Attachment 4

Response to
DAWE Advice

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

Additional Information

WHITEHAVEN COAL

Resource Strategies

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A4 RESPONSE TO DAWE ADVICE

A4.1 INTRODUCTION

The Winchester South Project (the Project) is located approximately 30 kilometres south-east of Moranbah, in the Isaac Regional Council Local Government Area (Figure A4-1), within the Bowen Basin Coalfield, in Queensland.

The Project involves the development of an open cut metallurgical coal mine in an existing mining precinct. Products would include metallurgical coal for the steel industry and thermal coal for energy production.

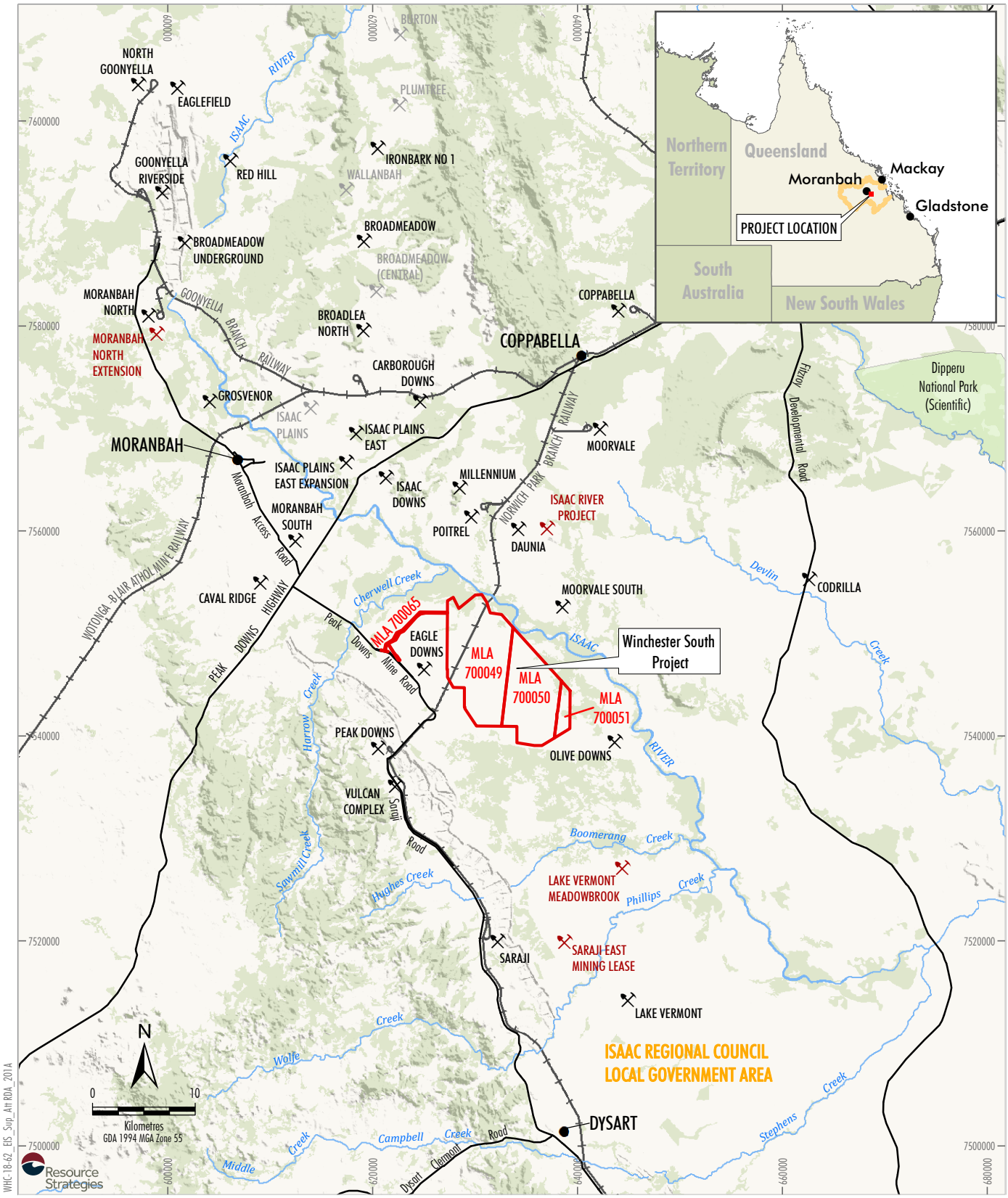
Whitehaven WS Pty Ltd (Whitehaven WS) is the proponent for the Project and is a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven). In 2021, Whitehaven WS submitted the *Winchester South Project Environmental Impact Statement* (the Draft EIS) for assessment under the *State Development and Public Works Organisation Act 1971* (SDPWO Act).

The Draft EIS was placed on public notification by the Office of the Coordinator-General (OCG) from 4 August 2021 until 15 September 2021. During and following this period, government advisory agencies, organisations and members of the public provided submissions on the Draft EIS to the OCG.

Subsequent to the public notification of the Draft EIS in 2021 and in response to comments raised in submission, Whitehaven WS reviewed the mine plan and mine schedule with the aim of reducing environmental impacts of the Project and modifying the proposed Project final landform. This review also considered new geological data, coal quality data and the outcomes of processing trials to further refine the mine plan.

On 3 December 2021, the Coordinator-General formally requested (in accordance with section 34A of the SDPWO Act) Additional Information on the environmental effects of the Project and other matters relating to the Project.

Accordingly, the Additional Information provides Whitehaven WS' response to the Coordinator-General's request and also provides responses to issues raised in submissions. This document provides a stand-alone response to comments from the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water). It is noted that DAWE also requested consideration to the comments provided by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC). Attachment 3 of the Additional Information provides consideration and responses to advice provided by the IESC.



LEGEND
- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Local Government Area Boundary
- Railway
- Road

Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018)

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WINCHESTER SOUTH PROJECT

Project Location

Figure A4-1

A4.2 ADVICE PROVIDED BY DAWE

A4.2.1 Species Specific

Brigalow Regrowth

DAWE requested additional information on the Brigalow (*Acacia harpophylla*) regrowth within the Project area and exclusion from classification as part of the *Brigalow (Acacia harpophylla dominant and co-dominant)* threatened ecological community (Brigalow TEC).

Response

The Habitat Type 3c (Brigalow Regrowth [<2 m Tall]) broad fauna habitat is regrowth that has been cleared within the last 15 years (<15 years old) and does not meet the key diagnostic characteristic thresholds of Brigalow TEC (Section 5.3.4 of the Draft EIS). Plate 1 shows the typical Brigalow Regrowth (<2 m tall) habitat, as presented in the Terrestrial Ecology Assessment (Appendix D of the Draft EIS).

Plate A4-1 – Typical Brigalow Regrowth (<2 m Tall) Habitat

A4.2.2 Mapping

Brigalow TEC Mapping

DAWE requested clarification on threatened ecological community and species habitat mapping shown in the Draft EIS.

Response

Figure 5-8 of the Draft EIS shows broad fauna habitat types as defined by E2M Pty Ltd (E2M) (2021), based largely on vegetation type and structure, which include the following Habitat Types that consist of Brigalow or Brigalow regrowth:

- Habitat Type 3a – Brigalow +/- *Eucalyptus spp*. Woodland.
- Habitat Type 3b – Mature Regrowth / Disturbed Brigalow +/- *Eucalyptus spp*. Woodland.
- Habitat Type 3c – Brigalow Regrowth [<2 m Tall].

E2M (2021) assessed patches of Brigalow-dominated regional ecosystems (RE) against Brigalow TEC thresholds as described in Section 3.2.2.2 of the Terrestrial Ecology Assessment (Appendix D of the Draft EIS), including any patches within the above Habitat Types. The mapped Brigalow TEC as shown on Figure 5-4 of the Draft EIS met the Brigalow TEC thresholds (i.e. a smaller subset of the Habitat Types that consist of Brigalow or Brigalow regrowth) and is therefore a different colour to Habitat Types 3a to 3c as shown on Figure 5-8 of the Draft EIS.

Impacts to Broad Fauna Habitat Types

DAWE requested clarification on broad fauna habitat type mapping.

Response

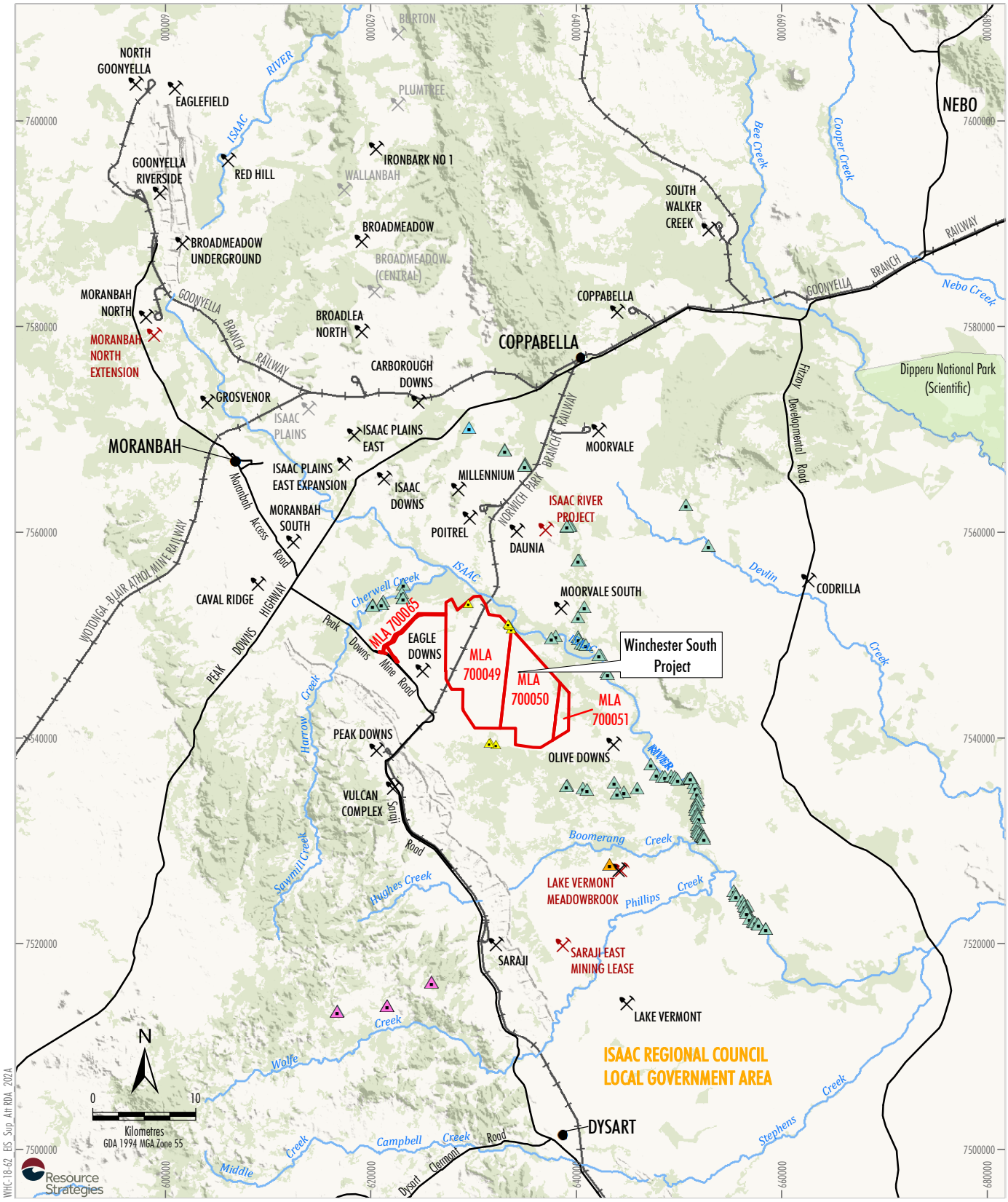
The broad fauna habitat types shown on Figure 5-8 of the Draft EIS are defined in Section 5.2 of the Terrestrial Ecology Assessment (Appendix D of the Draft EIS). As the broad fauna habitats do not constitute a Matter of National Environmental Significance (MNES), this detail was not duplicated in Section 5 of the Draft EIS.

Threatened Species Habitat Mapping

DAWE requested clarification on the Koala (combined populations of Queensland, NSW and the Australian Capital Territory [ACT]) (*Phascolarctos cinereus)* and Greater Glider (*Petauroides volans*) records shown on Figures 5-7 and 5-12 of the Draft EIS. In addition to this, DAWE requested changes to Figure 5-9 of the Draft EIS to distinguish mapping areas.

Response

The data on Figures 5-7 and 5-12 of the Draft EIS match, however some of the symbols overlap. To improve the clarity of the records, Figure 5-7 of the Draft EIS has been split into two separate figures (Figure A4-2a and Figure A4-2b), showing threatened species records of the Greater Glider and Koala (combined populations of Queensland, NSW and the ACT), respectively.



LEGEND

- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Railway
- Road

E2M (2021) Surveys

- Greater Glider

Previous Surveys

- Greater Glider (AARC Environmental Solutions, 2019)
- Greater Glider (Atlas of Living Australia, 2020)
- Greater Glider (DES, 2020e)
- Greater Glider (DPM Enviroscienses, 2018b)

Source: The State of Queensland (2018 - 2020); E2M (2021); Geoscience Australia (2018)

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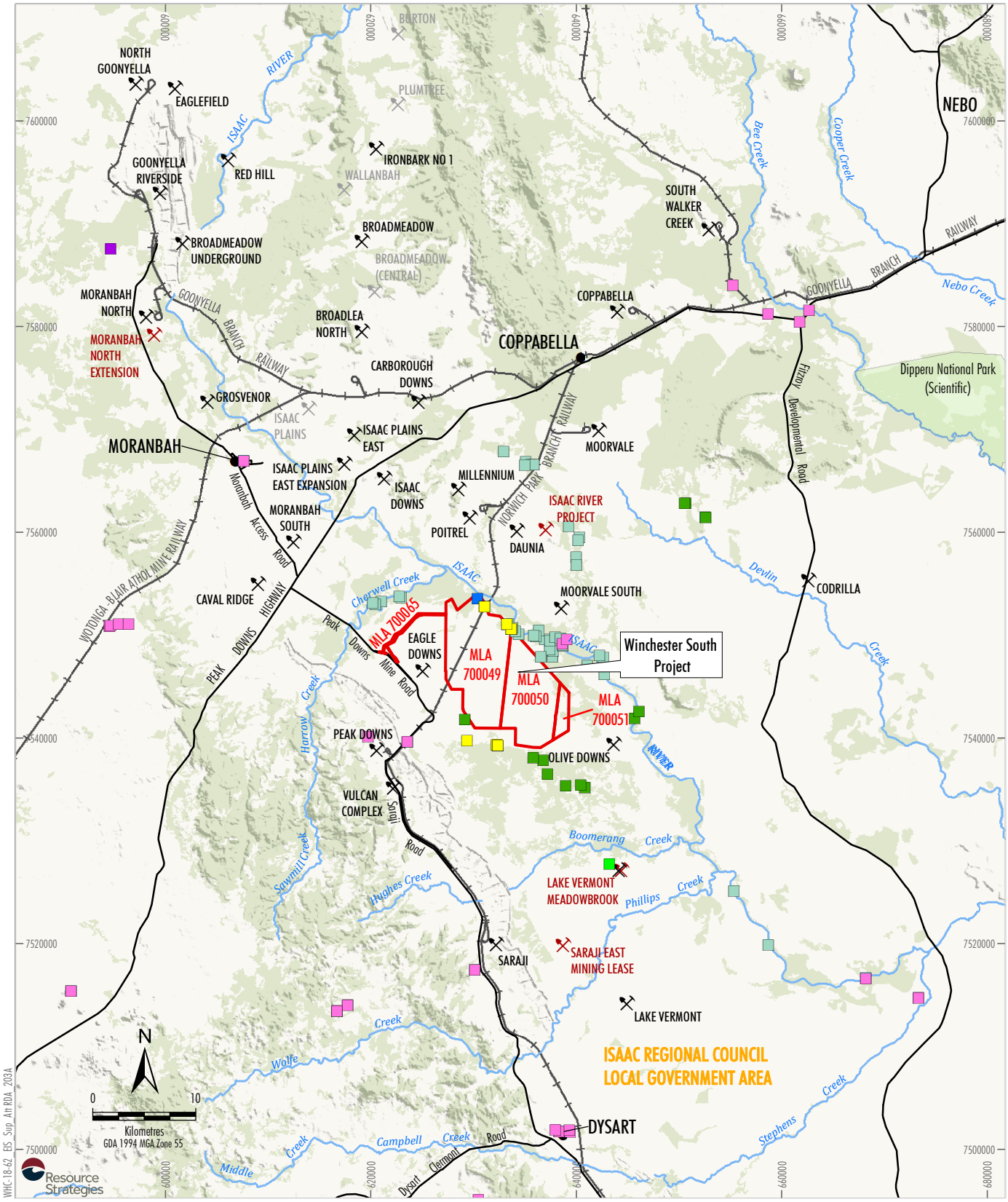
Threatened Species Records (Mammals) - Greater Glider

Figure A4-2a



LEGEND

- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Railway
- Road

E2M (2021) Surveys

- Koala

Previous Surveys

- Koala (AARC Environmental Solutions, 2020)
- Koala (Atlas of Living Australia, 2020)
- Koala (DES, 2020e)
- Koala (DPM Enviros ciences, 2018a)
- Koala (DPM Enviros ciences, 2018b)
- Koala (EcoSM, 2013)
- Koala (URS, 2013)

Source: The State of Queensland (2018 - 2020); E2M (2021); Geoscience Australia (2018)

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Threatened Species Records (Mammals) - Koala

Figure A4-2b

In regard to Figure 5-9 of the Draft EIS, the orange and yellow hatching (lined colour) run the opposite directions. To improve the clarity of the mapping, the colours on Figure 5-9 of the Draft EIS has been revised (refer to Figure A4-3).

A4.2.3 Project Definition and Allocation of Impacts

Allocation of Impacts

DAWE requested that all disturbance associated with the Project be allocated to the Mine Site and Access Road Action [EPBC 2019/8460].

Response

All associated Project disturbance has been allocated to the Mine Site and Access Road Action [EPBC 2019/8460] as shown on Figure A4-4a. This approach is consistent with Attachment 7 of the Project Additional Information (Offset Management Strategy).

Mapping of Actions

DAWE requested separate figures for each of the Proposed Actions that comprise the Project (Mine Site and Access Road Action [EPBC 2019/8460], Electricity Transmission Line (ETL) Action [EPBC 2019/8458] and Water Pipeline Action [EPBC 2019/8459]).

Response

Additional figures have been prepared to separately show the individual actions (Figures A4-4a and A4-4b). It is noted that the impacts in relation to the ETL and Water Pipeline Actions will be significantly reduced by co-locating this infrastructure.

A4.2.4 Matters of National Environmental Significance Management Plan

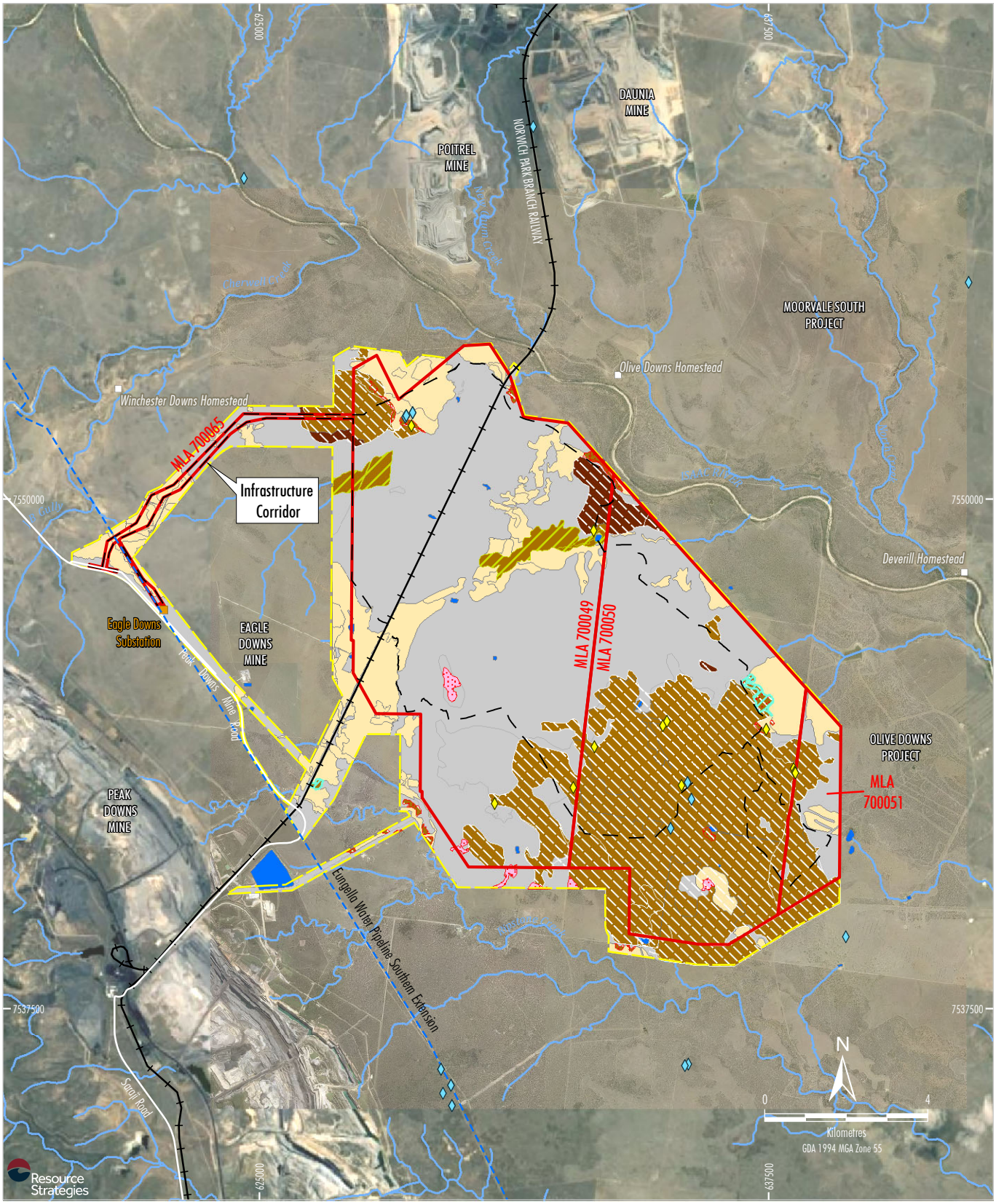
Matters of National Environmental Significance Management Plan

DAWE requested additional information on the mitigation and management measures that would be incorporated into the MNES Management Plan (MMP).

Response

A MMP would be developed for the Project, prepared by a suitably qualified ecologist and in accordance with the *Environmental Management Plan Guidelines* (Department of the Environment, 2014). Consistent with the advice provided by DAWE, the MMP would outline the following proposed mitigation and management measures:

- details of specific environmental outcomes to be achieved for the listed threatened species and community and their habitat;
- interim milestones that set targets at five-yearly intervals to track progress against achieving the environmental outcomes;
- details on how the measures have been developed with consideration of the S.M.A.R.T principle;



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

E2M (2021) Surveys

- Ornamental Snake

Previous Surveys

- Ornamental Snake

Potential Habitat

- Ornamental Snake Important Habitat

Other Mapping Units

- Remnant Regional Ecosystems Associated with the Ornamental Snake (REs 11.3.3c, 11.4.8 and 11.4.9)
- Woodland with Suitable Microhabitat
- Brigalow TEC
- Gilgai Soils
- Gilgai Soils without Suitable Microhabitat Features
- Remnant Regional Ecosystem Associated with the Ornamental Snake without Suitable Microhabitat Features
- Regional Ecosystem not Associated with the Ornamental Snake without Gilgai Soils
- Exotic Grasslands or Regrowth without Gilgai Soils
- Farm Dam
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); E2M (2021)
Orthophoto: Google (2019); Whitehaven (2017)

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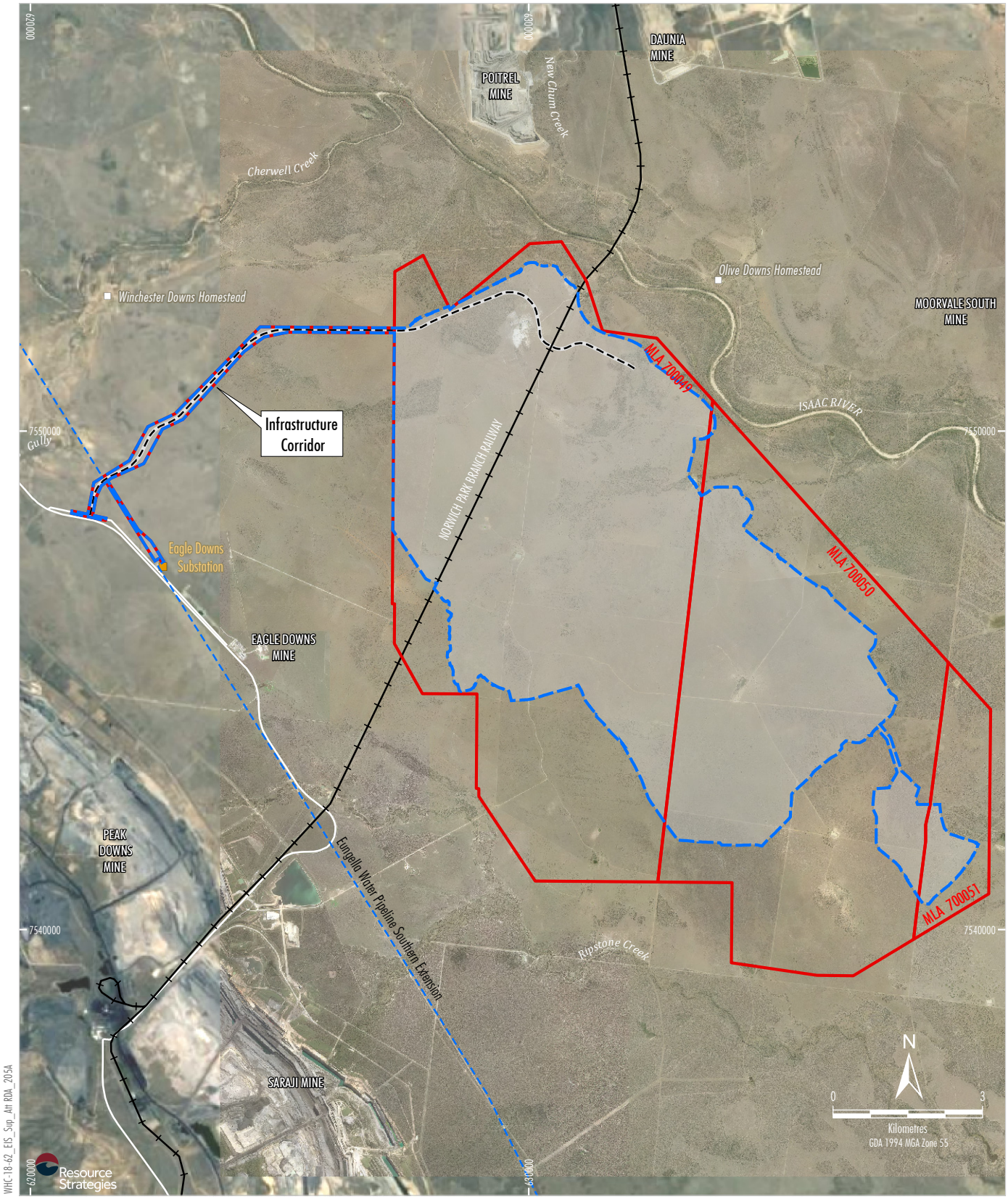
Threatened Species Habitat Mapping - Ornamental Snake

Figure A4-3



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LEGEND

- Mining Lease Application Boundary
- Substation
- Eungella Water Pipeline Southern Extension
- EPBC Proposed Actions - Indicative Layouts*
- Mine Site and Access Road (EPBC2019/8460) (Mine Site)
- Mine Site and Access Road (EPBC 2019/8460) (Access Road)
- EPBC Actions - Disturbance Extent#
- EPBC Mine Site and Access Road (EPBC 2019/8460)

Note:
* Indicative layout shown based on current mine planning and is subject to change based on detailed mine planning with offsets provided prior to on-ground impacts.

Note:# Disturbance associated with the Electricity Transmission Line (EPBC 2019/8458) and Water Pipeline (EPBC 2019/8459) within MLA 700049, MLA 700050, MLA 700051 and MLA 700065 is assessed under the Mine Site and Access Road (EPBC 2019/8460).

Source: The State of Queensland (2018 - 2020); Whitehaven (2020)
Orthophoto: Google Image (2019); Whitehaven (2017)

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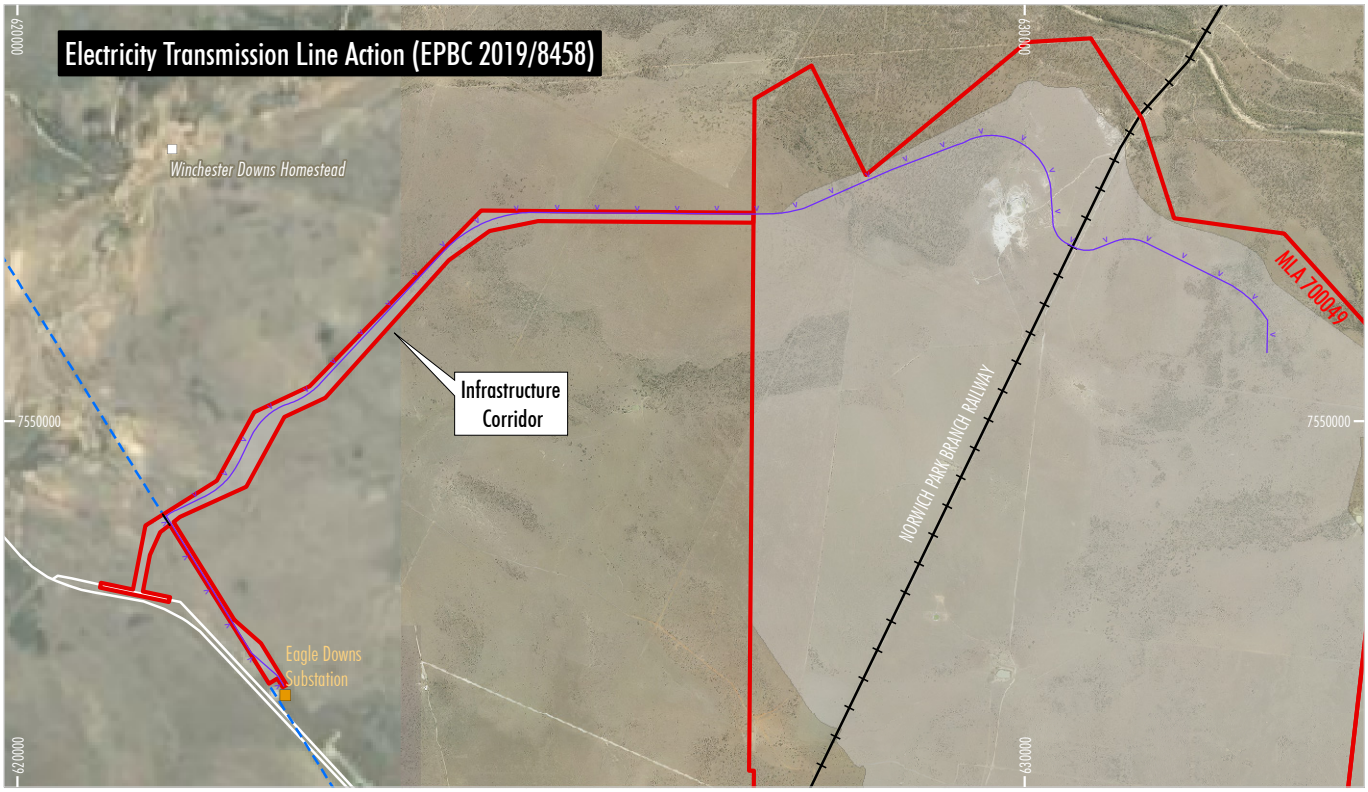
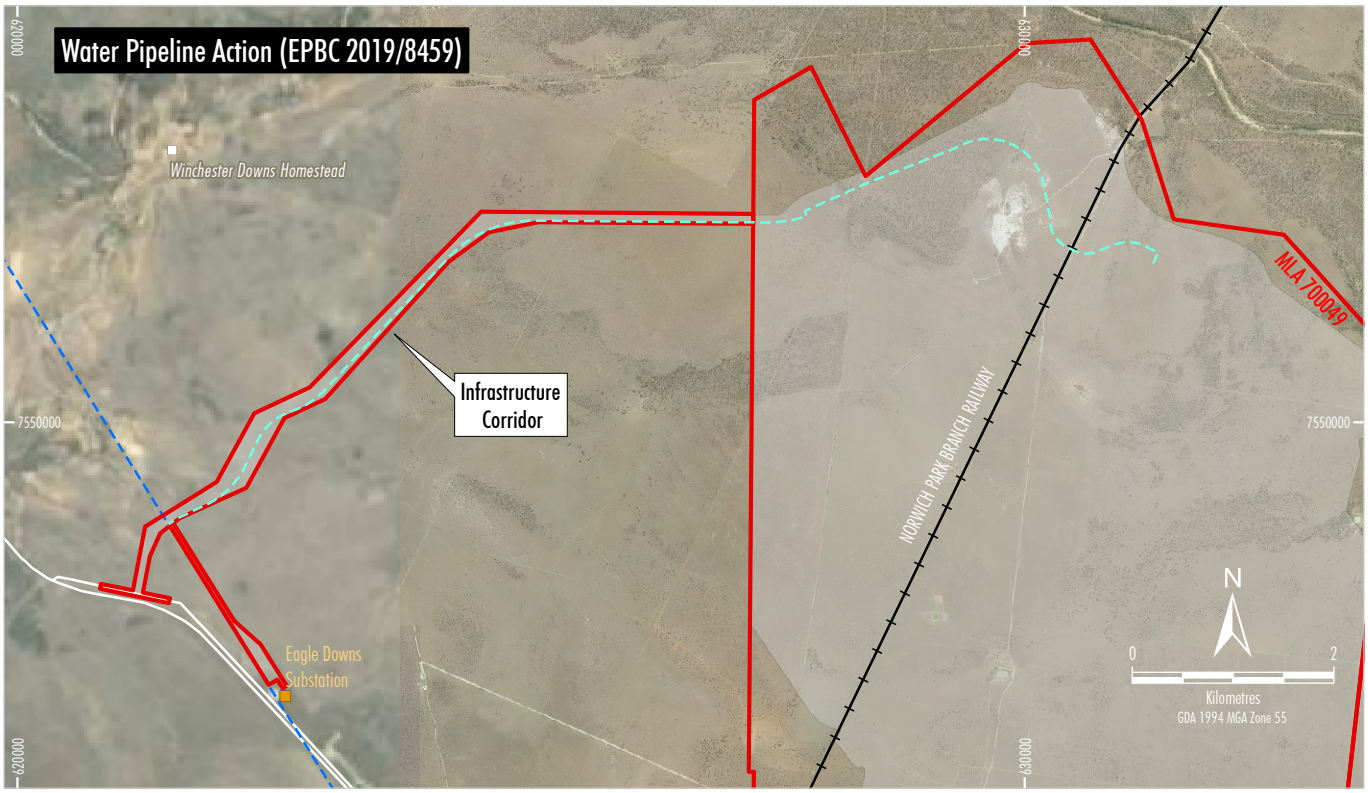
WINCHESTER SOUTH PROJECT

EPBC Act Assessment Areas - Mine Site and Access Road Action

Figure A4-4a





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LEGEND
- Mining Lease Application Boundary
- Substation
- Eungella Water Pipeline Southern Extension
- EPBC Proposed Actions - Indicative Layouts*
  - Electricity Transmission Line
  - Water Supply Pipeline
- EPBC Proposed Actions - Indicative Layouts*
- Mine Site and Access Road (EPBC2019/8460)

Note:
** Indicative layout shown based on current mine planning and is subject to change based on detailed mine planning with offsets provided prior to on-ground impacts.*

Note:# Disturbance associated with the Electricity Transmission Line (EPBC 2019/8458) and Water Pipeline (EPBC 2019/8459) within MLA 700049, MLA 700050, MLA 700051 and MLA 700065 is assessed under the Mine Site and Access Road (EPBC 2019/8460).

Source: The State of Queensland (2018 - 2020); Whitehaven (2020)
Orthophoto: Google Image (2019); Whitehaven (2017)

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EPBC Act Assessment Areas - Water Pipeline Action and Electricity Transmission Line Action

Figure 4-4b

- details of the nature, timing and frequency of implementation and monitoring;
- a risk analysis, a risk management and mitigation strategy; and
- evidence of how the measures and corrective actions take into account relevant approved conservation advice(s) and are consistent with relevant recovery plans and threat abatement plans.

A4.2.5 Offsets

DAWE requested additional information in regard to the proposed offset strategy for the Project, including the location of the offset areas, timing and figures showing staging.

Response

Attachment 7 provides the updated Offset Management Strategy for the Project, including additional information and figures of the proposed land-based offset properties for Stage 1 and the offset requirements. The updated Offset Management Strategy for the Project includes the Stage 1 Offset Area Assessment prepared by E2M (2022). Two baseline ecological survey reports are appended to the Stage 1 Offset Area Assessment.

These baseline reports outline the survey methodology, outcomes and MNES/Matters of State Environmental Significance (MSES) recorded but also contain additional figures as requested showing the regional location of the offset property. Additional figures have been included in the updated Offset Management Strategy to separately show the MNES and MSES values and their impact areas for the three stages.

A4.2.6 Water

Response to IESC Comments

DAWE requested that all IESC comments must be addressed in future documentation.

Response

Attachment 3 of the Additional Information provides a stand-alone response to the IESC comments provided on the Project and adequately addresses each specific comment provided by the IESC.

Key Additional Work

DAWE requested consideration to areas of concern identified by the IESC in relation to conceptualisation and assessment of impacts to water resources and groundwater-dependent ecosystems (GDEs).

Response

Attachment 3 provides consideration and responses to all comments provided by IESC, including those in relation to the groundwater conceptual model, and assessment of groundwater-dependency of potential terrestrial GDEs, changes to ephemeral creeks and cumulative impacts of the Project on groundwater and GDEs.

A summary of the responses to these issues presented in Attachment 3 is provided below.

Groundwater Conceptual Model

A numerical groundwater model was developed for the Groundwater Assessment for the optimised Project (SLR Consulting Australia Pty Ltd [SLR Consulting], 2022) (Attachment 5 of the Additional Information). The numerical groundwater model was adapted from the numerical groundwater model developed for the approved Olive Downs Project (HydroSimulations, 2018) as updated for the Moorvale South Project (SLR Consulting, 2019).

Dr Noel Merrick completed a peer review of the Groundwater Assessment (including the groundwater model) (Document #2) and concluded (Attachment 3 of the Draft EIS):

> *The reviewer concurs with the entire modelling methodology described in Document #2 and recognises it as "state-of-art".*

Note, the updated conceptual groundwater models for pre-mining, during mining and post-mining for the optimised Project, as well as additional detailed discussion of the vertical and horizontal groundwater flow between the hydrogeological units have been included in the revised Groundwater Assessment prepared by SLR Consulting (2022) (Attachment 5 of the Additional Information). The Groundwater Assessment for the optimised Project (SLR Consulting, 2022) (Attachment 5 of the Additional Information) also includes an ecohydrological conceptual model to demonstrate connectivity between the groundwater regimes, surface water regimes and any potential water-dependent ecosystems.

Assessment of Groundwater-Dependency of Potential Terrestrial GDEs

In relation to GDEs, the Draft EIS for the Project included an Integrated Assessment of Impacts on Groundwater Dependent Ecosystems (GDE Assessment) (Appendix F of the Draft EIS). The GDE Assessment was prepared in accordance with *Information Guidelines Explanatory Note: Assessing groundwater-dependent ecosystems* (Doody *et al*., 2019), and the *Information guidelines for proponents preparing coal seam gas and large coal mining development proposals* (IESC, 2018), and consolidated the key outcomes of the specialist's assessments prepared for the project and to provide a comprehensive assessment of potential inputs of the Project on GDEs. The GDE Assessment draws on information and assessments in the following technical reports prepared for the Project:

- Terrestrial Ecology Assessment (E2M, 2021) for the Draft EIS;
- Groundwater Assessment (SLR Consulting, 2021) for the Draft EIS;
- Surface Water and Flooding Assessment (WRM Water & Environment Pty Ltd [WRM], 2021) for the Draft EIS;
- Aquatic Ecology and Stygofauna Assessment (Ecological Service Professionals Pty Ltd [ESP], 2021) for the Draft EIS;
- Geochemistry Assessment (Terrenus Earth Sciences, 2020) for the Draft EIS; and
- Geomorphology Technical Study (Fluvial Systems Pty Ltd [Fluvial Systems], 2020) for the Draft EIS.

Additionally, a series of further investigations have been undertaken including a literature review of Brigalow Communities in Queensland which further support the outcomes and conclusions of the Draft EIS. This investigation found:

- Tree species rooting depths were consistently much shallower than commonly reported in literature and were predominantly utilising shallow sources of soil moisture located above the regional water-table aquifer (Jones *et al*., 2019). The Draft EIS Project Groundwater Assessment concludes that depth to groundwater within the Project area is typically greater than 30 to 40 m, with isolated areas of shallower groundwater (10 to 20 m) associated with ephemeral tributaries.
- The *Conceptual Model Case Study Series 'Gilgai wetlands'* (The State of Queensland, 2011) demonstrates consistencies with observations and conclusions drawn by the technical assessments for the Project, indicating that the area of Brigalow TEC identified is likely accessing water held within the clay-rich gilgai depressions for extended periods of time following rainfall events. Further to this point, Johnson (1964) describes that Brigalow has a well-developed lateral (horizontal) root system, and plants are often joined together by these roots which form colonies. Considering that depth to groundwater within the Project area is typically greater than 30 to 40 m, it is unlikely that the Brigalow TEC is accessing groundwater at such a depth.
- Based on review of pre-clearance regional ecosystem mapping (Attachment 3) it is likely that clearing for agricultural land use practices, rather than groundwater reliance, has resulted in the decline in potential Brigalow extent over the Project area.
- TEM Surveys were undertaken across representative wetland and potential GDE areas within the Study Area. Consistent with the findings of Johnson (1964), and Jones et al. (2019), TEM surveys within the Study Area indicated that wetlands and potential GDEs were underlain by a clay layer. These clay-rich layers create a perched aquifer within the geological profile, located well above the water table, and are disconnected from the surrounding groundwater regime.

Assessment of Changes to Ephemeral Creeks

The total catchment areas of the Isaac River and Ripstone Creek immediately downstream their confluence are approximately 5,166 square kilometres (km^2) and 286 km^2, respectively.

During mining operations, the water management system would capture runoff from areas that would have previously flowed to the receiving waters of the Isaac River and Ripstone Creek. The estimated maximum captured catchment areas during the Project would be 76 km^2 for runoff that would have reported to the Isaac River and 16 km^2 for runoff that would have reported to Ripstone Creek. The maximum catchment areas excised by the Project represent:

- up to approximately 1% of the Isaac River catchment (to the confluence with Ripstone Creek); and
- up to approximately 4.5% of the Ripstone Creek catchment (to the confluence with the Isaac River).

On this basis, the loss of catchment flows in the Isaac River and Ripstone Creek would be indiscernible. Therefore, the potential impact on water quantity in the Isaac River and Ripstone Creek due to the excision of catchment is considered negligible (WRM, 2022) (Attachment 6 of the Additional Information).

At the completion of mining, surface runoff from rehabilitated in-pit and out-of-pit waste rock emplacement areas would flow to the receiving environment.

An area of approximately 13.7 km^2 would report to the residual voids at the completion of mining. The changed topography following completion of the Project would have the following impacts on catchment areas:

- The catchment draining to the Isaac River (to the confluence of the Isaac River and Ripstone Creek) would reduce by approximately 13.7 km^2 (compared to pre-mining conditions), a decrease of less than 0.3%.
- The catchment draining to Ripstone Creek would reduce by approximately 4.3 km^2 (compared to pre-mining conditions), a decrease of less than 1.5%.

The loss of catchment flows in the Isaac River and Ripstone Creek would be indiscernible, and as such the potential impact on water quantity in Isaac River and Ripstone Creek due to the final landform is considered negligible (WRM, 2022) (Attachment 6 of the Additional Information). Therefore, unlikely to affect the alluvial groundwater recharge. As such there will be no impact to instream, riparian and floodplain eco-systems.

Furthermore, supplementary surveys of ephemeral creeks were undertaken by ESP (2022a). Several unnamed tributaries of the Isaac River are located within the Project area. Poor to fair aquatic habitat conditions were observed in the minor waterways (i.e. unnamed ephemeral waterways) with limited in-stream features, evidence of siltation, limited bankside vegetation and high levels of disturbance to the bed and bank, likely from cattle access and land clearing (ESP, 2022a).

Better aquatic habitat conditions were observed in the Isaac River (ESP, 2022b). As described above, WRM (2022) determined the maximum catchment area excised by the optimised Project would represent approximately 1 percent of the Isaac River catchment to the confluence with Ripstone Creek and further concluded that the loss of catchment flows in the Isaac River during the optimised Project would be indiscernible. Based on these findings, ESP (2022b) determined that impacts to aquatic ecosystems downstream of the Project area, or aquatic ecological values of the receiving environment, are not expected. Notwithstanding, to minimise and mitigate impacts, excised portions of the northern unnamed waterway would be reinstated in the final landform.

The change in flows as a result of the increased hydraulic gradient between the alluvium and the Isaac River would be a negligible reduction in average flow when the Isaac River flows; therefore, impacts to surface flows and subsequently aquatic ecosystems downstream of the Project area are not expected. The optimised Project is likely to result in fewer impacts (proportionally) on baseflow contributions to New Chum Creek, North Creek or Cherwell Creek given the distance of these waterways from the Project (SLR Consulting, 2022) (Attachment 5 of the Additional Information).

Cumulative Assessment of Impacts on Groundwater Regime and GDEs

The Project area represents less than 0.05% and 0.3% of the overall catchment areas (e.g. loss and diversion of water flows in the lower reaches of the tributaries) for the Fitzroy River basin and the Isaac-Connors sub-basin, respectively. The changed topography as a result of the optimised Project would reduce the catchment area draining to the Isaac River compared to pre-mining conditions; however, the decrease in catchment area is expected to be less than 1% (WRM, 2022) (Attachment 6 of the Additional Information). No measurable impacts to surface water quantity are likely to occur as a result of the Project and the loss of catchment area is minor in a regional context (WRM 2022), therefore it is unlikely there would be any associated cumulative impacts.

As described above, the comprehensive assessments undertaken for the optimised Project preclude vegetation communities within the Study Area for the optimised Project from forming GDEs, or, otherwise where there is potential for GDEs to occur, conclude that the optimised Project is unlikely to facilitate material impacts due to changes in groundwater quality or resource (including cumulatively impacts).

The Surface Water and Flooding Assessment for the optimised Project (WRM, 2022) and Groundwater Assessment for the optimised Project (SLR Consulting, 2022) provide an assessment of the water quality of the water bodies in the residual voids, including the potential for impacts to the surrounding groundwater and surface water systems. The residual voids are predicted to behave as groundwater sinks, preventing any water that accumulates in the residual voids from migrating into the surrounding aquifers, as well as any spills to the surrounding surface water system. Therefore, there would be no potential cumulative impacts on the surrounding groundwater system from the water within the residual voids.

For the optimised final landform, an opportunity was identified to beneficially reuse the water from the residual voids for agricultural or other purposes (e.g. water for cattle consumption). Given the predicted water quality, the reuse of residual void water would slow down the accumulation of salt in the residual voids, which may allow for a sustained final land use without potential impacts to the surrounding environment.

Progressing this re-use opportunity would be subject to further feasibility assessment and design, in addition to identification, negotiation and agreement with the final water user/s.

Given the above, it is not expected that there would be any potential ecological consequences due to the salinity of the residual void water bodies and the rehabilitated optimised final landform would be able to support the proposed final land uses (e.g. pasture and woodland).

Key Impacts

DAWE requested that a clear process of avoidance and mitigation must be implemented and undertaken prior to the consideration of offsets or other management requirements for identified key impacts.

Response

As described above, Attachment 3 provides consideration and responses to all comments provided by IESC. In regard to key impacts identified by the IESC, the following sub-sections provide a summary of the responses provided in Attachment 3.

Loss of Ephemeral Creeks

As described above, the loss of catchment flows in the Isaac River and Ripstone Creek would be indiscernible, and as such the potential impact on water quantity in Isaac River and Ripstone Creek due to the final landform is considered negligible (WRM, 2022) (Attachment 6 of the Additional Information). Therefore, it is unlikely that the loss of catchment flows will affect the alluvial groundwater recharge. As such there will be no impact to instream, riparian and floodplain eco-systems. Although as stated above, excised portions of the northern unnamed waterway would be reinstated in the final landform to minimise and mitigate any potential impacts.

Groundwater Drawdown in the Alluvium and Regolith

Extensive field validation surveys of vegetation across the Project area and surrounds have been undertaken for the Terrestrial Ecological Assessment (E2M, 2021) for the Draft EIS, in particular in areas of predicted drawdown for the Project in the regolith that are outside the extent of surface disturbance for the Project (see Figure 14 of the GDE Assessment [Appendix F of the Draft EIS]).

There are various patches of woodland in the vicinity of the Project that are mapped as likely to provide habitat for species such as the Koala (combined populations of Queensland, NSW and the ACT) and Greater Glider listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (see Figures 5-11 and 5-12 of Section 5 of the Draft EIS).

One of these patches of woodland is within the northern portion of the Project area and consists of mostly RE 11.5.3, but also with RE 11.3.2 and RE 11.3.4. These REs comprise of mainly *Eucalyptus populnea* (which may be a facultative user of groundwater in some locations), however, the depth to groundwater beneath these patches ranges from 12 m to 23 m as the shallowest aquifer is associated with the regolith (SLR Consulting, 2022) (Attachment 5 of the Additional Information). Water within the regolith material is generally highly saline, but can be brackish to moderately saline with an average total dissolved solids of 10,510 milligrams per litre (mg/L), ranging between 1,460 mg/L and 18,600 mg/L (SLR Consulting, 2022). As shown on Figure 13 of the GDE Assessment (Appendix F of the Draft EIS), RE 11.5.3 occurs elsewhere, where the depth to groundwater is in excess of 40 m (SLR Consulting, 2022) and too deep for the trees to access.

It is concluded that these woodland patches have a low potential to meet the definition of a terrestrial GDE, and any dependency on groundwater in the regolith is likely to be facultative, during dry times (if at all). It is unlikely that these REs would be dependent on the groundwater due to the poor quality (high salinity) of the groundwater source (E2M, 2021). As such, the predicted drawdown within the regolith is unlikely to impact on various patches of woodland in the vicinity of the Project area that are mapped as likely to provide habitat for species such as Koalas and Greater Gliders, and therefore, there would be no impacts to these species associated with drawdown in the regolith.

It should be noted that there is no predicted drawdown in the Isaac River alluvium for the Project (SLR Consulting, 2022), and therefore, there would be no mechanism for impact to any potential GDEs (or associated fauna that may use these GDEs as habitat), irrespective of the presence in these areas.

GDEs are not predicted to be impacted as a result of the Project, notwithstanding, SLR Consulting (2022) has prepared a conceptual ecohydrological model cross-section that shows the disconnection between the groundwater systems, surface water systems and the potential ecological sites.

The Tertiary-Quaternary aged sediments (regolith) present in the vicinity of the optimised Project form the base of the unconfined shallow groundwater system. Water within the regolith is generally of poor quality and not considered suitable for stock, irrigation, aquatic ecosystems or drinking water, and therefore is unlikely to support any potential GDEs.

The stygofauna pilot study for the Draft EIS (ESP, 2021) was designed to detect stygofauna if present in the Project area or surrounds in accordance with the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DES, 2015). No stygofauna were recorded during the pilot study for the Draft EIS (ESP, 2021). The highly saline and largely unsaturated regolith throughout the broader region suggested that the groundwater environment within the Project Area was not ideal for stygofauna (ESP, 2021). However, stygofauna were considered likely to occur in the alluvium associated with the Isaac River (DPM Enviroscience; 2018, ESP, 2021).

Supplementary, stygofauna sampling was completed by ESP in 2022 at six bores distributed within the regolith and alluvium. Each bore was established at least six months prior to stygofauna sampling and contained groundwater. In-situ water quality measurements for electrical conductivity (EC) and pH were also taken at each bore, to aid in the interpretation of results.

Two stygofauna taxa were recorded from a single bore targeting the Isaac River alluvium. However, there would be no impacts to stygofauna taxa within the Isaac River alluvium, as the numerical groundwater modelling results indicate there would be negligible drawdown within the Isaac River alluvium due to the optimised Project (SLR Consulting, 2022).

Furthermore, as recommended by SLR Consulting (2022) (Attachment 5 of the Additional Information), a Project monitoring bore in the regolith will be included in the Project monitoring program which would allow for groundwater quality and level to be monitored during the life of the Project.

Residual Voids

The optimised final landform for the Project would include three residual voids made up of a pit lake and low wall and highwall components. The residual voids are predicted to behave as groundwater sinks, preventing any water that accumulates in the residual voids from migrating into the surrounding aquifers which is supported by groundwater fate modelling provided in the Section 6.6 of the Groundwater Assessment for the optimised Project (SLR Consulting, 2022). Therefore, there would be no potential cumulative impacts on the surrounding groundwater system from the water within the residual voids.

Furthermore, for the optimised final landform, an opportunity was identified to beneficially re-use the water from the residual voids for agricultural or other purposes (e.g. water for cattle consumption). Given the predicted water quality, the re-use of residual void water would slow down the accumulation of salt in the residual voids, which may allow for a sustained final land use without potential impacts to the surrounding environment. Progressing this re-use opportunity would be subject to further feasibility assessment and design, in addition to identification, negotiation and agreement with the final water user/s.

Given the above, it is not expected that there would be any potential ecological consequences due to the salinity of the residual void water bodies and the rehabilitated optimised final landform would be able to support the proposed final land uses (e.g. pasture and woodland).

Cumulative Impacts

Cumulative impacts on listed terrestrial threatened species (e.g. Koala, Ornamental Snake) were considered in the Terrestrial Ecology Assessment (E2M, 2021) for the Draft EIS. The change in potential cumulative impacts on threatened species and communities arising from the Project is considered to be minimal because of the localised nature of the Project compared to the wider distribution of the species and associated habitats and communities in the surrounding landscapes and subregions (E2M, 2021) and impacts would be offset as part of the Project. As such, based on the surface disturbance for the Project, approved disturbance from nearby developments and the available habitat/area in the region, the Project is predicted to have negligible cumulative impacts on terrestrial flora and fauna (E2M, 2021).

Fish communities recorded at sites in the vicinity of the Project were typical of those inhabiting ephemeral systems in central Queensland (ESP, 2022a) (Attachment 10 of the Additional Information). All taxa recorded during numerous field surveys were common in the broader region, and no listed threatened species known from the catchment (or potential habitat for these species) were identified, and therefore there would be no impacts to threatened aquatic species (e.g. fish, turtles).

The Project area represents less than 0.05% and 0.3% of the overall catchment areas (e.g. loss and diversion of water flows in the lower reaches of the tributaries) for the Fitzroy River basin and the Isaac-Connors sub-basin, respectively. The changed topography as a result of the optimised Project would reduce the catchment area draining to the Isaac River compared to pre-mining conditions; however, the decrease in catchment area is expected to be less than 1% (WRM, 2022) (Attachment 6 of the Additional Information). No measurable impacts to surface water quantity are likely to occur as a result of the Project and the loss of catchment area is minor in a regional context (WRM 2022), therefore it is unlikely there would be any associated cumulative impacts.

The comprehensive assessments undertaken for the optimised Project preclude vegetation communities within the Study Area for the optimised Project from forming GDEs, or, otherwise where there is potential for GDEs to occur, conclude that the optimised Project is unlikely to facilitate material impacts due to changes in groundwater quality or resource (including cumulatively impacts).

A4.3 REFERENCES

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