment area is expected to decrease by \$22,775 annually, however there would be a net increase of 1,067 ha land available for livestock production, primarily through increase grazing area resulting from the resumption of the SMCAs.

Land permanently removed from potential agricultural production comprises approximately 28,000 ha required for biodiversity offsets, and an estimated 52 ha associated with the proposed final void at the West Balranald mine. Irrigation water (from the Murrumbidgee River) temporarily removed from potential agricultural production totals 450 ML per annum. No groundwater would be removed from irrigators as a result of the project. The impact to existing groundwater users within the vicinity of the project area is predicted to be minimal.

Rehabilitation of disturbed areas would be progressive throughout the life of the project. The proposed final land use is consistent with pre-mining land uses.

On balance, the Balranald Project would provide considerable economic activity to the regional economy. This activity is much greater than the potential activity generated by the impacted agricultural resources. The Balranald Project would provide economic benefits to the region and would minimise impacts on surrounding agricultural resources and dependent industries.

ES6.10 Traffic

A traffic assessment was prepared by EMM to, among other things, assess potential traffic impacts from the Balranald Project on the safety and efficiency of the affected road networks within NSW, within approximately 100 km of the mine. This includes the two proposed mine access roads (West Balranald Access Road and Nepean Access Road). The assessment was undertaken in accordance with the SEARs and relevant guidelines and policies.

Project related traffic impacts were assessed for the peak stage of mine construction in 2018 (which included the overlap period of mine construction and operations) and the peak stage of mine operations in 2020.

The Nepean Access Road, would incorporate sections of two existing local roads (Burke and Wills Road and Arumpo Road) which would be upgraded to an appropriate standard to accommodate the proposed mine traffic in combination with the existing local and tourist traffic. Prior to the establishment of the West Balranald access road Iluka may require temporary access along Burke and Wills Road for traffic during the early stages of construction. Iluka would ensure sections are regraded to address induced damage and minimise corrugations, potholes and other surface defects.

The current road widths have been measured for all the major roads and sealed local roads in the area potentially affected by the project traffic. The existing daily traffic volumes for these roads were determined from a combination of historic traffic counts undertaken by RMS and more recent counts undertaken specifically for the project.

The assessment of construction and operational traffic impacts for assumed continuing background locality traffic growth of +2.5% per annum. This included the likely project generated traffic from the recently approved Atlas-Campaspe Mineral Sands Project. The product haulage operations for the two mineral sands projects would not generally have cumulative impacts for roads in the Balranald area. However, potential cumulative traffic impacts from the two mineral sands projects have been assessed for the off - site workforce and delivery traffic movements to and from each mine which would be travelling via Balranald from the Swan Hill, Mildura and Tooleybuc directions.

The existing traffic levels of service for the affected roads are generally level of service 'A', with low peak hourly traffic volumes. The only exception is the busiest Sturt Highway urban section (Market Street) through the centre of Balranald either side of the Mayall Street (Balranald-Ivanhoe Road) intersection, which is level of service 'B'. These levels of service will not change with the project generated traffic.

There are no congested intersections within the townships of Balranald or Tooleybuc currently, where the busiest intersections are at Market Street/Mayall Street within Balranald and at Murray Street/Tooleybuc Bridge within Tooleybuc. These intersections are currently at levels of service 'A' during both the morning and afternoon traffic peak hours. However at the Murray Street/Tooleybuc Bridge intersection, the peak hour level of service (which is also affected by the alternating one way traffic operation of the Tooleybuc Bridge) will change to level of service 'B' by 2018 as a result of the background traffic growth independently of the project and there would not be any specific project related traffic capacity impacts at this intersection or any other intersection within either the Balranald or the Tooleybuc townships.

ES6.11 Social

A social assessment for the Balranald Project was prepared by EMM based on work undertaken by Environmental Affairs which included gathering the majority of the baseline data used in this report, including documenting the relevant policy context, developing a profile of the Balranald community and documenting the results of engagement with relevant stakeholders.

The assessment was undertaken in accordance with the SEARs and relevant policies and guidelines. It included an analysis of relevant strategic policies and plans, comprehensive engagement with local stakeholders and an analysis of the Balranald community (both Balranald town and LGA) using a range of data, including data from the Australian Bureau of Statistics (ABS) 2011 Census of Population and Housing (2011 Census).

The majority of the strategic policies and plans at the local, regional, State and Commonwealth level emphasise fostering responsible economic growth consistent with environmental and social sustainability. In particular, both the State Government's regional action plan for the Murray-Lower Darling Region and BSC's economic development strategy recognise opportunities to grow the economy and increase regional business investment through mineral sand mining. As such, the Balranald Project is considered to be consistent with the applicable policy framework.

A total of 65 interviews were held with business owners, community service providers, community leaders and landholders in and around Balranald town. In addition, a number of stakeholder engagement sessions were held to provide any interested member of the community with the opportunity to learn about the Balranald Project. Community members generally expressed very positive attitudes to the Balranald Project, particularly in relation to the possible employment opportunities. Interviewees in particular expressed interest in the proposed Iluka workforce arrangements, potential employment opportunities for local people and how local people, especially young people, could position themselves to be considered for jobs with Iluka or its contractors.

The stakeholder engagement and analysis of the Balranald community found that the population of the Balranald LGA and town has been declining as a result of the impacts of the Millennium Drought and the closure of the river red gum timber industry. It found that, for a regional town of its size and population, Balranald is well served by essential community services such as education, health, emergency services. In most community service sectors, there is a degree of spare capacity because of recent and continuing population decline. Notwithstanding this, some services such as pupil/teacher ratios are being progressively scaled back in response to population decline. It was noted that the availability of rental accommodation is limited and that the housing market is relatively small with more sales in the lower price range than in higher price brackets. Stakeholders stated that there is a particular need for more facilities and services that cater for youth in Balranald.

The social assessment found that the Balranald Project would, overall, benefit the Balranald community. It found that the project has the potential to diversify and strengthen the region's economic base. It would likely increase the size of a number of industry sectors - particularly mining, but also mining related services such as mechanical repairs, utilities, wholesale and retail trade, accommodation and entertainment. Businesses in the region would likely benefit through direct expenditure and the extra money injected into the area through mine employment and services catering to the Balranald Project. These factors mean the economy of the Balranald region could be more resilient in the short and medium term.

Jobs created through the Balranald Project and other mineral sands mining projects would provide the opportunity for more people to remain in the region helping to offset population decline.

ES6.12 Economics

An economic assessment of the Balranald Project was prepared by Gillespie Economics in accordance with the SEARs and relevant guidelines.

The assessment included two main analyses; a benefit cost analysis (BCA) and an economic activity analysis using input-output analysis of the regional economy (comprising the LGAs of Balranald, Deniliquin, Hay, Murray, Wakool, Wentworth, Mildura and Swan Hill) and NSW economy.

The BCA indicated that the Balranald Project would have net production benefits of \$148 M. Assuming 55% foreign ownership, \$132 M of these net production benefits would accrue to Australia. Provided the residual environmental, social and cultural impacts of the Balranald Project that accrue to Australia are considered to be valued at less than \$132 M, the Project can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

Instead of leaving the environmental, cultural and social impacts unquantified an attempt was made to quantify them. The main quantifiable environmental impacts of the Balranald Project that have not already been incorporated into the estimate of net production benefits via mitigation, offset and compensation costs, relate to greenhouse gas emissions. These impacts to Australia are estimated at less than \$1 M, considerably less than the estimated net production benefits of the Balranald Project. There may also be some non-market benefits of employment provided by the Balranald Project which are estimated to be in the order of \$16 M. Overall, the Balranald Project is estimated to have net social benefits to Australia of between \$132 M and \$148 M and hence is desirable and justified from an economic efficiency perspective.

The Balranald Project construction would require an average workforce of 209 people for the construction of the West Balranald mine, requiring an annual expenditure of approximately \$75 M. Economic activity analysis, using input-output analysis, found that the stimulus effects of this expenditure and employment on the region are in the order of:

- \$136 M in annual direct and indirect regional output or business turnover;
- \$51 M in annual direct and indirect regional value added;
- \$24 M in annual direct and indirect household income; and
- 420 direct and indirect jobs.

Stimulus effects would be much greater during the operational phase when the expenditure and employment created would be more substantial. The representative increased annual stimulus provided to the region and NSW is estimated as follows:

- \$965 M and \$720 M in annual direct and indirect output or business turnover regionally and for NSW respectively;
- \$300 M and \$196 M in annual direct and indirect value added regionally and for NSW respectively;
- \$82 M and \$58 M in annual direct and indirect household income regionally and for NSW respectively; and
- 1,289 and 771 extra direct and indirect jobs created regionally and for NSW respectively.

While the Balranald Project would result in some displacement of agricultural activity, these economic impacts are estimated at between 0.1% and 0.8% of the regional economic activity benefits of the project.

Accordingly, the economic benefits of the Balranald Project are significant.

ES6.13 Geochemical

A geochemistry assessment of the Balranald Project was prepared by Earth Systems in accordance with the SEARs and relevant legislation, policies and guidelines. The geochemistry assessment specifically relates to the potential for acid and metalliferous drainage (AMD) impacts on water quality associated with sulfide oxidation in mine materials.

Samples from the West Balranald and Nepean deposits were analysed to characterise the overburden and ore as part of the Balranald Project's geochemical assessment. Mining by-products that would be generated both on-site and at the Hamilton MSP and product samples were also classified as part of the assessment. The results of the assessment indicate that the non saline overburden (NSOB) and saline overburden (SOB) at the West Balranald deposit is non acid forming (NAF), while the ore and organic overburden (OOB) is potentially acid forming (PAF). At the Nepean deposit, both the ore and NSOB is NAF. All of the mining by-products and products tested were classified as PAF.

The results were used in conjunction with the water balance estimates and groundwater modelling to assess potential water quality impacts and the quantity of AMD generated from overburden, ore, mining by-products, pit walls, benches and floors and products. As a result of this assessment the highest risk AMD impacts were considered to be:

- during construction phase - runoff or seepage of AMD from temporary OOB stockpile into surface water or groundwater;
- during operations phase - runoff or seepage of AMD from stockpiled ore at the West Balranald mine into surface water or groundwater and release of AMD from the TSF to Box Creek; and
- post closure and decommissioning - release of AMD from backfilled overburden, mining by-products and dewatered in situ material at the West Balranald mine into the final void or groundwater.

A range of measures are proposed to manage and mitigate AMD risks associated with the Balranald Project, including the application of limestone to neutralise AMD. Following implementation of these management and mitigation measures, residual risks were generally found to be low and manageable throughout the three project phases.

ES6.14 Hazards and risk

In addition to other technical assessments undertaken as part of the EIS to address potential hazards and risks associated with the Balranald Project (ie geochemistry and bushfire), a radiation risk assessment and an assessment of potential hazards and risks associated with the storage of dangerous goods within the project area was undertaken.

The radiation risk assessment was prepared by Iluka based on relevant legislation, guidelines and policies. It relied on three baseline radiation assessments prepared by Earth Systems and Land and Water Consulting. Based on the existing environment baseline information collected for the Balranald Project, waste characterisation work and results from the radiological risk assessment, it is considered that with the implementation of mitigation measures, the project will present a negligible radiological risk to human health and the environment.

The assessment of potential hazards and risks associated with the storage of dangerous goods within the project area, such as diesel, petrol and liquefied petroleum gas (LPG) and/or liquefied natural gas (LNG) was undertaken in accordance with State Environmental Planning Policy No. 33 - Hazardous and Offensive development (SEPP 33). Hazardous materials were identified and would comply with threshold quantities and distances to site boundaries specified in DP&E's guideline Applying SEPP 33. Subject to these setbacks being maintained and provided that dangerous goods such as diesel, petrol oils and LPG/LNG are stored in accordance with relevant standards, the Balranald Project will not be a hazardous or offensive development.

ES6.15 Bushfire

A bushfire assessment was prepared by EMM in accordance with the SEARs and relevant legislation and guidelines, including the NSW Rural Fire Services' (RFS) Planning for Bushfire Protection (PBP) Guidelines (RFS 2006).

The assessment found that parts of the project area contain bushfire prone land, including the processing area where habitable buildings would be constructed. Asset protection zones (APZs) for these buildings were determined using the PBP guidelines which compares the PBP bushfire hazard vegetation classification and slope classes on bushfire prone land. The assessment found that proposed vegetation clearance in and around the processing area would provide APZs that more than meet the PBP Guidelines. In addition, buildings in the processing area would be designed and constructed to protect human life and reduce the impact from a bushfire.

Management measures would be used to prevent a fire or explosion in the project area igniting a bushfire, reduce the severity of an existing bushfire through the provision of the APZs and outline ways of fighting fires with mine resources.

Therefore, the risks associated with the Balranald Project being damaged by, igniting or contributing to the severity of a bushfire are expected to be appropriately managed.

ES6.16 Non-Indigenous heritage

A non-Indigenous (or historic) heritage assessment of the Balranald Project was undertaken by Landskape in accordance with the SEARs and relevant legislation, policies and guidelines. The non-Indigenous heritage assessment did not identify any historic heritage sites or values within and within close proximity to the project area with potential to be impacted by the Balranald Project.

ES6.17 Visual

An assessment of potential visual impacts of the Balranald Project was undertaken by EMM in accordance with the SEARs. The assessment considered potential visual impacts associated with:

- temporary changes to the landscape as a result of vegetation removal, overburden stockpiling, landform modification, modification to natural drainage patterns and the placement of artificial elements into the landscape (ie buildings or structures); and
- permanent changes to the landscape as a result of the development of the final landforms that would remain post mining, including removal of mallee vegetation and a final void.

The visual assessment considered potential visual impacts of the project on surrounding sensitive receivers, including Balranald town, rural residences, conservation areas (WLRWHA, Munga National Park and Yanga National Park) and road users.

The assessment of potential impacts on rural residences surrounding the project area was based on eight representative viewpoints surrounding both the West Balranald and Nepean mines. The visual assessment utilised a viewshed analysis using GIS to calculate the visibility of features in the Balranald Project for three conceptual mine layout plans, Year 1, Year 4 and Year 8, at any point in surrounding the project area. Generally, visual and lighting impacts were considered to be negligible to low based on the distances between viewpoints and mining operations, and screening provided by existing vegetation.

Given the limitations of viewshed analysis to determine the visibility of lattice towers, an assessment of two proposed steel lattice telecommunication towers proposed as part of the Balranald Project was undertaken based on the results of a study determining visibility distance of towers in the US. The results of this study indicate that the telecommunications towers at the West Balranald and Nepean mines would not be visible from any sensitive receptors.

ES7 Management and mitigation measures

Management during the Balranald Project would be in accordance with an environmental management strategy (EMS). The EMS would contain a suite of environmental management plans which detail the site-specific management measures and procedures to be implemented during construction and operation of the Balranald Project for mitigating and managing impacts including noise, air quality, GHG emissions, biodiversity, heritage, water resources, land resources, traffic, social, geochemical, hazards and risks, bushfire, visual and rehabilitation.

The EMS would be developed to be consistent with the mining operations plan (MOP) process. This would include development of plans consistent with a MOP, and annual monitoring and reporting to the Department of Primary Industries (DPI) through the annual environmental management report (AEMR) process. The EMS would be prepared to allow it to integrate with the MOP and AEMR for the Balranald Project.

Management plans under the EMS would be prepared in consultation with relevant government agencies where required. The EMS would be developed to be consistent with the conditions of the Balranald Project development consent and other planning approvals, should they be granted.

ES8 Justification and conclusion

There is a sound and broadly based justification for the Balranald Project. It would provide a secure supply of HMC to the Hamilton MSP and thus provide a social and economic benefit to the region, NSW and broader Australian community and would provide substantial stimulus to a region in need and with few equivalent economic opportunities.

While the Balranald Project would result in the cessation of agricultural activities in the project area for its duration, these impacts would be temporary, and the majority of the land would be progressively rehabilitated to enable future use for agriculture and grazing. Part of the land would be restored with native vegetation communities to re-establish a fauna corridor linking native vegetation communities to the east and west of the West Balranald mine.

In the long term, the biodiversity offset strategy would improve overall biodiversity values in the region.

A range of commitments are proposed by Iluka to meet regulatory environmental standards underpinned by Commonwealth, state and local strategic planning policies and minimise/address impacts of the Balranald Project. The proposed measures would be further detailed in a comprehensive series of management plans which would underpin the operations of the Balranald Project. Through the commitments, the management plans and operational practices, the Balranald Project would enable the orderly and logical use of natural, physical and human resources existing in the area and region. Enhanced outcomes would result from greater investment, employment and the use of leading practices to recover the mineral sands efficiently, while minimising potential environmental and social impacts.

The Balranald Project construction would require an average workforce of 209 people for the construction of the West Balranald mine, requiring an annual expenditure of approximately \$75 M. The stimulus effects of this expenditure and employment on the region are in the order of:

- \$136 M in annual direct and indirect regional output or business turnover;
- \$51 M in annual direct and indirect regional value added;
- \$24 M in annual direct and indirect household income; and
- 420 direct and indirect jobs.

Stimulus effects would be much greater during the operational phase when the expenditure and employment created would be more substantial. The representative increased annual stimulus provided to the region and NSW is estimated as follows:

- \$965 M and \$720 M in annual direct and indirect output or business turnover regionally and for NSW respectively;
- \$300 M and \$196 M in annual direct and indirect value added regionally and for NSW respectively;
- \$82 M and \$58 M in annual direct and indirect household income regionally and for NSW respectively; and

- 1,289 and 771 extra direct and indirect jobs created regionally and for NSW respectively.

The clearest indication of the Balranald Project's overall worth to society is shown by the results of the comparison of costs and benefits using dollar values. The Balranald Project is estimated to have total net production benefits of \$148 M.

The benefits of the Balranald Project largely outweigh its costs and it is considered to be in the public interest.



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