

ATLAS-CAMPASPE

Mineral Sands Project

ENVIRONMENTAL IMPACT STATEMENT



EXECUTIVE SUMMARY



CRISTAL



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ES1 OVERVIEW

This Environmental Impact Statement (EIS) is for the Atlas-Campaspe Mineral Sands Project (the Project). The Project includes the development of a mineral sands mining operation (the Atlas-Campaspe Mine), together with the construction and operation of a rail loadout facility (the Ivanhoe Rail Facility).

The proposed Atlas-Campaspe Mine is located approximately 80 kilometres north of Balranald and 270 kilometres south-east of Broken Hill in New South Wales (Figure ES-1). The proposed Ivanhoe Rail Facility is located approximately 135 kilometres north-east of the proposed Atlas-Campaspe Mine, and is approximately 4.5 kilometres to the south-west of the township of Ivanhoe in New South Wales (Figure ES-1).

The Project is being developed by Cristal Mining Australia Limited¹ (Cristal Mining), which is wholly owned by Cristal Australia Pty Ltd. Cristal Australia Pty Ltd is a wholly-owned subsidiary of The National Titanium Dioxide Company Limited (Cristal).

The Project would integrate with currently existing/approved Cristal Mining operations in western New South Wales, including (Figure ES-1):

- the Broken Hill Mineral Separation Plant (the MSP);
- Snapper Mine – located approximately 105 kilometres to the west of the proposed Atlas-Campaspe Mine; and
- Ginkgo Mine – located approximately 100 kilometres to the west of the proposed Atlas-Campaspe Mine.

Nature of the Project

Construction

Initial construction activities would be associated with the development of the Atlas deposit footprint and supporting infrastructure at the Atlas-Campaspe Mine and construction of the Ivanhoe Rail Facility (Figures ES-2 and ES-3).

It is expected that construction activities would peak during Year 1 of the Project, requiring a short-term peak construction workforce of up to 300 people (total) for approximately 2 to 3 months, but averaging at approximately 150 people during the initial construction phase.

Construction works associated with roadworks along the proposed mineral concentrate transport route would also be undertaken during this time (Figure ES-4).

Construction activities associated with the initial development of the Campaspe deposit footprint at the Atlas-Campaspe Mine (Figure ES-2) would also be required during the life of the Project (approximately Year 5), and would require a short-term construction workforce averaging approximately 100 people.

The majority of the construction workforce would utilise the proposed accommodation camp at the Atlas-Campaspe Mine (Figure ES-2).

Construction would be undertaken up to 24 hours per day, seven days per week.

The Socio-Economic Assessment indicates that, in total, the construction of the Project is predicted to have the following positive impacts on the New South Wales economy:

- \$124 million in annual direct and indirect output;
- \$56 million in annual direct and indirect regional value added;
- \$40 million in annual direct and indirect household income; and
- 485 direct and indirect jobs.

Operations

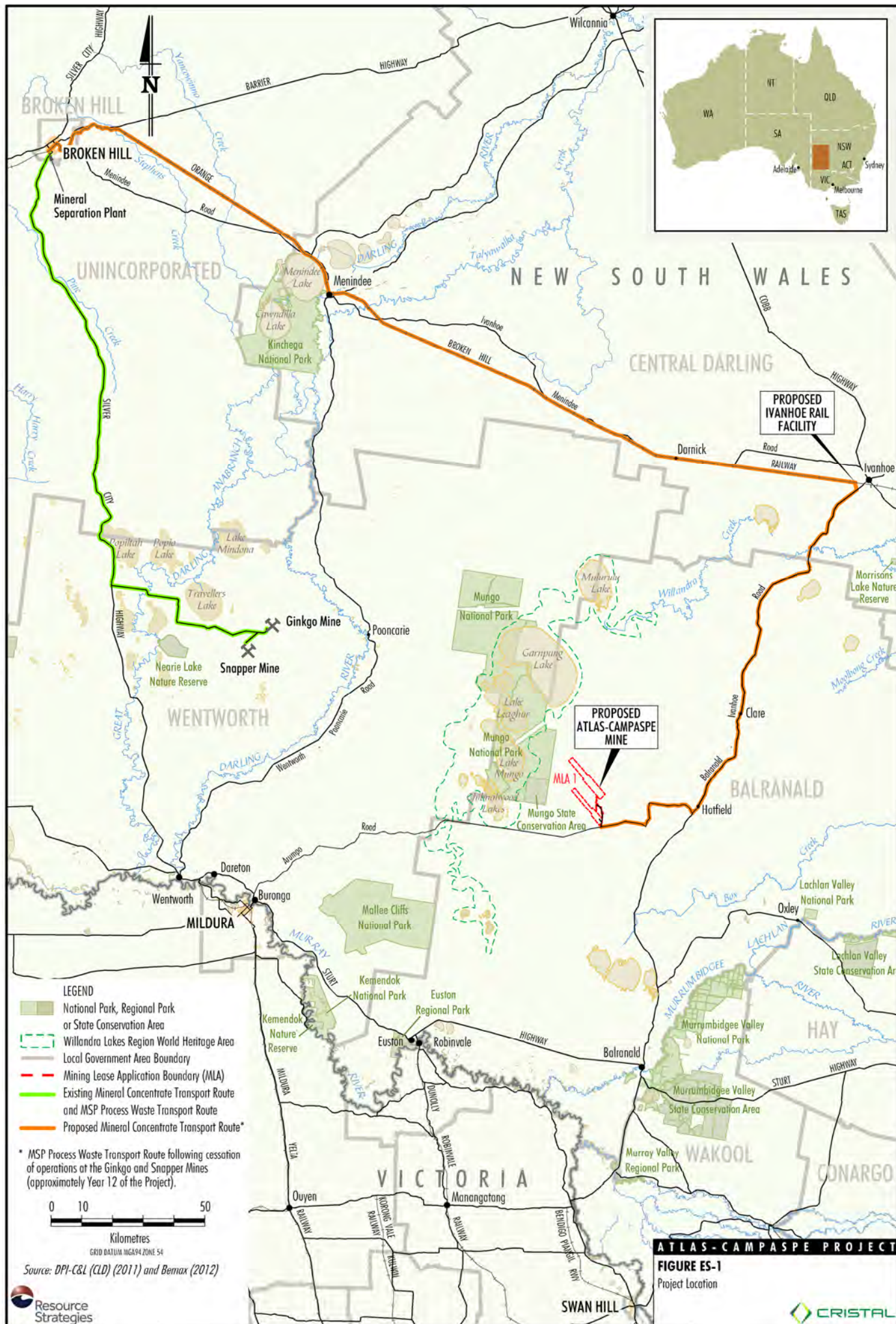
The Project would operate 24 hours per day, seven days per week.

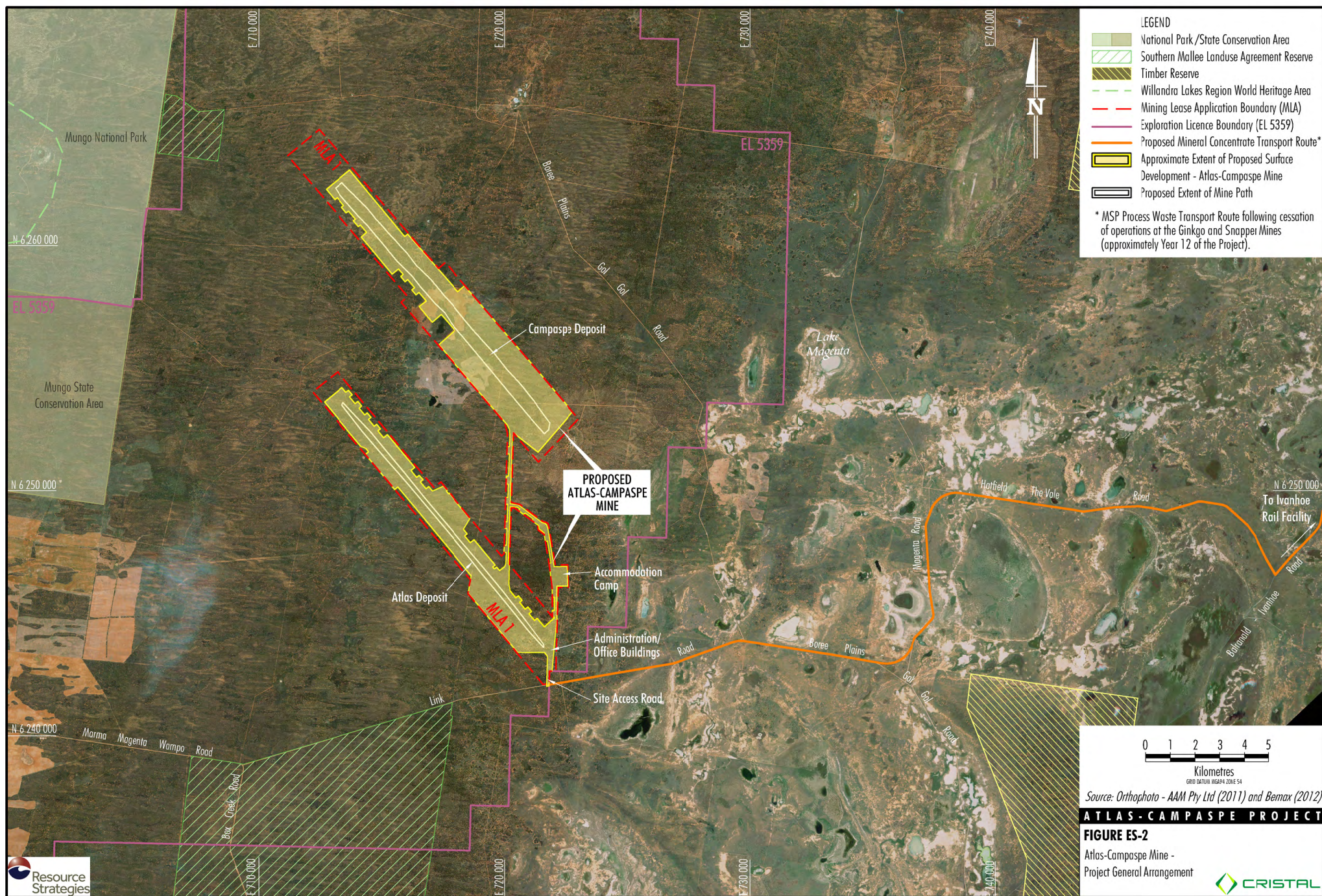
Approximately 109 million tonnes of mineral sands ore would be mined using conventional (non-dredge) mining methods over the life of the Project.

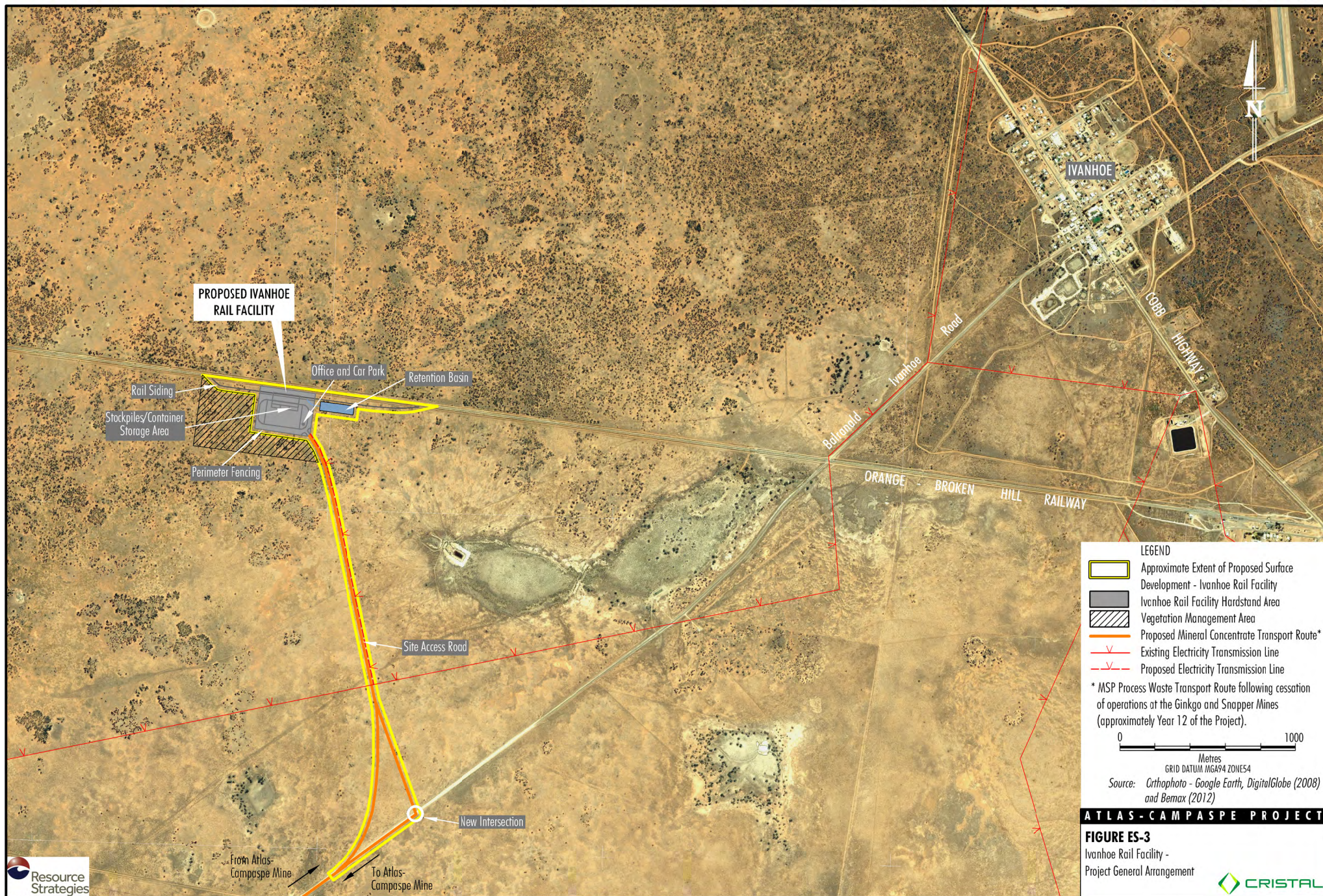
Product (mineral concentrates) generated as a result of operations at the Atlas-Campaspe Mine would be trucked to the Ivanhoe Rail Facility for transfer to train wagons, which would then be railed to the existing MSP (Figure ES-1).

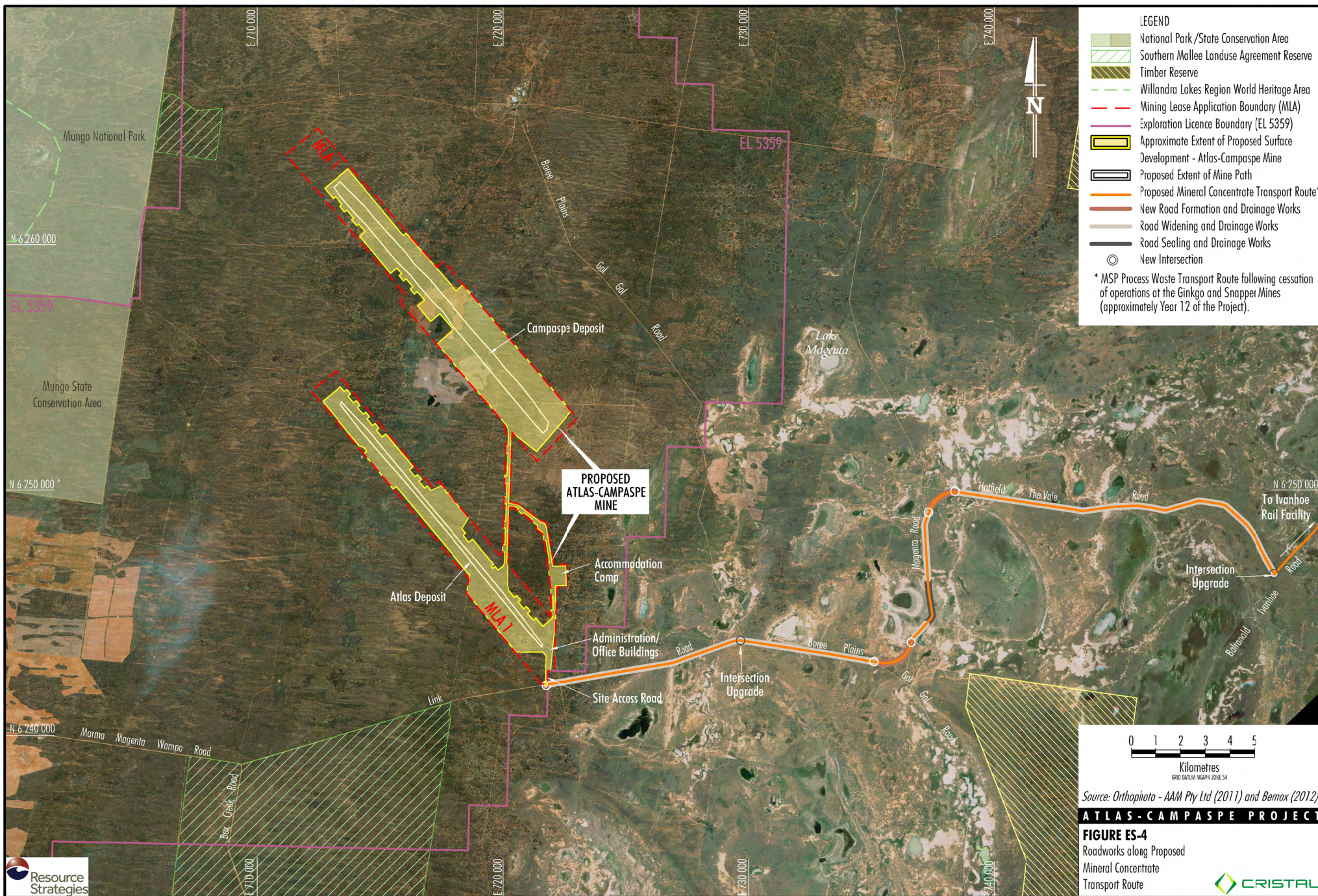
At the MSP, the mineral concentrates from the Atlas-Campaspe Mine would be separated and treated to produce valuable minerals including ilmenite, leucosene, rutile and zircon.

¹ Prior to 1 October 2012, Cristal Mining was known as Bemax Resources Limited.









Process wastes generated as a result of processing mineral concentrates at the MSP would continue to be backloaded to the Snapper and Ginkgo Mines until the Development Consents at the existing operations expire (approximately Year 12 of Project).

At that time, the MSP process waste generated as a result of processing mineral concentrates from the Atlas-Campaspe Mine would be transported in sealed containers via the Orange – Broken Hill railway to the Ivanhoe Rail Facility for subsequent road transport in sealed containers to the Atlas-Campaspe Mine for unloading, short-term stockpiling and placement behind the advancing ore extraction areas.

At full development, the proposed Project operational workforce would be approximately 200 people, including a mixture of direct Cristal Mining employees and contractors.

The Socio-Economic Assessment indicates that, in total, the operation of the Project is predicted to have the following positive impacts on the New South Wales economy:

- \$388 million in annual direct and indirect regional output or business turnover;
- \$202 million in annual direct and indirect regional value added;
- \$54 million in annual direct and indirect household income; and
- 643 direct and indirect jobs.

Statutory Context

The Project is “State Significant Development” to which Division 4.1 of Part 4 of the New South Wales *Environmental Planning and Assessment Act, 1979* applies.

This EIS has been prepared to accompany a Development Application made for the Project. This EIS addresses the Director-General’s Requirements issued by the New South Wales Department of Planning and Infrastructure.

This EIS will be placed on public exhibition and comments from the community and government agencies will be addressed by Cristal Mining. The Project will be determined by the New South Wales Minister for Planning and Infrastructure (or delegate).

The proposed action to develop the Project is a “controlled action” for the purposes of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

This EIS forms part of the assessment process under the *Environment Protection and Biodiversity Conservation Act, 1999*. A decision will be made whether or not to approve the controlled action by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (or delegate).

This EIS does not seek approval for any modification to the approved MSP, Snapper Mine or Ginkgo Mine.

ES2 KEY FEATURES OF THE PROJECT

The proposed life of the Project is approximately 20 years, commencing approximately 1 July 2013 or upon the grant of all required approvals (both State and Commonwealth).

ES2.1 ATLAS-CAMPASPE MINE

The main activities associated with the development of the Atlas-Campaspe Mine would include:

- ongoing exploration activities;
- sequential development and operation of two separate mineral sands ore extraction areas within the mining lease application area (MLA 1);
- use of conventional mobile equipment to mine and place mineral sands ore into dry mining units at a maximum ore production rate of up to 7.2 million tonnes per annum;
- mineral processing infrastructure including the primary gravity concentration unit, salt washing facility and a wet high intensity magnetic separation circuit;
- mineral concentrate stockpiles and materials handling infrastructure (e.g. towers and stackers);
- progressive backfilling of mine voids with overburden behind the advancing ore extraction areas or in overburden emplacements adjacent to the mine path;

- placement of sand residues and coarse rejects (and MSP process wastes²) following mineral processing to either the active mining area (behind the advancing ore extraction area) or in sand residue dams;
- development of a groundwater borefield at the Atlas deposit and localised dewatering systems (e.g. bores, spearfields and trenches) at both the Atlas and Campaspe deposits, including associated pump and pipeline systems;
- a reverse osmosis plant to supply the salt washing facility and potable water;
- progressive development of water storage dams, sediment basins, pumps, pipelines and other water management equipment and structures;
- administration/office buildings, car parking facilities, workshop and stores;
- on-site accommodation camp;
- sewage treatment plant;
- diesel powered generators, electricity distribution station and associated internal electricity transmission lines;
- site access road, internal access roads and haul roads;
- roadworks along the proposed mineral concentrate transport route to the Ivanhoe Rail Facility;
- transport of mineral concentrates along the mineral concentrate transport route to the Ivanhoe Rail Facility;
- road transport of MSP process waste² in sealed storage containers from the Ivanhoe Rail Facility to the Atlas-Campaspe Mine for subsequent unloading, stockpiling and placement behind the advancing ore extraction areas;
- development of soil stockpiles and laydown areas;
- monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

Mining Operations

Mining at the Atlas-Campaspe Mine would commence with the development of an initial excavation at the south-eastern end of the Atlas deposit and then progress in a north-westerly direction during Years 2 to 5 of the Project.

Mining of the Campaspe deposit at the Atlas-Campaspe Mine would commence once mining within the Atlas deposit footprint is complete. Initial development would commence at the south-eastern end of the Campaspe deposit in approximately Year 5 and mining would progress in a north-westerly direction during Years 6 to 20.

The general sequence of mining operations would be as follows:

1. Vegetation clearance and soil stripping.
2. Overburden removal ahead of ore extraction areas using conventional truck and shovel methods (e.g. excavators and haul trucks).
3. Mineral sands ore extraction and placement in a dry mining unit using conventional dry mining equipment (e.g. dozers and loaders).
4. Overburden replacement including progressive backfilling of mine voids behind the advancing ore extraction areas or in overburden emplacements adjacent to the mine path.
5. Placement of process wastes (i.e. sand residues, coarse rejects and MSP process waste²) following mineral processing to either the active mining area (behind the advancing ore extraction area) or in sand residue dams.
6. Overburden and soil replacement including profiling of the final landform in preparation for rehabilitation activities.
7. Progressive rehabilitation behind the advancing mining operation.

On-site Processing and Mineral Concentrate Stockpiling

Processing of mineral sands ore would operate at the Atlas-Campaspe Mine up to 24 hours per day, seven days per week.

The mineral concentrates would be stockpiled in the mineral concentrate stockpile areas at the Atlas-Campaspe Mine.

² Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).

Prior to loading and transport to the MSP, the mineral concentrate stockpiles would be dewatered and front end loaders used to load mineral concentrates from the stockpiles direct to haulage vehicles.

In consideration of the MSP processing schedule (including Ginkgo and Snapper Mines), the total mineral concentrate transported from the Atlas-Campaspe Mine to the MSP has been assessed at up to approximately 0.45 million tonne in any one year. Given the planned maximum production rate in Years 3 to 5 from the Atlas mine path is greater than 0.45 million tonne per annum, mineral concentrate would need to be stockpiled during this time.

The mineral concentrates stockpiled would be progressively reclaimed following cessation of mining at the Atlas deposit and would continue to be transported during mining operations within the Campaspe footprint until the stockpiles are depleted.

Mineral Concentrate and MSP Process Waste Transport

Road Transport

Mineral concentrate would be hauled via road approximately 175 kilometres from the Atlas-Campaspe Mine to the Ivanhoe Rail Facility. The mineral concentrate would be transported in road trains³.

The proposed mineral concentrate transport route to the Ivanhoe Rail Facility is shown on Figure ES-1.

Road transport of mineral concentrate would be undertaken 24 hours per day, seven days per week.

From approximately Year 12 of the Project, MSP process waste in sealed containers would be unloaded from trains at the Ivanhoe Rail Facility, and temporarily held in a designated area prior to loading onto haulage vehicles for the return trip to Atlas-Campaspe Mine. No additional haulage movements for the MSP process waste, in addition to the mineral concentrate haulage vehicle movements, would be required for the Project.

ES2.2 IVANHOE RAIL FACILITY

The main activities associated with the construction and operation of the Ivanhoe Rail Facility would include:

- development of a rail siding for:
 - loading of train wagons with mineral concentrate for rail transport to the MSP via the Orange – Broken Hill railway; and
 - unloading of MSP process waste in sealed storage containers (transported via the Orange – Broken Hill railway) from train wagons⁴;
- site access road and internal haul roads/pavements;
- hardstand areas for mineral concentrate and MSP process waste⁴ unloading, stockpiling/sealed container storage and loading;
- a retention basin, drains, pumps, pipelines and other water management equipment and structures;
- site office and car parking facilities;
- extension to an existing 11 kilovolt powerline;
- monitoring, landscaping and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

Mineral Concentrate and MSP Process Waste Transport

Rail Transport

Mineral concentrates would be railed from the Ivanhoe Rail Facility to the MSP via the Orange – Broken Hill railway.

Based on train lengths of up to 600 metres, the Project would require a maximum of three trains per week over the life of the Project. No more than one train load of mineral concentrate from the Atlas-Campaspe Mine would be railed to the MSP in any 24 hour period. Rail transport movements would be scheduled to occur at any time once loading is completed (i.e. 24 hours per day, seven days per week).

³ Type 1 road train.

⁴ Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).

From approximately Year 12 of the Project, MSP process waste in sealed containers would be unloaded from trains at the Ivanhoe Rail Facility prior to returning to the Atlas-Campaspe Mine. No additional rail movements for MSP process waste would be required for the Project.

ES3 CONSULTATION AND COMMUNITY INITIATIVES

The Project consultation programme during the preparation of the EIS has been comprehensive and has included:

- Meetings and briefings with Members of the Parliament of New South Wales including:
 - Minister for Trade and Investment (The Honourable Andrew Stoner);
 - Minister for Resources and Energy (The Honourable Chris Hartcher);
 - Minister for Roads and Ports (The Honourable Duncan Gay); and
 - Member for Murray-Darling (Mr John Williams).
- Regular meetings and briefings with key State government agencies for feedback on environmental assessments, key management and mitigation measures, and the proposed biodiversity offset area, including:
 - Department of Planning and Infrastructure;
 - Office of Environment and Heritage;
 - Environment Protection Authority;
 - Roads and Maritime Services;
 - Department of Primary Industries (including the New South Wales Office of Water); and
 - Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure and Services).
- Briefings and meetings with relevant local government agencies including the Balranald Shire Council, Central Darling Shire Council and Broken Hill City Council.
- Consultation with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities regarding assessment under the *Environment Protection and Biodiversity Conservation Act, 1999*.
- Meetings with and presentation of briefing information to the Willandra Lakes Region World Heritage Property Technical Scientific Advisory Committee/Community Management Council regarding the Willandra Lakes Region World Heritage Area.
- Consultation with the community and affected landholders through community information sessions and other Project-specific consultation mechanisms (e.g. newsletter, one-on-one discussions and community meetings).
- Involvement of and consultation with the Aboriginal community through the Aboriginal Cultural Heritage Assessment in accordance with relevant guidelines, including participation in surveys and meetings.
- Briefings with catchment management authorities, including the Lower Murray Darling Catchment Management Authority⁵ and Lachlan Catchment Management Authority.
- Consultation (including provision of a briefing package) with service providers and infrastructure owners, including the Australian Rail Track Corporation regarding the Ivanhoe Rail Facility and rail transport, and Essential Energy for extension to the existing 11 kilovolt powerline for the Ivanhoe Rail Facility.



⁵ The Lower Murray Darling Catchment Management Authority has since merged with the Murray Catchment Management Authority and Western Catchment Management Authority.

Cristal Mining strives to support local communities in the vicinity of its operations including financial support through sponsorships, support programmes, employment and the indirect economic growth and benefits that flow from significant company expenditure within these communities.

Cristal Mining is also a regular contributor to schools, sporting groups, festivals, service organisations and the indigenous community. Cristal Mining has also maintained a relationship with the University of Ballarat including financial contributions and in-kind support of regional environmental research projects.

Cristal Mining will continue its support of local community programmes and groups during the life of the Project.

ES4 ENVIRONMENTAL ASSESSMENT

An environmental risk assessment was conducted for the Project to identify key potential environmental issues for further assessment in the EIS. The environmental risk assessment involved a workshop with Cristal Mining representatives and specialists that contributed to the EIS.

The key environmental assessment issues for the Project are summarised below.

ES4.1 BIODIVERSITY

The Project is located in the Murray Darling Depression Biogeographic Region in an area characterised by predominantly semi-arid woodlands and arid shrublands. The condition of the vegetation/habitat ranges from good to poor depending on the level of previous clearing, grazing and fire history, all of which vary throughout the Project area.

Flora and fauna surveys of the Atlas-Campaspe Mine site including roadworks along the mineral concentrate transport route and the proposed biodiversity offset area (Figure ES-5) were undertaken by Australian Museum Business Services. The surveys were conducted over multiple seasons in consideration of the relevant State and Commonwealth guidelines. The fauna survey techniques included Elliot trapping, pitfall trapping, funnel traps, harp trapping, remote cameras, bat call recording, hair tubes, spotlighting, herpetological searches, bird census, call playback and searches for scats and traces.

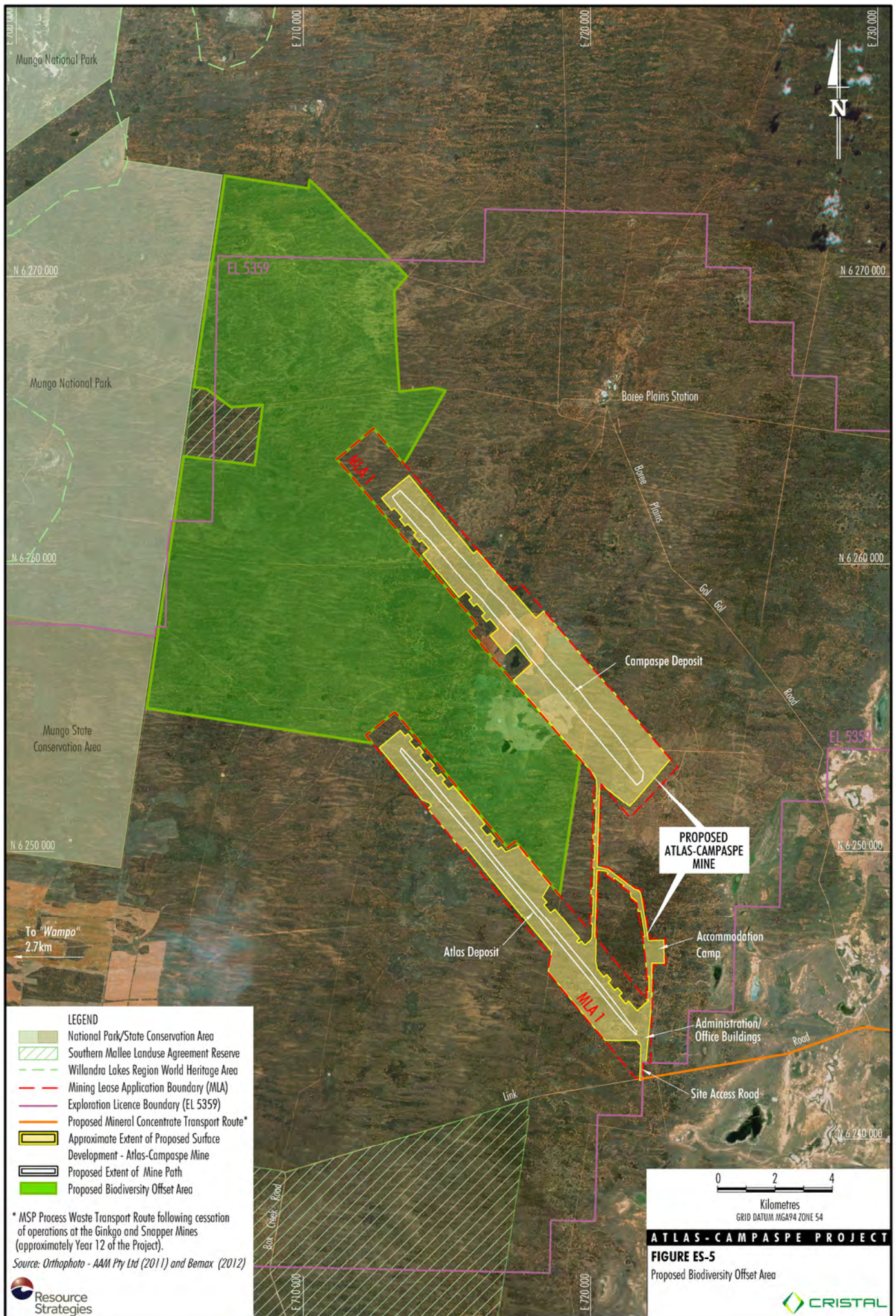
The flora survey techniques included quadrats, rapid data points, vegetation mapping, condition assessment and threatened species searches.

The main vegetation communities present across the Atlas-Campaspe Mine footprint are Belah-Rosewood Woodland and mallee (Linear Dune Mallee and to a lesser extent Sandplain Mallee). Other vegetation communities are more localised, such as the Black Box Woodland and various Acacia shrublands (Mulga Woodland, Yarran Shrubland and Disturbed Area Shrubland Complex).

Most of the vegetation communities in the Project area are estimated to be at least 70 percent of their pre-European extent. However, one vegetation community in the Atlas-Campaspe Mine footprint is listed under the New South Wales *Threatened Species Conservation Act, 1995*, namely the *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression Bioregions Endangered Ecological Community and another threatened ecological community occurs in scattered occurrence along the mineral concentrate transport route, namely the *Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and New South Wales Western Slopes Bioregions Endangered Ecological Community*.

In 2010 and 2011, the region received approximately double the annual average rainfall. This resulted in ideal conditions during the flora and fauna surveys. Three threatened flora species listed under both the New South Wales *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* were recorded, namely the Winged Peppercreess, Cobar Greenhood Orchid and Mossgiel Daisy. Sixteen threatened fauna species listed under the New South Wales *Threatened Species Conservation Act, 1995* were recorded in the Project area, comprising one reptile, ten birds, one marsupial mouse/dasyurid and four bats. Two of these threatened fauna species are also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

Refinements to the Project design have resulted in avoiding additional impacts on flora and their habitats, such as refinement of the mine layout to avoid impacts to two Malleefowl nesting mounds and two Cobar Greenhood Orchid locations (one of which is located within the proposed offset, however, the 25 m-radius zone around this location within the disturbance area would be avoided).



Additionally, there would be refinement of the Campaspe footprint to avoid some direct impacts on the Black Box Woodland and design of the mineral concentrate transport route to predominantly follow existing road alignments to reduce the amount of vegetation clearance required.

The Project would require the progressive removal of 4,158 hectares of native vegetation and 305 hectares of previously cleared land over approximately 20 years. The progressive clearance of native vegetation ahead of the advancing ore extraction area and active mining area would be followed by progressive rehabilitation and revegetation of the backfilled pit and overburden emplacements.

The potential impacts on all threatened species and communities known or considered likely to occur in the Project area and immediate surrounds were assessed according to the relevant State and Commonwealth legislation and guidelines.

The Project is assessed as potentially having a significant impact on the *Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression Bioregions Endangered Ecological Community* due to the combined area of proposed clearance. However, the conservation and enhancement of this community in the proposed biodiversity offset area has the potential to improve the quality of substantial areas of the community in the medium to long-term. Similarly, the Project could significantly impact the Cobar Greenhood Orchid. Additional mitigation measures are proposed to minimise impacts on the orchid, including conservation of the species in the proposed biodiversity offset area.

Refinements to the Project design have also resulted in avoiding impacts on the Mossgiel Daisy. A section of the existing Magenta Road in the vicinity of the known Mossgiel Daisy population would not be widened (Figure ES-4). This section of road would be sealed to prevent erosion and minimise dust generation.

The Project would be unlikely to significantly impact on any threatened species of fauna, with the possible exception of the Malleefowl, Western Pygmy-possum and South-eastern Long-eared Bat (also known as Corben's Long-eared Bat). It was considered that these species have the potential to be significantly impacted in the short-term due to the proposed removal of habitat and a temporary increase in isolation of some known habitat areas.

These impacts are however not considered likely to result in the loss of the entire local population and the proposed biodiversity offset area has the potential to improve the conservation of these species in the medium to long-term.

Cristal Mining would prepare and implement a Biodiversity Management Plan for the Project to manage potential impacts on flora and fauna. Section ES6 provides a summary of the proposed biodiversity offset area for the Project. The Flora and Fauna Assessments conclude that biodiversity in the region would be maintained and improved in the medium to long-term.

ES4.2 ROAD TRANSPORT

The Atlas-Campaspe Mine site is linked to the Balranald-Ivanhoe Road via a series of unsealed roads (i.e. Link Road, Boree Plains-Gol Gol Road, Magenta Road, Hatfield-The Vale Road) (Figure ES-2). The Balranald-Ivanhoe Road provides access between Balranald and Ivanhoe (Figure ES-1).

The key road transport-related concern that has been raised during the Project consultation programme has been the proposed transport of mineral concentrate and MSP process waste between the Atlas-Campaspe Mine and the Ivanhoe Rail Facility on the proposed mineral concentrate transport route (Figure ES-1).

Based on the planned maximum production rate, up to a maximum 24 road train⁶ trips (i.e. 48 road train movements) per day would be required, with approximately 19 road train trips (i.e. 38 road train movements) per day on average over the life of the Project.

With the exception of approximately 37 kilometres of existing unsealed roads between the Atlas-Campaspe Mine site access road and the intersection with the sealed Balranald-Ivanhoe Road, the remaining section of the approximate 175 kilometre long proposed mineral concentrate transport route is approved to accommodate road trains. Roadworks would be conducted in consultation with the Balranald Shire Council on approximately 37 kilometres of existing unsealed roads between the Atlas-Campaspe Mine site access road and the intersection with the sealed Balranald-Ivanhoe Road (Figure ES-4).

⁶ Type 1 road train.

A new intersection would also be required for the Ivanhoe Rail Facility site access road off Balranald-Ivanhoe Road (Figure ES-3).

In addition, safety deficiencies on Balranald-Ivanhoe Road identified by a Road Safety Audit commissioned by Cristal Mining would be progressively addressed in conjunction with Balranald Shire Council, Central Darling Shire Council and New South Wales Roads and Maritime Services during maintenance activities.

Cristal Mining would enter into road maintenance agreements with Balranald Shire Council, Central Darling Shire Council and NSW Roads and Maritime Services to address the ongoing maintenance requirements for the Project. The road maintenance agreements would specify the timing for the implementation of maintenance to address the safety deficiencies identified in the Road Safety Audit (GTA Consultants, 2012).

A Road Transport Assessment has been prepared by GTA Consultants to assess the potential road transport impacts of the Project. In order to conservatively consider potential cumulative road transport impacts, background traffic growth and the expected traffic generation from the proposed Balranald Mineral Sands Project (Figure ES-6) have also been considered.

The Road Transport Assessment concludes that no significant impacts on the performance, capacity, efficiency and safety of the local road network are expected as a result of the Project. Notwithstanding, Cristal Mining would prepare and implement a Mineral Concentrate and MSP Process Waste Transport Management Plan for the Project.

ES4.3 ABORIGINAL HERITAGE

An Aboriginal Cultural Heritage Assessment for the Project was undertaken by Niche Environment and Heritage with the involvement of and consultation with the Aboriginal community.

Modern Barkandji (Paakantji), Mutthi Mutthi and Ngiyampaa people identify strong contemporary, historical and traditional associations with the Project area and surrounds.

Significant traditional, historical and contemporary cultural values and associations have been identified within the Project area and surrounds by the registered Aboriginal stakeholders and are also known through ethno-historical evidence.

A total of 100 Aboriginal heritage sites were identified within the Project area and surrounds. These consisted of stone artefacts, a scarred tree, hearths and middens. The vast majority of sites were recorded adjacent to the proposed mineral concentrate transport route associated with the lunettes and wider relic lake system.

The Project would result in the direct disturbance of 15 known Aboriginal heritage sites and the partial disturbance of 14 sites. Of these, seven sites are associated with the Atlas-Campaspe Mine footprint, all of which are isolated artefacts of low archaeological significance.

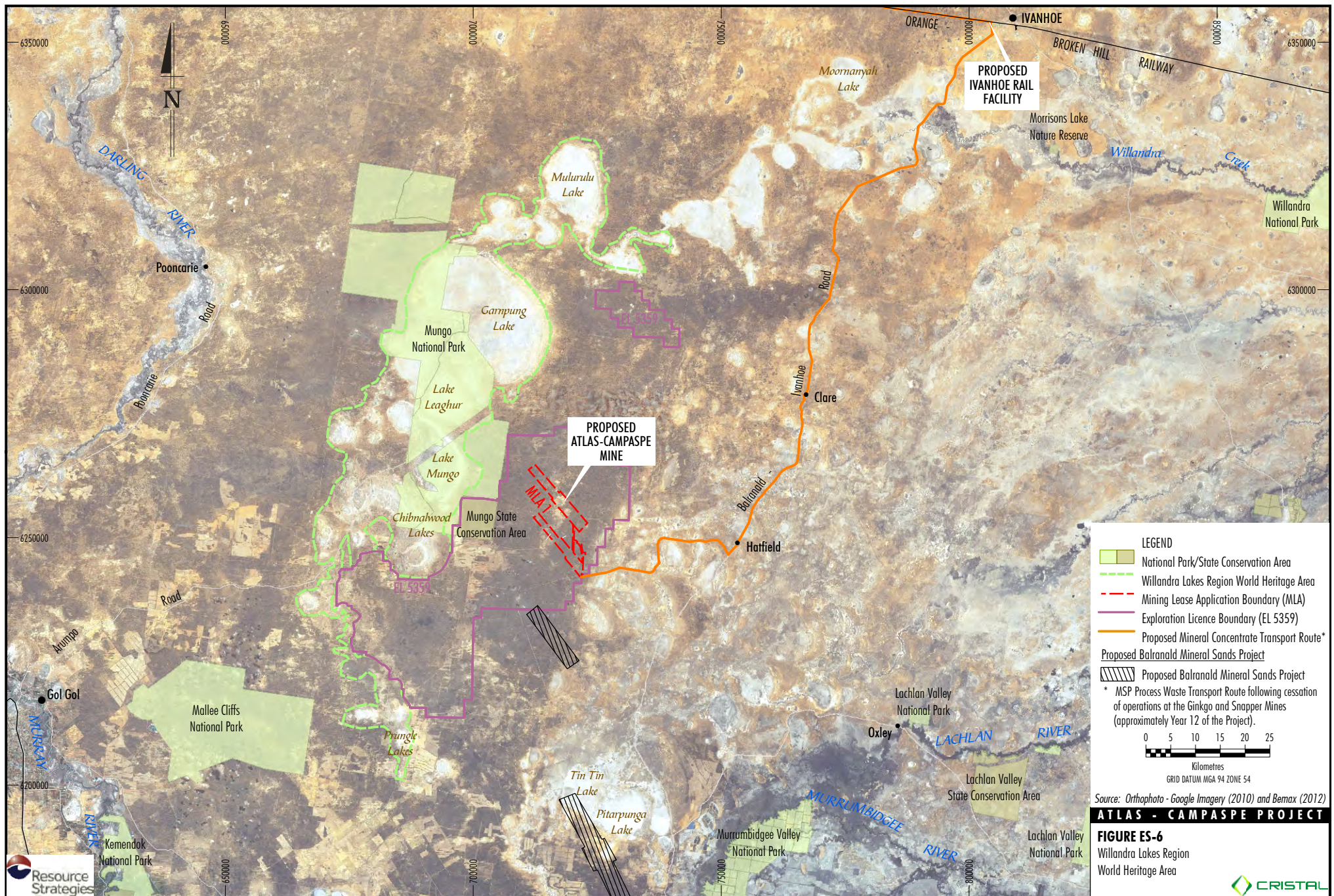
The 22 sites associated with the proposed mineral concentrate transport route include three sites of high archaeological significance, three sites of moderate archaeological significance and 16 sites of low archaeological significance. These 22 sites are located either within or partially within the footprint of the roadworks along the proposed mineral concentrate transport route.

The Ivanhoe Rail Facility (including the site access road) has been designed to avoid known Aboriginal heritage sites.

The Willandra Lakes Region World Heritage Area, located 10 kilometres to the west of the Atlas-Campaspe Mine (Figure ES-6), is listed on both the New South Wales State Heritage Inventory and the Australian Heritage Database for its natural and cultural values. Of particular note, the remains of a 42,000 year old male and female (i.e. Mungo Man and Mungo Lady) were separately discovered within the dunes of Lake Mungo. Mungo Lady is believed to be the oldest site of ritual cremation in the world. Stone artefacts found at Lake Mungo have been dated to between 46,000 and 50,000 years old.

The Willandra Lakes Region World Heritage Area would not be impacted by the Project (Section ES5).

A Heritage Management Plan would be developed for the Project in consultation with the registered Aboriginal stakeholders and the Office of Environment and Heritage to detail management and mitigation measures for implementation throughout the life of the Project.



ES4.4 WATER RESOURCES

Groundwater

A Hydrogeological and Water Supply Assessment for the Project was undertaken by GEO-ENG. The Hydrogeological and Water Supply Assessment was peer reviewed by Heritage Computing (Dr Noel Merrick).

The review of available baseline hydrogeological data indicates underlying saline groundwater aquifers at moderate to significant depths.

The Hydrogeological and Water Supply Assessment has evaluated the potential impacts of the Project on groundwater resources using hydrogeological conceptualisation and is supported by a numerical groundwater model. The model predicts maximum drawdown extents from the groundwater supply borefield and dewatering of the Atlas and Campaspe deposits as follows (Figures ES-7 and ES-8):

- Atlas deposit at the end of mining [Year 5] – 1 metre drawdown at approximately 2 kilometres from the water supply borefield; and
- Campaspe deposit at the end of mining [Year 20] – 1 metre drawdown at approximately 2.9 kilometres from the water supply borefield/dewatering of the Campaspe deposit.

Staged groundwater drawdown contours during the life of the Project are presented in the Hydrogeological and Water Supply Assessment.

The only registered bore local to the Atlas-Campaspe Mine site is at Boree Plains (GW063606), situated approximately 7 kilometres to the north-east (Figure ES-7). The water quality in this bore could not be sampled during the bore census, but is expected to be poor, and the bore is not currently used. Notwithstanding, the model predicted drawdown at this bore due to the Project is negligible.

The Hydrogeological and Water Supply Assessment concludes that there is expected to be negligible change in groundwater quality as a result of the Project. The Hydrogeological and Water Supply Assessment also concludes that there is no evidence of any groundwater dependent ecosystems that would be affected by the Atlas-Campaspe Mine.

Cristal Mining currently holds a combined total of 21,442 share components (units or million litres) in the Western Murray Porous Rock Water Source for the Ginkgo and Snapper Mines, authorised by the following water access licences (WALs):

- WAL 27918 (60AL582836) – 14,000 shares;
- WAL 27915 (60AL582832) – 7,402 shares; and
- WAL 27912 (60AL582834) – 40 shares.

Based on the planned mine progression at the Atlas-Campaspe Mine, and continued operations at the Ginkgo and Snapper Mines until cessation of operations in approximately Year 12 of the Project, the existing volumetric licence allocations held by Cristal Mining are considered to be adequate.

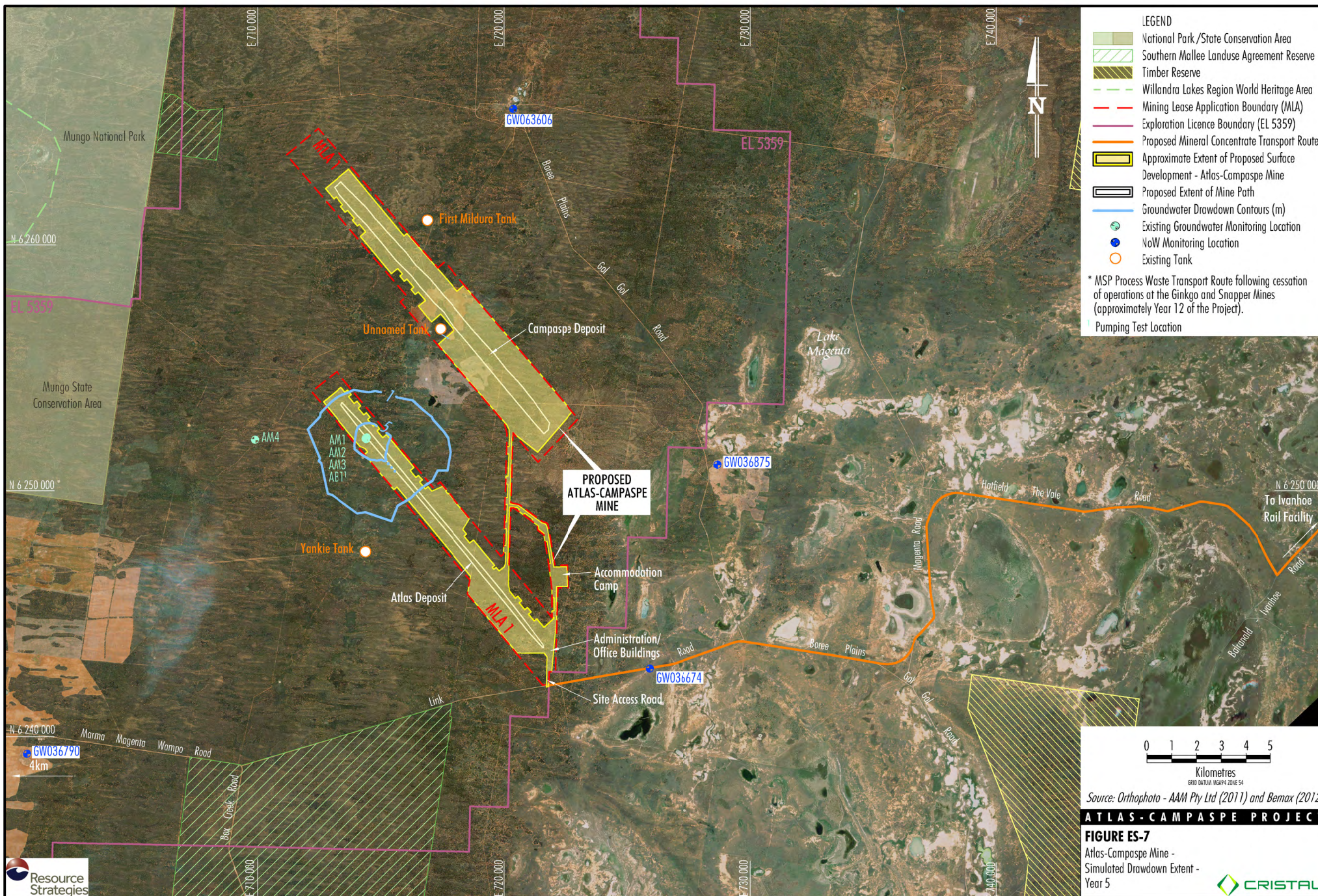
As the Ginkgo and Snapper Mines and Atlas-Campaspe Mine are located within the same groundwater source (i.e. Western Murray Porous Rock Water Source) the appropriate licence allocations would be traded in accordance with the rules of the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011*.

Surface Water

The Atlas-Campaspe Mine is located within the Benanee basin of the lower Murray River system in New South Wales. The Benanee basin borders the upstream effluent creeks of the Lachlan River basin, Darling and Murrumbidgee River basins and the downstream Murray River basin. The Benanee basin is made up of a number of ill-defined creeks, streams and ephemeral lakes that contribute negligible inflows to the Murray River.

The Ivanhoe Rail Facility is located within the Willandra Creek catchment in the Lachlan River basin. Willandra Creek is an effluent creek of the lower Lachlan River which terminates in a series of lignum swamps and intermittent lakes in the Benanee basin south-west of Ivanhoe. Flows into Willandra Creek are primarily controlled by Willandra Weir on the Lachlan River, and like most unregulated streams in western New South Wales experience long periods of no flow interspersed with rare flows of varying magnitude.

The absence of defined drainage lines has led landholders to construct extensive catch drain systems in the region to direct overland flow into excavated tanks to provide water for domestic stock. In the vicinity of the Atlas-Campaspe Mine site, the topographic maps show the existence of three such tanks, including the 'First Mildura Tank', 'Yankie Tank' and an unnamed tank system (Figure ES-7).





The regional surface drainage in the vicinity of the Atlas-Campaspe Mine site occurs by overland flow from north-east towards the south-west. The Atlas-Campaspe Mine site contains no defined watercourses other than a few minor drainage lines that drain from the south-eastern end of the Campaspe deposit towards a relic lake depression.

Temporary ponding of rainfall occurs in localised topographic depressions where rainfall runoff is concentrated and the surficial soils have lower permeability (i.e. contains clays). These locations are isolated and do not contribute to any significant surface water system. Drainage from these locations is limited due to the low permeability surficial soils and the majority of the water eventually dissipates by evaporation. Given the limited rainfall and drought experienced in the area historically, the frequency of surface ponding is low.

There are not expected to be any measurable changes in the water quality of temporary surface ponding areas as a consequence of the Project.

There are no existing permanent surface water features that would be affected by the mining at the Atlas-Campaspe Mine.

No access water licences would be required for the water containments at either the Atlas-Campaspe Mine or Ivanhoe Rail Facility. Surface water runoff contained would either be within harvestable rights (i.e. all rain water runoff on landholdings) and/or would be relevant excluded works under Schedule 1 (clauses 1 to 3) of the New South Wales *Water Management (General) Regulation, 2011*.

Objectives of on-site water management throughout the Project life would be to:

- maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas;
- collect and preferentially re-use surface water runoff from disturbed areas for dust suppression or processing make-up requirements (when available); and
- capture and contain on-site any potentially contaminated mine site water.

As there are no permanent surface water features that would be affected by the mining at the Atlas-Campaspe Mine, the management of surface water resources post-mining is limited to allow for drainage across the final mine landforms and final void management (refer Section ES7).

ES4.5 OTHER SPECIALIST STUDIES

In addition to the key studies described above, specialist studies and assessments in this EIS include:

- non-Aboriginal heritage;
- agricultural resources;
- socio-economic;
- noise;
- air quality and greenhouse gases;
- process waste;
- geochemistry;
- land contamination;
- preliminary hazard analysis; and
- visual amenity.

The findings of these studies demonstrated that the impacts would be negligible, within acceptable levels or could be readily managed.

ES5 WILLANDRA LAKES REGION WORLD HERITAGE AREA

The Willandra Lakes Region World Heritage Area, located 10 kilometres to the west of the Atlas-Campaspe Mine (Figure ES-6), is listed on both the New South Wales State Heritage Inventory and the Australian Heritage Database for its natural and cultural values.

The natural and cultural values of the Willandra Lakes Region World Heritage Area which meet the World Heritage List criteria and National Heritage List criteria are:

Natural

- *as an outstanding example representing the major stages in the earth's evolutionary history; and*
- *as an outstanding example representing significant ongoing geological processes.*

Cultural

- *bearing exceptional testimony to a past civilisation.*

The Willandra Lakes Region World Heritage Area includes the dunes of Lake Mungo, where the remains of a 42,000 year old male and female (i.e. Mungo Man and Mungo Lady) were discovered.

Mungo Lady is believed to be the oldest site of ritual cremation in the world. The Aboriginal Cultural Heritage Assessment concludes that the Project would not impact on the natural and cultural heritage values of the Willandra Lakes Region World Heritage Area, based on the following:

- At its closest point, the Project is located 10 kilometres to the east of the Willandra Lakes Region World Heritage Area.
- The dunefields and sandplains on which the Atlas-Campaspe Mine is located do not contain the landscape features (i.e. relic lakes and lunettes) directly associated with the natural heritage values of the Willandra Lakes Region World Heritage Area.
- Relic lakes and lunettes landforms are present along the proposed mineral concentrate transport route. However, these features are located approximately 30 kilometres south-east of the Willandra Lakes Region World Heritage Area and the new sections of road have been designed to avoid the relic lake beds and lunette landforms.
- Consultation has been undertaken for the Project with Aboriginal stakeholders including those from the Barkandji (Paakantji), Mutthi Mutthi and Ngaympaa tribal groups associated with the Willandra Lakes Region World Heritage Area.
- The registered Aboriginal stakeholders have not identified any of the recorded sites as being of particular cultural significance or raised any concerns regarding potential impacts to the Willandra Lakes Region World Heritage Area or its cultural values.

The values of the Willandra Lakes Region World Heritage Area which meet the World Heritage criteria are not botanical or zoological. Nevertheless, an assessment of the potential impacts on the flora and fauna in the Willandra Lakes Region World Heritage Area has been undertaken and concludes that the Atlas-Campaspe Mine is not likely to have an adverse impact on the Willandra Lakes Region World Heritage Area.

The cumulative groundwater modelling results presented in the Hydrogeological and Water Supply Assessment (including the proposed Balranald Mineral Sands Project [Figure ES-6]) shows that drawdown of the deep underlying saline groundwater aquifer does not extend to the Willandra Lakes Region World Heritage Area.

Given the intervening topography and large separation distances, excavation into local areas of temporary surface water ponding at the Atlas-Campaspe Mine would not impact on any surface water ponding associated with the Willandra Lakes Region World Heritage Area.

The Surface Water Assessment concludes that the possibility of any surface water runoff from the Atlas-Campaspe Mine site reaching, or having any impact on, the Willandra Lakes Region World Heritage Area could only occur under heavy rainfall conditions that are unlikely to have been experienced in the region for thousands of years.

Visual simulations demonstrate that the level of visual impact from key viewpoints within the Willandra Lakes Region World Heritage Area as a result of the Atlas-Campaspe Mine would be low given the:

- generally low landforms and topographic depressions characteristic of the Willandra Lakes Region World Heritage Area;
- intervening regional topography and vegetation;
- distance to the Atlas-Campaspe Mine landform components (i.e. greater than 10 kilometres); and
- resultant negligible vertical change in landform elevations (i.e. there would be negligible vertical change in landform elevations at the Atlas-Campaspe Mine site from distances greater than 5 kilometres) if visible at all.

Due to the distance to the Atlas-Campaspe Mine landform components (i.e. greater than 10 kilometres), no direct night-lighting impacts associated with the Atlas-Campaspe Mine are expected at key viewpoints within the Willandra Lakes Region World Heritage Area. An increased glow in the night sky may be experienced, particularly during overcast weather conditions.

The Air Quality and Greenhouse Gas Assessment concludes that the contribution of particulates and dust at the Willandra Lakes Region World Heritage Areas from operations at the Atlas-Campaspe Mine would be minor.

The Noise Assessment concludes that the operations at the Atlas-Campaspe Mine are likely to be inaudible under most meteorological conditions at Willandra Lakes Region World Heritage Area.

ES6 BIODIVERSITY OFFSET AND VEGETATION MANAGEMENT AREAS

Biodiversity Offset Area

The proposed biodiversity offset area for the Project is approximately 16,540 hectares and is comprised of 16,270 hectares of existing native vegetation and 270 hectares of cleared land. The proposed biodiversity offset area adjoins Mungo National Park, Mungo State Conservation Area and a small conservation area (a Southern Mallee Landuse Agreement Reserve) to the west of the Atlas-Campaspe Mine (Figure ES-5). Cristal Mining is entering into agreements with the leaseholders (i.e. Boree Plains and Wampo Stations) for the lease of the land in the vicinity of the Atlas-Campaspe Mine for the Project.

The proposed biodiversity offset area includes similar vegetation communities/fauna habitats and biodiversity values to the Project area, and has substantial areas of Yarran Shrubland which is equivalent to the *Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression Bioregions Endangered Ecological Community* listed under the New South Wales *Threatened Species Conservation Act, 1995*.

A number of management measures to enhance the flora and fauna values of the proposed biodiversity offset area would be detailed in the Biodiversity Management Plan to be developed for the Project.

An arrangement would be made for the enduring protection and management of the proposed biodiversity offset area within 12 months of grant of Development Consent. A voluntary conservation agreement pursuant to section 69B of the New South Wales *National Parks and Wildlife Act, 1974*, Change of Lease Purpose, or similar arrangement is proposed, which may include an agreement with the New South Wales Government to add the proposed biodiversity offset area to the adjoining Mungo National Park.

Vegetation Management Area

A Vegetation Management Area would be conserved at the Ivanhoe Rail Facility (Figure ES-3).

The Ivanhoe Rail Facility would include retention and management of 15 hectares of existing vegetation in a Vegetation Management Area, comprising approximately 14.8 hectares of Belah-Rosewood Woodland and approximately 0.2 hectares of Native Grassland.

The perimeter of the area would be fenced with a goat proof fence to facilitate regeneration of the native vegetation. Cristal Mining would undertake control of noxious weeds within the Vegetation Management Area.

ES7 REHABILITATION

Cristal Mining has successful rehabilitation experience at the Ginkgo and Snapper Mines and the former Wemen Mine, including re-establishment of agricultural production areas and native vegetation. In particular, the diligence and expertise of Cristal Mining in applying such rehabilitation planning and practices at the Ginkgo Mine have been recognised through the receipt of a highly commended award at the 2012 New South Wales Minerals Council Excellence Awards.

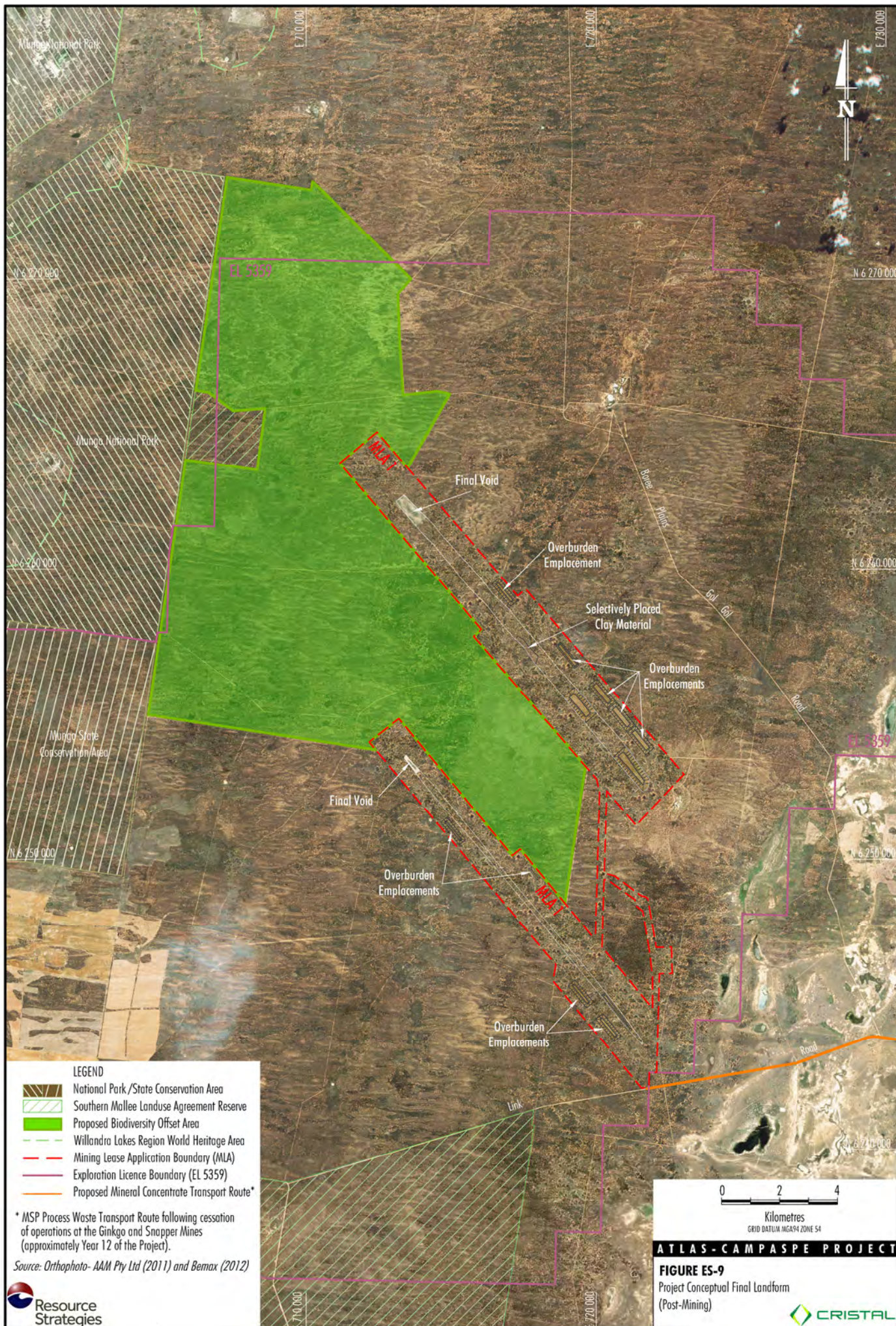
In developing the rehabilitation strategy for the Project, Cristal Mining has drawn on the relevant rehabilitation experience at these mines.

The rehabilitation strategy for the Project includes rehabilitation concepts, objectives, methods and measures that have been developed to achieve the proposed final land use for the Project. Cristal aims to restore self-sustaining ecosystems including endemic native species which could be used for light intensity grazing or protected for nature conservation.

At the completion of mining, the key final landforms and features at the Project would include:

- elevated overburden emplacements located adjacent to and within the rehabilitated mine paths;
- rehabilitated areas level with the natural ground surface associated with the backfilled mine paths;
- partially backfilled final voids located at the north-western corner of each rehabilitated mine path;
- shallow depressions associated with rehabilitated water management and process waste infrastructure;
- local closed depressions generally consistent with pre-mining topography; and
- diversion banks/channels to maintain overland flow to local closed depressions.

The conceptual rehabilitated final landform at the Atlas-Campaspe Mine (post-mining) is shown on Figure ES-9.



Revegetation would include the planting of species characteristic of the existing remnant vegetation in areas with suitable soil, slope and aspect.

An objective of the rehabilitation programme is to restore ecosystem function to land affected by Project development including maintaining or establishing self-sustaining ecosystems.

There is a patch of Black Box Woodland (approximately 45 hectares) on the edge of the Campaspe mine path and mining of the Campaspe deposit (between Years 11 to 13) would remove part of the clay associated with the water holding capacity in the depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining with material with a higher permeability (i.e. higher infiltration). To minimise this, Cristal Mining would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate the water holding capacity of, and run-on to adjacent depressions. The management of the rehabilitation in this way is likely to maintain the Black Box Woodland in this location.

At the cessation of mining, a final void would remain at the north-western extent of both the Atlas and Campaspe footprints. The final voids would be partially backfilled with overburden material pushed down from the void batters and replaced overburden.

The depths of the final voids would remain above the groundwater table (i.e. a permanent water body would not be formed in the void), however incident rainfall and local surface water runoff following rainfall events would temporarily pond in the void prior to evaporating or infiltrating to the groundwater table.

A Rehabilitation Management Plan would be developed and implemented for the Project, including a rehabilitation monitoring programme designed to track the progress of rehabilitation and revegetation.

Key strategic rehabilitation completion criteria would be reviewed and refined as part of the Mining, Rehabilitation and Environmental Management Process.

The specific rehabilitation parameters and completion criteria would be determined in consultation with relevant government agencies and documented in the Mining Operations Plan and Rehabilitation Management Plan.

ES8 KEY ENVIRONMENTAL MANAGEMENT, MITIGATION, MONITORING AND OFFSET COMMITMENTS

The environmental management systems proposed for the Project include various environmental management strategies, plans and programmes that would be developed and implemented following the grant of all required approvals (both State and Commonwealth).

Key environmental management, mitigation, monitoring and offset commitments would include the following:

- Cristal Mining would develop and implement a Biodiversity Management Plan to mitigate impacts on flora and fauna due to Project activities as well as stipulate land management practices for lands under the control of Cristal Mining.
- Cristal Mining would implement a biodiversity offset strategy to offset residual impacts to biodiversity, including the establishment and protection of the proposed biodiversity offset area in perpetuity.
- Cristal Mining would develop and implement a Mineral Concentrate and MSP Process Waste Transport Management Plan to minimise potential impacts arising from transport of mineral concentrate and MSP process waste between the Atlas-Campaspe Mine and the MSP.
- Cristal Mining would develop and implement a Heritage Management Plan to manage potential impacts to Aboriginal heritage for surface disturbance throughout the life of the Project.
- Cristal Mining would implement a Groundwater Monitoring Programme. The Groundwater Monitoring Programme would be progressively implemented to detect changes in groundwater levels and quality as a result of groundwater extraction for water supply, dewatering during mining operations, deposition of process wastes behind the advancing ore extraction areas and disposal of excess waters, if required.
- Cristal Mining would review and progressively refine the site water balance over the life of the Project to record the status of inflows, storage and consumption and to optimise ongoing water management performance.

- Cristal Mining would implement a Surface Water Monitoring Programme, which would involve sampling of water from nearby tanks and the ephemeral waterbody in the vicinity of the Atlas-Campaspe Mine.
- Cristal Mining would implement a Noise Monitoring Programme. The Noise Monitoring Programme would include half yearly attended noise monitoring along the mineral concentrate transport route, at the Ivanhoe Rail Facility, and the nearest residential receiver (Boree Plains) when mining operations are nearest the receiver.
- Cristal Mining would utilise the existing air quality (dust) monitoring network in the vicinity of the Atlas-Campaspe Mine. The continued operation of the existing air quality (dust) monitoring network would be re-evaluated every two years to evaluate the need for the continued use of all monitors.
- Cristal Mining would develop and implement a Rehabilitation Management Plan for the Project, including progressive rehabilitation of Project disturbance areas, the reinstatement of key agricultural and ecological values, and implementation of a mine closure strategy.
- Cristal Mining would develop and implement a Radiation Management Plan and a Radioactive Waste Management Plan (including a radiation monitoring programme) in accordance with the Australian Radiation Protection and Nuclear Safety Agency *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*.
- Cristal Mining would develop and implement Construction and Operational Environmental Management Plans specifically for the management of environmental impacts at the Ivanhoe Rail Facility.