Section 4

Assessment of Project Specific Matters

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

WHITEHAVEN COAL

Resource Strategies

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4 ASSESSMENT OF PROJECT SPECIFIC MATTERS

Assessment Scenarios

As described in Section 2.1.7, Whitehaven WS is investigating automation of the fleet for the Project. The Project 'base case' refers to a workforce which includes consideration of automation, and generates the following employment opportunities:

- an operational workforce of up to approximately 500 personnel;
- a construction workforce of up to approximately 500 personnel; and
- a decommissioning workforce of approximately 50 personnel (required towards the end of the life of the Project).

Employee numbers may increase depending on the extent of automation. The effect of the extent of automation on potential Project impacts has been considered by relevant specialist studies, including the SIA, Road Transport Assessment and Economic Assessment.

The SIA and Economic Assessment assessed the automated base case for their impact assessment, whereas the Road Transport Assessment assessed a non-automated case. Notwithstanding, all three specialist studies also present a sensitivity analysis of the alternate assessment scenario.

The outcomes of the base case impact assessments and sensitivity analyses are summarised in Sections 4.9.2 (Road Transport Assessment), 4.4.3 (SIA) and 4.11.3 (Economic Assessment) and detailed in Appendices C (SIA), I (Road Transport Assessment) and K (Economic Assessment).

4.1 WATER QUALITY

4.1.1 Methodology, Environmental Objectives and Performance Outcomes

Potential impacts of the Project on water quality have been considered in the following assessments:

- Groundwater Assessment prepared by SLR (Appendix A);
- Surface Water and Flooding Assessment prepared by WRM (Appendix B);
- Geomorphology Assessment prepared by Fluvial Systems (Appendix B); and
- Geochemistry Assessment prepared by Terrenus Earth Sciences (Appendix M).

The Groundwater Assessment and Surface Water and Flooding Assessment have been peer reviewed by suitably qualified and experienced experts in their respective fields (Attachment 3), including:

- Dr Noel Merrick (groundwater assessment); and
- Tony Marszalek (surface water and flooding assessment).

The Groundwater Assessment (Appendix A) has considered the cumulative drawdown impacts of the Project and surrounding developments (existing and approved).

The Surface Water and Flooding Assessment (Appendix B) includes a cumulative assessment of catchment excision and controlled releases from both the Project and surrounding developments (existing and approved).

The Geochemistry Assessment (Appendix M) evaluates and characterises the geochemical nature of potential waste rock and coal rejects that would be generated over the life of the Project.

These assessments have been prepared in consideration to the *Guideline – Application requirements for activities with impacts to water* (DES, 2017b).

The environmental objectives stated in the Terms of Reference for water quality are that the Project be operated in a way that:

(a) protects the environmental values of waters

(b) protects the environmental values of wetlands

(c) protects the environmental values of groundwater and any associated surface ecological systems.

The corresponding Item 2 performance outcomes as stated in Schedule 5, Part 3, Table 1 of the EP Regulation to be achieved are provided in Table 4-1.

A description of existing local and regional water quality, including baseline data and the existing monitoring regime is provided in Section 4.1.2. Section 4.1.3 describes the potential impacts of the Project on groundwater and surface water quality including cumulative impacts and Section 4.1.4 outlines the proposed mitigation measures, management and monitoring.

Table 4-1
Performance Outcomes for Water, Wetlands and Groundwater

Performance Outcomes	Section
Water – Performance Outcomes	
2 All of the following— *(a) the storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks;*	Yes (Section 4.1.4)
(b) contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water;	Yes (Section 4.1.3)
(c) the activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment;	Yes (Section 4.1.3)
(d) the disturbance of any acid sulfate soil, or potential acid sulfate soil, will be managed to prevent or minimise adverse effects on environmental values;	Yes (Section 4.10)
(e) acid producing rock will be managed to ensure that the production and release of acidic waste is prevented or minimised, including impacts during operation and after the environmental authority has been surrendered;	Yes (Sections 4.1.4 and 4.2.4)
(f) any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland;	Yes (Sections 4.1.3 and 4.1.4)
(g) for a petroleum activity, the activity will be managed in a way that is consistent with the coal seam gas water management policy, including the prioritisation hierarchy for managing and using coal seam gas water and the prioritisation hierarchy for managing saline waste;	N/A
(h) the activity will be managed so that adverse effects on environmental values are prevented or minimised.	Yes (Section 4.1.4)
Wetlands – Performance Outcomes	
2 The activity will be managed in a way that prevents or minimises adverse effects on wetlands.	Yes (Section 4.1.3)
Groundwater – Performance Outcomes	
2 The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.	Yes (Section 4.1.4)

4.1.2 Description of Environmental Values

A range of environmental values have been assigned broadly for the three mapped areas in the vicinity of the Project area under the Water and Wetland Biodiversity EPP (Figure 4-1):

- Isaac western upland tributaries;
- Isaac and lower Connors River main channel; and
- Isaac northern tributaries.

All three mapped areas have been assigned the following environmental values:

- aquatic ecosystems;
- irrigation;
- farm supply/use;
- stock water;
- human consumption;
- primary recreation;
- secondary recreation;
- visual recreation;
- drinking water;
- industrial use; and
- cultural and spiritual values.

Only the Isaac western upland tributaries mapped areas have 'aquaculture' assigned as an environmental value.

To assist in describing the relevant environmental values and corresponding water quality objectives (WQOs) for the Project, the following sub-sections present a summary description of the baseline water quality data and the water quality of the local and regional surface water and groundwater resources.

Baseline Water Quality Data

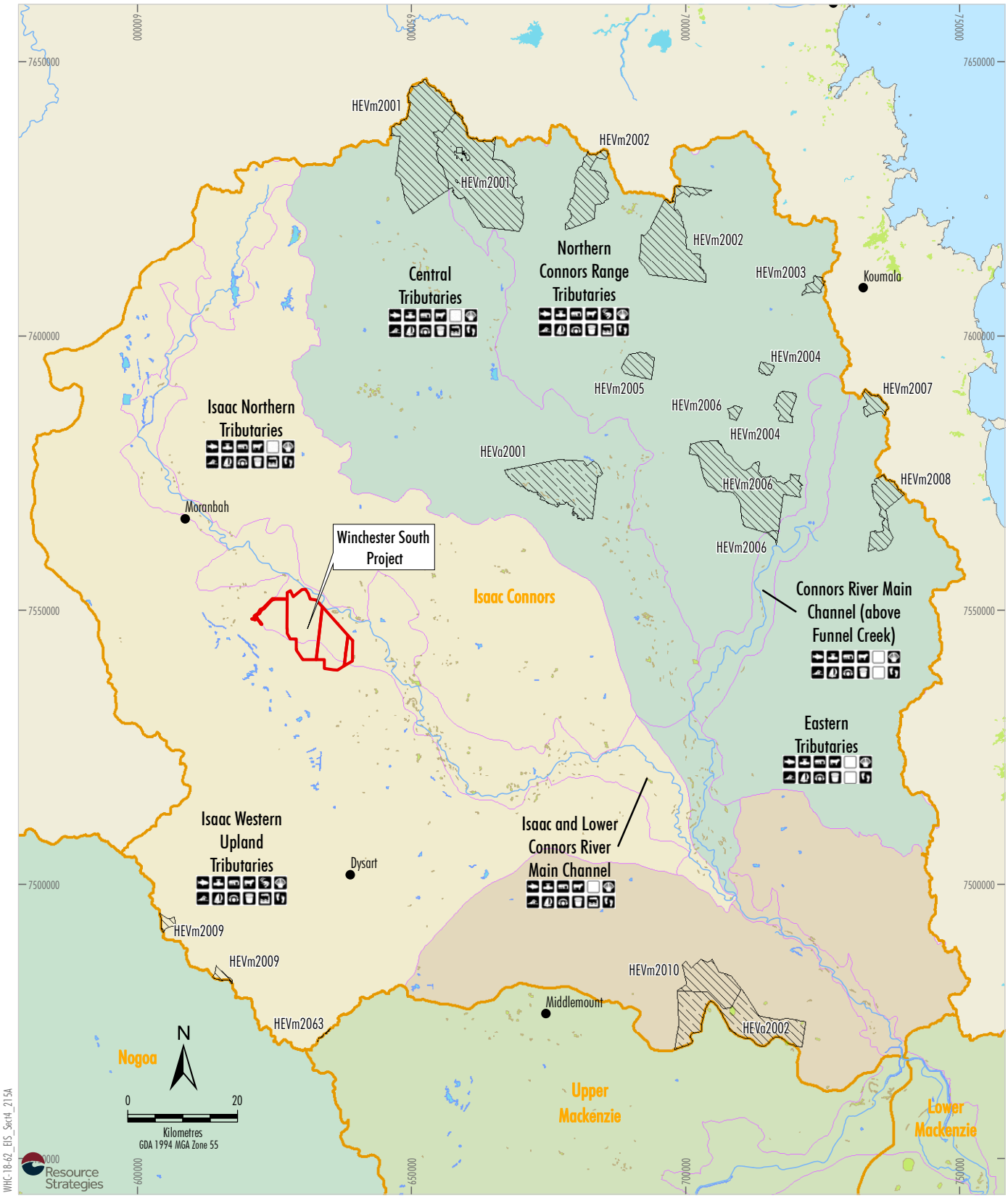
Water quality data has been collected and analysed from a number of different sources, including (Figure 4-2):

- a range of recorded physico-chemical parameters, including continuous monitoring for select analytes, at the Deverill gauging station on the Isaac River (DRDMW, formerly DNRME) (since 1964);
- continuous (sub-daily) logger records for pH, EC and temperature at the downstream ISDS gauging station on the Isaac River provided by Pembroke under the existing data sharing agreement;
- surface water quality results during the baseline sampling campaign for the Project including sites on:
  - the Isaac River (SW4 and SW5);
  - Ripstone Creek (SW6);
  - Ripplestone Creek (SW7); and
  - other unnamed drainage lines or water bodies (SW1, SW2, SW3, SW8 and SW9);
- surface water quality results during the aquatic ecology surveys conducted by ESP, including sampling sites on the Isaac River, Ripstone Creek, Cherwell Creek, other unnamed watercourses and drainage lines and water bodies;
- groundwater quality sampling undertaken as part of the groundwater investigation program, including sampling of:
  - three alluvial standpipe installations, Knob Hill 1, Knob Hill 2 and Winnet Bore;
  - four standpipe installations monitoring the Vermont Seams;
  - three standpipe installations monitoring the interburden strata; and
  - five standpipe installations monitoring the Leichhardt Seams;
- resistivity data from the transient electromagnetic (TEM) survey conducted by Groundwater Imaging Pty Ltd (Groundwater Imaging) (Appendix A); and
- groundwater sampling and quality analysis undertaken by ESP as part of the stygofauna assessment included, as part of the Aquatic Ecology and Stygofauna Assessment (Appendix E).

Regional Surface Water Quality

The Isaac River is the surface water resource of regional relevance to the Project. Further downstream, the Isaac River converges with the Connors River and the Mackenzie River before ultimately joining the Fitzroy River and flowing to the eastern coast of Australia (i.e. Keppel Bay near Rockhampton).

Water quality data is available for the Isaac River at locations upstream, adjacent and downstream of potential influences of the Project.



LEGEND

- Mining Lease Application Boundary
- Boundary of Waters Covered by the Scheduling Document
- Isaac River Sub-basin Boundary
- Watercourse

Environmental Values

- Aquatic Ecosystems
- Primary Recreation
- Irrigation
- Secondary Recreation
- Farm Supply
- Visual Recreation
- Stock Water
- Drinking Water
- Aquaculture
- Indsutrial Use
- Human Consumer
- Cultural & Spiritual Values

Water Types (Fresh Waters)

- Connors River Catchment fresh waters
- Lower Isaac River Catchment fresh waters
- Lower Nogoa / Theresa Creek Sub-basin fresh waters
- Mackenzie River Sub-basin fresh waters
- Upper Isaac River Catchment fresh waters
- Lakes / Reservoirs
- Wetlands (Palustrine)

Management Intent

- High Ecological Value Fresh Waters (Maintain)
- High Ecological Value Fresh Waters (Achieve)

Source: The State of Queensland (2013, 2018 - 2020).

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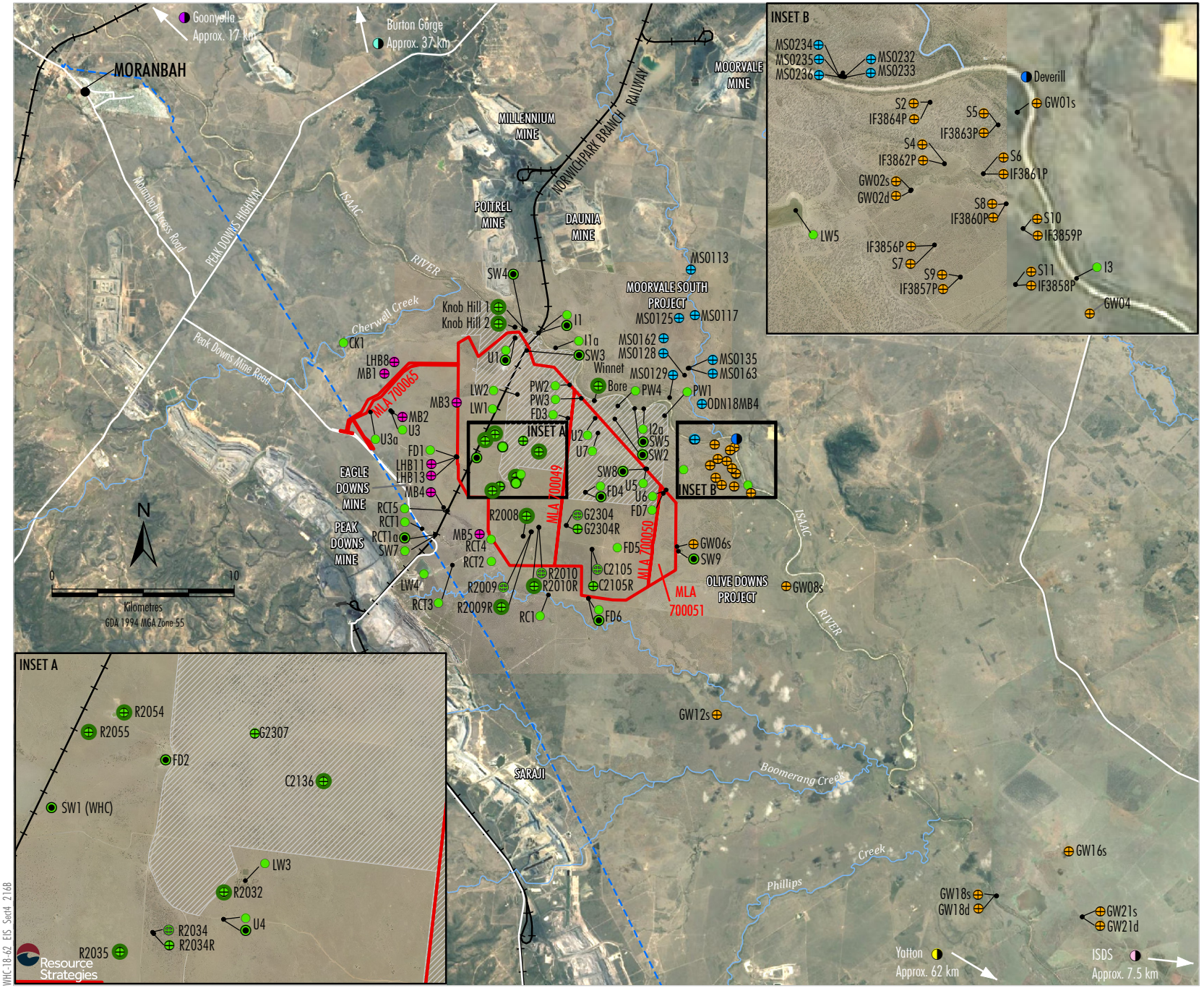
Environmental Values - Isaac River Sub-basin

Figure 4-1



LEGEND

- Mining Lease Application Boundary
- Watercourse
- Eungella Water Pipeline Southern Extension
- Approximate Extent of TEM Survey

Project Groundwater Monitoring Network

- Former Standpipe
- Standpipe
- Stygofauna Sampling Site

Project Surface Water Monitoring Network

- Surface Water Monitoring
- Aquatic Ecology Survey Site

DRDMW Monitoring Network

- ISDS
- Yatton Gauging Station
- Burton Gorge Gauging Station
- Deverill Gauging Station
- Goonyella Gauging Station

Neighbouring Groundwater Monitoring Network

- Eagle Downs Mine Standpipe
- Moorvale South Project Standpipe
- Olive Downs Project Standpipe

Source: The State of Queensland (2020); ESP (2021); SLR (2021); WRM (2021); Hydrogeologist.com.au (2020); Pembroke (2020); Whitehaven (2020).

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Water Quality Monitoring - Baseline Data

Figure 4-2

Collation and comparison of available regional water quality data for the Isaac River at the Deverill and Yatton gauging stations (downstream of the Project), and further upstream at the Red Hill Mining Lease, are included in the Surface Water and Flooding Assessment (Appendix B).

DNRME (now DRDMW) has collected and published daily EC data at the Deverill and Yatton gauging stations in the Isaac River. The Deverill gauging station is located to the east of the Project (downstream) and would be representative of water quality in the vicinity of the Project. The Yatton gauging station is located downstream of the Connors River confluence but includes mining releases from all mines within the Isaac River catchment.

A time history of recorded instantaneous EC and stream flow for the Isaac River at the Deverill and Yatton gauging stations from 2011 is presented on Figure 4-3. The relationship between instantaneous flow and EC is also shown on Figure 4-3.

Water quality monitoring data collected by DNRME between 2011 and 2019 at the Deverill gauging station in the Isaac River indicate the following (Appendix B):

- The EC for high flows greater than 200 m^3/s are below the high flow WQO EC of 250 µS/cm for 100% of readings.
- The EC of instantaneous flows below 100 m^3/s vary significantly, from 50 µS/cm to 1,870 µS/cm, with many recorded values exceeding the low flow WQO EC of 720 µS/cm (5% of readings).
- The mean daily EC has exceeded the low flow WQO on a total of 22 days over this period (5% of readings) and all of these days experienced some flow (not stagnant flow).
- The stream flows are highly ephemeral with baseflows ceasing within a few days or weeks of a runoff event, or at least flowing below the top of the sandy bed.

Water quality monitoring data collected by DNRME between 1995 and 2019 at the Yatton gauging station in the Isaac River indicate the following (Appendix B):

- The EC for high flows greater than 200 m^3/s varies much more than at Deverill gauging station but are generally below 410 µS/cm for 100% of readings.
- The high flow EC since 2011 has generally been below the high flow WQO (97% of readings).
- The low flow EC has frequently been above the low flow WQO of 410 µS/cm (35% of readings). EC rises during extended baseflow periods, which would be associated with either the Connors River or an increase in baseflow in the reach between Deverill and Yatton gauging stations.
- The recorded low flow EC is generally less than at Deverill gauging station.

Local Surface Water Quality

Local surface water quality sampling has been undertaken as a component of the baseline water quality assessments for the Project (Appendices A and B).

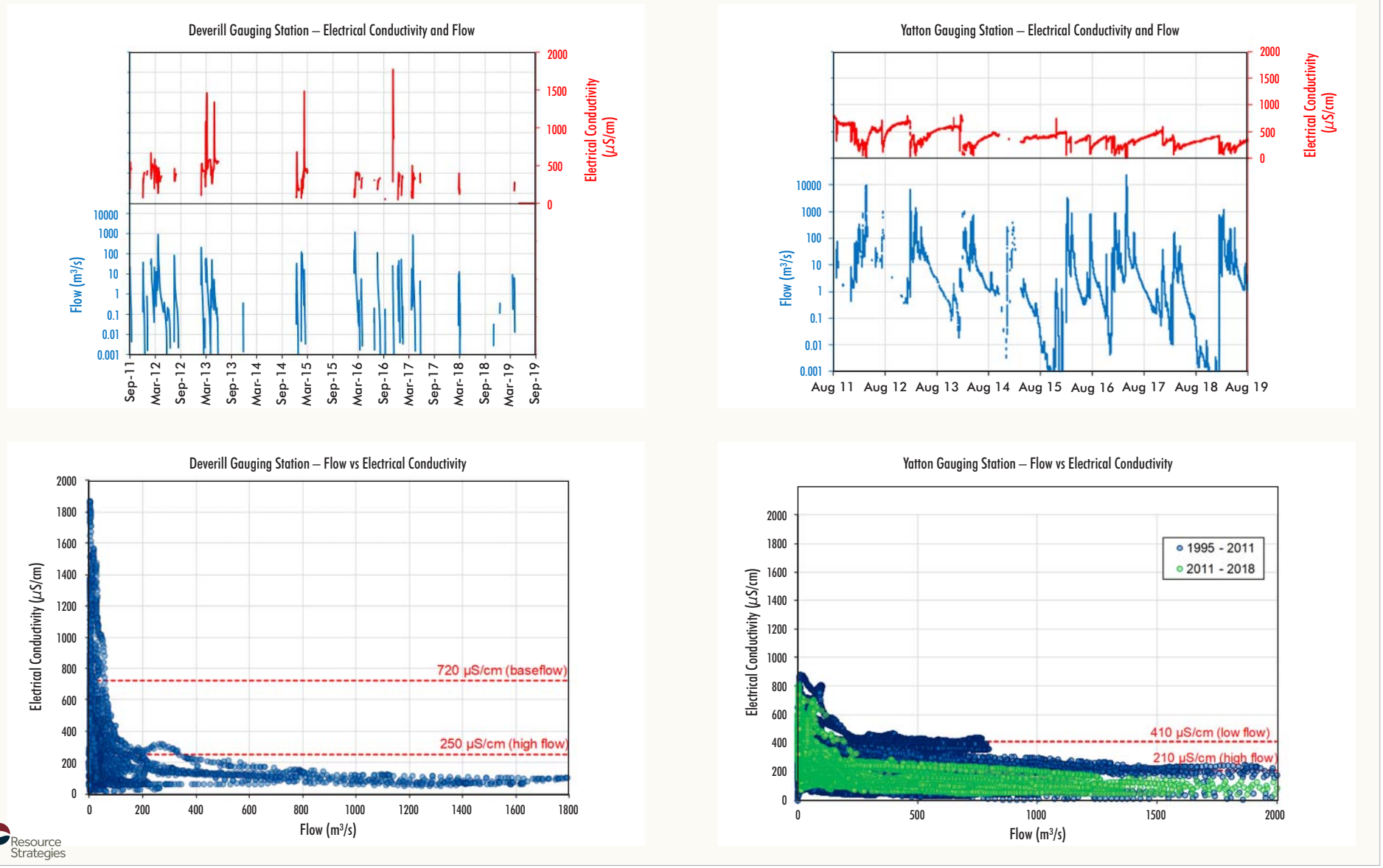
Analyses for a range of physico-chemical parameters were undertaken between March 2019 and June 2020 at sites SW1, SW2, SW3, SW4, SW5, SW7, SW8 and SW9 (SW6 was dry for all surveys) (Figure 4-2).

A number of the baseline water quality samples do not meet the default guideline values (DGVs) for the region, in particular for the Isaac River (represented by the samples at SW4 and SW5). These background exceedances of the regional DGVs are also generally reflected in the other sampling locations along Ripstone Creek and the unnamed tributaries of the Isaac River (Appendix B).

Water quality monitoring has also been undertaken at various locations in the Isaac River and tributaries between July 2017 and March 2019 for the Olive Downs Project. Similar to the data collected for the Project, the water quality samples for the Olive Downs Project from the Isaac River show that a number of the baseline water quality samples do not meet the DGVs for the region (Appendix B).

Groundwater Quality

An analysis of water quality attributes of groundwater within the Project area and surrounds is provided in Appendix A.



Source: WRM (2021)

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Isaac River Water Quality and Flow

Figure 4-3

Available water quality data has been compared to the:

- Fitzroy Basin Zone 34 groundwater quality objectives for deep and shallow water under the Water Plan;
- ADWG (NHMRC, 2018); and
- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ) (2000) water quality guidelines for aquatic ecosystems, irrigation (long-term and short-term) and stock water supply.

The main geological units are discussed below and include alluvium, regolith and the Permian-aged coal measures (including sandstone/siltstone interburden).

Alluvium

While water within the Isaac River is largely fresh, water within the Isaac River alluvium ranges from fresh to moderately saline with an average TDS of 863 mg/L, ranging between 10 mg/L and 3,430 mg/L (Appendix A).

Spatial distribution of TDS depicts mostly fresh water quality localised along the Isaac River (with some observations of brackish to moderately saline water along the Isaac River and tributaries).

Alluvial monitoring bores for the Project show marginal to saline water along the Isaac River alluvium, further outlining the spatial variability of salinity within the Isaac River alluvium (Appendix A).

The water quality data for the alluvium typically shows an inverse correlation in EC to rainfall, with rising EC recorded during periods of declining/below average rainfall and vice versa (Appendix A).

Comparing the available data to relevant guideline levels, the results indicate that water within the Quaternary alluvium is generally suitable for stock water supply and short-term irrigation. However, the alluvial groundwater generally exceeds guideline levels for drinking water (i.e. TDS, chloride and sodium), freshwater aquatic systems and long-term irrigation (chromium, iron, and manganese). The alluvial groundwater also records concentrations of total and dissolved iron and manganese above the Water Plan WQOs (Appendix A).

Regolith

Water within the regolith material is generally highly saline, however can be brackish to moderately saline with an average TDS of 10,510 mg/L, ranging between 1,460 mg/L and 18,600 mg/L (Appendix A).

Where water is present within the regolith material, it exhibits poorer quality compared to the alluvium and is not considered a suitable groundwater resource for livestock, irrigation, drinking water or aquatic ecosystems. The water within regolith material also exceeded the Water Plan WQOs (Zone 34 – shallow) for EC, chloride, calcium, sodium, hardness, magnesium, sulfate, copper and manganese (Appendix A).

Coal Measures (Interburden and Coal)

The target coal seams are contained within the Permian coal measures, namely, the Rangal and Fort Cooper Coal Measures. Water within these Permian coal measures is generally saline. Coal seam units of the Permian coal measures record an average TDS of 6,212 mg/L, ranging between 923 mg/L and 16,400 mg/L. The interburden units of the Permian coal measures record an average TDS of 3,436 mg/L, ranging between 421 mg/L and 18,400 mg/L (Appendix A).

Salinity within the Permian coal measures increases with depth. Bores within the Permian coal measures near the subcrop areas in the west generally record moderately saline water quality, which increases to saline quality where the Permian coal measures are deepest near the Isaac River. This corresponds with the Permian coal measures being largely recharged by rainfall where they subcrop (Appendix A).

Water within the interburden of the Permian coal measures is generally suitable for stock water supply at monitoring locations for the Project. The exception is R2034 which displays nickel (total and dissolved) and aluminium (total) concentrations above the guidelines for three of the sampling events. In contrast, groundwater within the coal seams generally exhibit a higher TDS, which is on average higher than the guideline level for beef cattle but below the guideline level for sheep (Appendix A).

Comparison of results to the guideline levels indicates the Rangal Coal Measures (interburden and coal) are not considered a suitable groundwater resource for irrigation, drinking water or aquatic ecosystems. Groundwater within the Permian coal measures (coal and interburden) record concentrations of bicarbonate above the Water Plan WQOs (Zone 34 – deep) and fluoride above the Water Plan WQO (Zone 34 – shallow and deep) (Appendix A).

Project Water Quality Objectives

Draft WQOs have been developed for the Project for each physical and chemical parameter, based on review and consideration of:

- the lowest WQO for each relevant environmental value; and
- the available baseline water quality datasets.

Where the available baseline water quality datasets demonstrate clearly that the lowest WQO could not be achieved, an alternative WQO that reflects recorded baseline conditions has been derived.

Where there remains substantial ambiguity, the lowest WQO has been adopted as the default, until such time as ongoing baseline datasets are available to derive an alternative WQO.

The draft WQOs for the Project are presented in Table 4-2.

4.1.3 Potential Impacts

Surface Water Quality

Potential impacts of the Project on surface water quality are considered in the following sub-sections.

Geochemistry (Drainage and Seepage)

A Geochemistry Assessment was conducted by Terrenus Earth Sciences (2020) and is presented in Appendix M. The assessment was undertaken to evaluate the geochemical nature of potential waste rock and coal reject materials likely to be produced from the Project.

The Geochemistry Assessment also aimed to identify any environmental issues that may be associated with mining, handling and storing these materials. Based on the geochemical testwork, waste rock is expected to:

- be overwhelmingly NAF (i.e. 99% of samples) with excess acid neutralising capacity (ANC) and have a negligible risk of developing acidic conditions; and
- generate relatively low to moderate salinity surface runoff and seepage with low soluble metals concentrations.

Overall, the geochemical assessment found that approximately 68% of potential coarse reject material was NAF, with the remaining coarse reject material having a relatively low degree of risk associated with potential acid generation. The material has a low sulphur (and sulphide) concentration and low metals/metalloids concentrations (Appendix M).

In consideration of the geochemical characteristics, it should be noted that coal reject is expected to comprise approximately 4% of all mineral waste generated at the Project. Therefore, coal reject generated by the Project would have a relatively low degree of environmental risk associated with potential acidity.

Runoff and Contaminants

Disturbance associated with mining activities has the potential to adversely affect the quality of surface runoff by increasing sediment loads.

Water management, erosion and sediment controls (e.g. sediment dams) and other land contamination controls that would be applied to the Project are described in Section 2.7.

The water balance model was used to assess the risk of uncontrolled releases from the mine-affected water management system. The water balance model results indicate there would be no uncontrolled releases from the mine-affected water management system to the Isaac River for the climatic scenarios modelled over the life of the Project (Appendix B).

Table 4-2
Draft Water Quality Objectives for the Project

Physico-chemical Parameter	Draft WQO	Relevant Environmental Value
pH	6.5-8.5	Aquatic Ecosystem
Conductivity (EC) – Baseflow	< 720 µS/cm	Aquatic Ecosystem
Conductivity (EC) – High flow	< 250 µS/cm	Aquatic Ecosystem
Total Dissolved Solids	< 2,000 mg/L	Stock Watering
Total Hardness (as $CaCO_3$)	< 150 mg/L	Drinking Water
Suspended Solids	< 55 mg/L	Aquatic Ecosystem
Sodium	< 30 mg/L	Drinking Water
Sulfate	< 25 mg/L	Aquatic Ecosystem
Turbidity	< 50 NTU	Aquatic Ecosystem
Colour	50 Hazen Units	Drinking Water
Dissolved Oxygen	85-110% Saturation	Aquatic Ecosystem
	> 4 mg/L (at surface)	Drinking Water
Iron	< 10 mg/L	Irrigation
Manganese	< 10 mg/L	Irrigation
	< 1.9 mg/L	Aquatic Ecosystem
Aluminium	< 5 mg/L	Stock Watering
	< 0.055 mg/L	Aquatic Ecosystem
Boron	< 5 mg/L	Stock Watering
	< 0.37 mg/L	Aquatic Ecosystem
Zinc	< 5 mg/L	Irrigation
	< 0.008 mg/L	Aquatic Ecosystem
Lithium	< 2.5 mg/L	Irrigation
Fluoride	< 2 mg/L	Irrigation
Arsenic	< 2 mg/L	Irrigation
	< 0.5-5 mg/L	Stock Watering
	< 0.024 mg/L	Aquatic Ecosystem
Chromium	< 1 mg/L	Stock Watering
	< 0.001 mg/L	Aquatic Ecosystem
Copper	< 1 mg/L	Stock Watering (Cattle)
	< 0.0014 mg/L	Aquatic Ecosystem
Nickel	< 1 mg/L	Stock Watering
	< 0.011 mg/L	Aquatic Ecosystem
Beryllium	< 0.5 mg/L	Irrigation
Vanadium	< 0.5 mg/L	Irrigation
Cobalt	< 0.1 mg/L	Irrigation
	< 0.0014 mg/L	Aquatic Ecosystem
Lead	< 0.1 mg/L	Stock Watering
	< 0.0034 mg/L	Aquatic Ecosystem
Uranium	< 0.1 mg/L	Irrigation
Molybdenum	< 0.05 mg/L	Irrigation

Note: NTU = Nephelometric Turbidity Units

Table 4-2 (Continued)
Draft Water Quality Objectives for the Project

Physico-chemical Parameter	Draft WQO	Relevant Environmental Value
Selenium	< 0.02 mg/L	Stock Watering
	< 0.005 mg/L	Aquatic Ecosystem
Cadmium	< 0.01 mg/L	Stock Watering
	<0.0002 mg/L	Aquatic Ecosystem
Mercury	< 0.002 mg/L	Irrigation
	< 0.00006 mg/L	Aquatic Ecosystem
Total Nitrogen	< 500 µg/L	Aquatic Ecosystem
Organic Nitrogen	< 420 µg/L	Aquatic Ecosystem
Oxidised Nitrogen	< 60 µg/L	Aquatic Ecosystem
Total Phosphorus	< 50 µg/L	Aquatic Ecosystem
Filterable Reactive Phosphorus	< 20 µg/L	Aquatic Ecosystem
Ammonia Nitrogen	< 20 µg/L	Aquatic Ecosystem
Chlorophyll a	< 5 µg/L	Aquatic Ecosystem

Source: Appendix B.

An uncontrolled overflow would only occur during an extreme rainfall event (i.e. greater than the modelled climatic conditions) which would also generate significant volumes of runoff from the surrounding undisturbed catchments, as well as in the receiving waterways. Therefore, it is very unlikely that uncontrolled overflows from the mine-affected water management system would have a measurable impact on receiving water quality and therefore the environmental values.

Controlled releases from the mine water management system would occur rarely and only when the water quality and flows of the Isaac River meet the proposed release trigger levels. Therefore, it is expected that these controlled releases would have negligible impacts on the Isaac River water quality (Appendix B).

To minimise the potential for mine-affected water releases, the Project would utilise the Railway Pit and Main Pit as in-pit water storages when available.

An Erosion and Sediment Control Plan would be developed and implemented throughout construction and operation of the Project. If implemented effectively, environmental risks from disturbed area runoff (i.e. sediment-laden runoff) are expected to be low (Appendix B).

In rainfall events below the design standard of the sediment dams, runoff from disturbed areas would be intercepted and treated by sediment dams. In larger events that exceed the design standards, these dams would overflow. Temporary storage within the sediment dams prior to overflow would reduce suspended sediment concentrations through settlement of sediment particles (Appendix B).

Available geochemical information indicates that the runoff draining to the sediment dams would have low to moderate salinity. Overflows would only occur during significant rainfall events which would also generate large volumes of runoff from surrounding undisturbed catchments.

Therefore, it is unlikely that sediment dam overflows would have a measurable impact on receiving water quality or environmental values (Appendix B).

Progressive rehabilitation of disturbance areas and waste rock emplacements would minimise the potential generation of sediment-laden water on-site.

Controlled Releases

Controlled releases would be conducted in accordance with the proposed controlled release strategy described in Section 2.7.6.

An assessment of the dilution ratio of controlled releases to the Isaac River flow was undertaken (Appendix B).

The assessment indicated that the minimum modelled dilution ratio for all model iterations was 407, which means that the river flow is more than 400 times larger than the controlled release flow. Therefore controlled releases would have a negligible impact on Isaac River water quality (Appendix B).

Rehabilitated Mine Landforms

As described in Section 6, sediment dams would be retained until the revegetated surface of the waste rock emplacements are stable and runoff water quality reflects runoff water quality from similar undisturbed areas, at which time these controls would be removed and the areas would be free-draining.

Groundwater Quality

Workshops and Storages

There is limited potential for groundwater contamination to occur with relation to workshops and fuel/chemical storage areas as each would be developed in accordance with current Australian Standards (e.g. adequate bunding and equipped for immediate spill clean-up).

Out-of-Pit Waste Rock Emplacements

As the mine progresses, waste rock material would be placed within selected out-of-pit waste rock emplacement areas. The out-of-pit waste rock emplacement areas may produce seepage as a result of rainfall inundation.

Runoff from disturbed areas outside the open cut pit and infrastructure areas, such as out-of-pit waste rock emplacement areas (both active and under rehabilitation) would be captured in the sediment and mine-affected water dams and managed under the mine water management system. The system would be designed to capture and reuse water.

The Geochemistry Assessment (Appendix M) indicates that waste rock material is overwhelmingly NAF, with the leachate generally being fresh (EC ranging between 110 µS/cm to 2,410 µS/cm) and low in sulfur content (<0.1%).

The Cainozoic sediments generally comprise surficial soil and clays, up to 10 m in thickness. Where the low permeability surficial clays are present, they would inhibit potential seepage from the out-of-pit waste rock emplacement to the underlying regolith and alluvium. Additionally, the groundwater modelling indicates that water would flow towards the residual voids (e.g. groundwater sinks) and therefore would limit potential seepage to the surrounding alluvium (Appendix A).

In-Pit Waste Rock Emplacements

The in-pit waste rock emplacements would be rehabilitated progressively as the mining operations progress. The Project would involve progressively backfilling the open cut pits as space becomes available with water levels within backfilled areas predicted to recover back towards pre-mining levels (Appendix A).

While the waste rock material leachate generally exhibits poorer water quality compared to the alluvium, groundwater levels within the in-pit waste rock emplacements would remain below the base of Isaac River alluvium. Therefore, a hydraulic gradient would not exist to enable interaction between water within the in-pit waste rock emplacements and the surrounding alluvium (Appendix A).

Residual Voids

Following the cessation of mining at the Project, there would be four residual voids. Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff and groundwater (Appendix B).

The predicted equilibrated water levels within the residual voids are between approximately 20 m and 60 m below the pre-mining groundwater levels, and therefore the residual voids would act as sinks to groundwater flow (Appendix A).

Water within the residual voids would evaporate from the equilibrated water body surface and draw in groundwater from the surrounding strata and runoff from the residual void catchment areas. As the residual voids would act as sinks, evaporation from the equilibrated water body would, over time, concentrate salts.

The gradual increase in salinity of the residual void water body would not pose a risk to the surrounding groundwater regime or receiving environment as the residual voids would remain as groundwater sinks in perpetuity (Appendix A).

Further detail regarding the residual voids is provided in Section 4.2.3.

Cumulative Impacts

Mine-affected water from the Project would be managed through a water management system which is designed to operate in accordance with the *Guideline - Model mining conditions* (DES, 2017a) and the *Model water conditions for coal mines in the Fitzroy basin* (DES, 2013). That is, the controlled release conditions and in-stream trigger levels are aligned with the WQOs in the Water and Wetland Biodiversity EPP.

Given that the Project mine-affected water releases are being managed within an overarching strategic framework for management of cumulative impacts of mining activities and the controlled releases for the Project are expected to have negligible impacts on the Isaac River water quality, the proposed management approach for mine-affected water from the Project is expected to have negligible cumulative impacts on surface water quality and associated environmental values (Appendix B).

The regional cumulative impacts of the Project on geomorphic characteristics of streams would also be negligible (Appendix B).

The Project is not expected to impact groundwater quality as (Appendix A):

- runoff from disturbed areas outside the open cut extent and infrastructure areas would be captures in the sediment and mine-affected water dams and managed under the water management system;
- there would be no mechanism for seepage from the out-of-pit waste rock emplacements to impact on groundwater quality in the alluvium and regolith;
- a hydraulic gradient would not exist to enable interaction between water in the in-pit waste rock emplacement material and the surrounding alluvium;
- the residual voids would act as groundwater sinks in perpetuity, as such there would be no risk to the surrounding surface water and groundwater regimes;
- there is limited potential for groundwater contamination to occur with relation to workshops and fuel/chemical storage; and
- there is limited potential for impacts to the surrounding groundwater regime as a result of sewage effluent irrigation.

It is therefore expected that the Project would not have a cumulative impact on groundwater quality.

4.1.4 Mitigation Measures, Management and Monitoring

Water Management System

As described in Section 2.7.1, key water quality related objectives of the Project water management system are to:

- maintain separation of clean, sediment-laden and mine-affected water within the limitations of operational requirements; and
- design and operate the mine water management system to minimise uncontrolled releases to the receiving environment.

Sediment dams would be designed based on the *Best Practice Erosion and Sediment Control Guideline* (IECA, 2018) as described in Appendix B.

Surface Water Monitoring Program

Monitoring of surface water quality both within and external to the Project would form a key component of the surface water management system. Monitoring of upstream, on-site and downstream water quality would assist in demonstrating that the site water management system is effective in meeting its objective of minimal impact on receiving water quality. Monitoring would also allow for early detection of any impacts and appropriate corrective action.

The surface water monitoring protocols would:

- maintain compliance with the environmental authority for the Project;
- provide valuable information on the performance of the water management system; and
- facilitate adaptive management of water resources on-site.

Section 10.7 of Appendix B (refer to Figure 10.3) provides the proposed surface water monitoring locations for the Project.

Sediment Dam Monitoring

Surface runoff and seepage from waste rock emplacements, including any rehabilitated areas during operations, would be monitored for 'standard' water quality parameters, including but not limited to pH, EC, alkalinity, major anions (e.g. sulfate and chloride), major cations (e.g. sodium, calcium, magnesium and potassium), TDS and a broad suite of soluble metals/metalloids.

The sediment dam monitoring would be used to validate the anticipated quality of water runoff reporting to sediment dams and haul road runoff dams. Initially, the sediment dam monitoring would occur on a regular (e.g. quarterly) basis to demonstrate the water quality of stored waters is consistent with the relevant operating parameters to allow releases from sediment dams to occur when required. Subject to demonstrating the WQOs can be met, the frequency of monitoring and suite of parameters for the sediment dam monitoring would be reviewed and updated accordingly (e.g. to occur only when releases occur).

Controlled Releases

Controlled releases would be conducted in accordance with the proposed controlled release strategy described in Section 2.7.6.

Management and Monitoring of Waste Rock, ROM Coal and Coal Rejects (Drainage and Seepage)

Waste Rock Emplacements

Waste rock is expected to be overwhelmingly NAF with excess ANC (i.e. negligible risk of developing acidic conditions). Furthermore, waste rock is predicted to generate low to moderate salinity surface runoff and seepage with low soluble metal/metalloid concentrations (Appendix M).

Surface water runoff and seepage from waste rock emplacements, including any rehabilitated areas, would be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, alkalinity, major anions (sulfate and chloride), major cations (sodium, calcium, magnesium and potassium), TDS and a broad suite of soluble metals/metalloids (Appendix M).

It is, however, noted that some waste rock materials may be sodic (to varying degrees) with potential for dispersion and erosion (to varying degrees) (Appendix M). Where highly sodic and/or dispersive waste rock is identified, it would not report to final landform surfaces and would not be used in construction activities, wherever practicable.

It may not be practical to selectively handle and preferentially emplace highly sodic and dispersive waste rock during operation of the Project. However, reasonable measures would be taken to identify and selectively place (or alternatively manage) highly sodic and dispersive waste rock.

Therefore, in the absence of such selective handling, waste rock emplacements would be designed to be short and low (shallow) slopes and progressively rehabilitated to minimise erosion. Where practical, and where competent rock is available, armouring of slopes would also be considered.

Where waste rock is used for construction activities, this would be limited (as far as practical and feasible) to unweathered Permian sandstone, as this material is widely accepted to be more suitable for construction and for use as embankment covering on final landform surfaces.

Regardless of the waste rock type, especially where engineering or geotechnical stability is required, laboratory testing and rehabilitation field trials would be undertaken to determine the propensity for dispersion and erosion of waste rock landforms.

With the implementation of the proposed management and mitigation measures, the waste rock is regarded as posing a low risk of environmental harm.

ROM Coal and ROM Pads

Surface water runoff and seepage from ROM pads would not report off-site and would be managed as part of the on-site mine water management system. Project specific data suggests that ROM coal is expected to have a low degree of risk associated with potential acid, salt and soluble metals generation.

Notwithstanding, surface water runoff from ROM coal stockpiles would be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, alkalinity, major anions (sulfate and chloride), major cations (sodium, calcium, magnesium and potassium), TDS, acidity and a broad suite of soluble metals/metalloids.

Coal Rejects

The management of coal rejects generated by the Project is described in Section 2. As concluded in the Geochemistry Assessment (Appendix M), when placed amongst alkaline waste rock (overwhelming NAF) within in-pit emplacements, the overall risk of environmental harm and health-risk that emplaced coal rejects pose is very low.

Notwithstanding, a Waste Management Program would be developed, that would describe the handling and disposal of fine reject and coarse reject material for the Project.

Geochemical test-work validation for coal reject from the CHPP would be undertaken during development of the Project, particularly during the first two years of CHPP operation and whenever new seams/plies are being processed.

Test-work would comprise a broad suite of environmental geochemical parameters, such as pH, EC, acid-base account parameters and total and soluble metals/metalloids.

Groundwater Quality Monitoring

Groundwater quality sampling would continue at existing monitoring sites to detect any changes in groundwater quality during and post-mining.

Groundwater quality monitoring would continue to be undertaken on a quarterly basis. In addition to collecting field parameters (EC and pH), water samples would be submitted to a National Association of Testing Authorities (NATA) accredited laboratory for analysis of:

- physico-chemical indicators (TDS and total suspended solids [TSS]);
- major ions, hardness and ionic balance;
- total alkalinity as $CaCO_3$, HCO_3, CO_3;
- total and dissolved metals;
- nutrients (total nitrogen, nitrogen oxides, ammonia, phosphate); and
- organics (total petroleum hydrocarbons C_6-C_{40}).

It is also proposed that quarterly groundwater quality monitoring continue to be conducted on accessible privately-owned bores near to the Project.

Section 8.2 of Appendix A (refer to Figure 8-1) provides the proposed groundwater monitoring locations for the Project.

Groundwater Quality Triggers and Data Review

Groundwater quality triggers would be established to monitor predicted impacts on both environmental values and predicted changes in groundwater quality. The groundwater quality triggers would be developed in consideration of *Using monitoring data to assess groundwater quality and potential environmental impacts* (DSITI, 2017), Water Plan WQOs, ANZECC and ARMCANZ (2000) criteria and site-specific conditions. Impact assessment criteria for the site would be documented within a Water Management Plan.

Groundwater quality triggers would be established for each groundwater unit potentially impacted by the Project, including alluvium, regolith and the Permian coal measures.

An annual review of groundwater quality trends would be conducted by a suitably qualified person. The review would assess the change in groundwater quality over the year, compared to historical trends and impact assessment predictions. The annual review would consider any groundwater trigger exceedances or where data trends show potential for environmental harm.

Water Quality Auditing, Reporting, Corrective and Preventative Actions

Whitehaven WS would generally undertake the following process for any exceedance identified to water quality:

1. Confirm the timing of the exceedance(s) and general location of the exceedance(s).
2. Report exceedances to the appropriate regulatory authorities within regulatory timeframes.
3. Confirm the climatic conditions at the time of the exceedance(s) (where relevant).
4. Identify any potential contributing factors, including consideration of current mine activities.
5. Assess the monitoring results for any anomalies or causes and develop appropriate mitigation and management strategies with assistance from appropriate specialists.
6. Implement the mitigation and management strategies, based on the results of the above investigations.
7. Review of follow up results and report the outcomes of the review to the appropriate regulatory authorities.

Groundwater Model Validation

Every five years, the validity of the groundwater model predictions would be assessed and if the data indicates significant divergence from the model predictions, the groundwater model would be updated for simulation of mining.

Groundwater Licensing

Underground water rights would be exercised for the life of the Project as described in Section 4.2.4.

Water Management Plan

A Water Management Plan would be prepared cognisant of the DES guideline for the *Preparation of water management plans for mining activities* (Department of Environment and Resource Management [DERM], 2010) and would include:

- details of the potential sources of contaminants that could impact on water quality;
- a description of the water management system for the Project;
- measures to manage and prevent saline drainage and sodicity;
- measures to manage and prevent acid rock drainage;
- corrective actions and contingency procedures for emergencies; and
- a program for monitoring and review of the effectiveness of the Water Management Plan.

Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan would be developed and implemented throughout the construction and operation of the Project.

A 'best practice' approach would be adopted that is consistent with the IECA recommendations. The following broad principles would apply:

- minimise the area of disturbance;
- apply local temporary erosion control measures, where practical;
- intercept runoff from undisturbed areas and divert around disturbed areas; and
- where temporary measures are unlikely to be effective, divert runoff from disturbed areas to sedimentation basins prior to release from the site.

The Erosion and Sediment Control Plan would be implemented throughout the life of the Project to minimise erosion and the release of sediment to receiving waters, and for management of stormwater.

Receiving Environment Monitoring Plan

A Receiving Environment Monitoring Plan (REMP) would be developed for the Project in accordance with the *Guideline - Model mining conditions* (DES, 2017a). The REMP would be implemented to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for water quality. This is described further in Section 7.

Proposed water quality monitoring locations for the Project are shown on Figure 8-1 of Appendix A and Figure 10.3 of Appendix B.

4.2 WATER RESOURCES

4.2.1 Methodology and Environmental Objectives

Potential impacts of the Project on water resources have been considered in the following assessments:

- Groundwater Assessment prepared by SLR (Appendix A);
- Surface Water and Flooding Assessment prepared by WRM (Appendix B); and
- Geomorphology Assessment prepared by Fluvial Systems (Appendix B).

The Groundwater Assessment and Surface Water and Flooding Assessment have been peer reviewed by suitably qualified and experienced experts in their respective fields (Attachment 3), including:

- Dr Noel Merrick (groundwater assessment); and
- Tony Marszalek (surface water and flooding assessment).

In relation to the groundwater numerical modelling, the peer reviewer, Dr Noel Merrick, noted:

The groundwater modelling has been conducted to a very high standard and a rigorous Monte Carlo uncertainty analysis offsets much of the uncertainty that is inherent in a groundwater model.

In relation to the Surface and Flooding Assessment, the peer reviewer, Tony Marszalek, concluded:

> *… the assessment as it stands is sufficient and fit for purpose for the EIS…*

The environmental objectives stated in the Terms of Reference for water resources are:

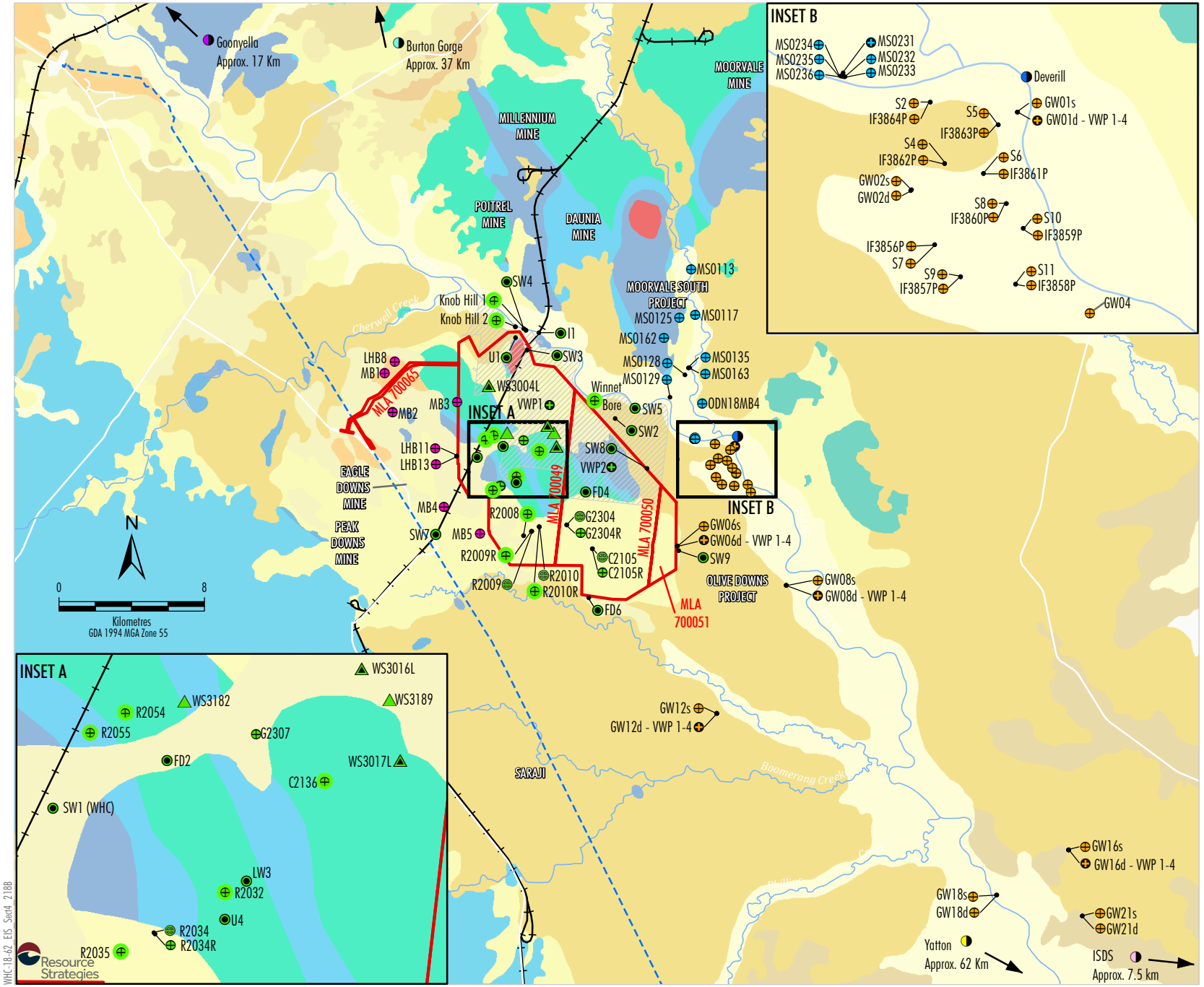
> *(a) equitable, sustainable and efficient use of water resources*
>
> *(b) environmental flows, water quality, in-stream habitat diversity, and naturally occurring inputs from riparian zones to support the long-term maintenance of the ecology of aquatic biotic communities*
>
> *(c) the condition and natural functions of waterbodies, lakes, springs, watercourses and waterways are maintained—including the stability of beds and banks of watercourses*
>
> *(d) volumes and quality of groundwater are maintained, or alternate water supply is provided and current lawful users of water (such as entitlement holders and stock and domestic users) and other beneficial uses of water (such as surface water users, spring flows and groundwater-dependent ecosystems) are not adversely impacted by the development.*

4.2.2 Description of Environmental Values

Baseline Water Resource Data

A range of data sources have been used to describe the environmental values relevant to the Project. In addition to the baseline water quality data listed in Section 4.1, available surface water flow and groundwater data has been utilised, including:

- rainfall and evaporation records from BoM and DRDMW weather stations;
- data from DRDMW gauging stations in the Isaac River catchment area (Figure 4-4);
- data from the groundwater monitoring and investigation program undertaken in the vicinity of the Project (Figure 4-4 and Appendix A);
- data from the surrounding developments that Whitehaven WS has established data sharing agreements with (Figure 4-4 and Appendix A);
- publicly available data from surrounding developments; and
- geomorphology surveys undertaken in the vicinity of the Project (Figure 4-5 and Appendix B).



LEGEND

- Mining Lease Application Boundary
- Approximate Extent of TEM Survey

Project Groundwater Monitoring Network

- Former Standpipe
- Standpipe
- VWP
- Stygofauna Sampling Site

Project Surface Water Monitoring Network

- Surface Water Monitoring

Project Testwork Sites

- Core Permeability Site
- Packer Testing Site

DRDMW Monitoring Network

- ISDS
- Yatton Gauging Station
- Burton Gorge Gauging Station
- Deverill Gauging Station
- Goonyella Gauging Station

Neighbouring Groundwater Monitoring Network

- Eagle Downs Mine Standpipe
- Moorvale South Project Standpipe
- Moorvale South Project VWP
- Olive Downs Project Standpipe
- Olive Downs Project VWP

Surface Geology

- Quaternary Alluvium
- Quaternary Regolith
- Qr\b-QLD
- Late Tertiary - Quaternary Alluvium
- Late Tertiary - Quaternary Regolith
- Duaringa Formation
- Ki-CQ
- Rewan Group
- Clematis Group
- Fort Cooper Coal Measures
- Rangal Coal Measures

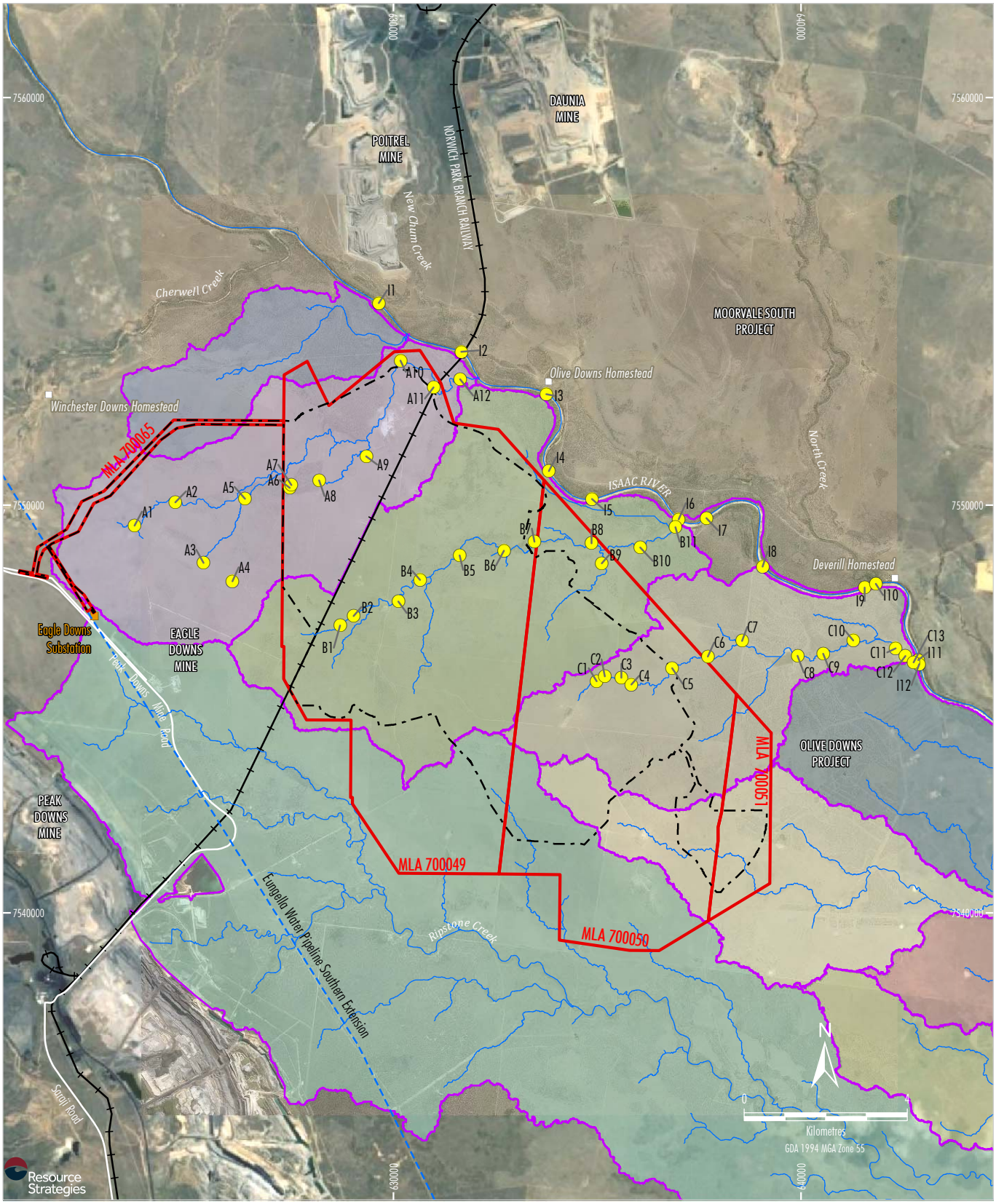
Source: The State of Queensland (2021); ESP (2021); SLR (2021); WRM (2021); Hydrogeologist (2020); Pembroke (2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Water Resource Monitoring - Baseline Data

Figure 4-4



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Eungella Water Pipeline Southern Extension
- Railway
- Substation
- Geomorphology Survey Site
- Existing Drainage Network - Project Area
- Sub-Catchment Boundary

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

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Geomorphology Survey Sites

Figure 4-5

The baseline groundwater monitoring and investigation program for the Project has included the following (Figure 4-4):

- Three alluvial standpipe installations, namely Knob Hill 1, Knob Hill 2 and Winnet Bore.
- Four standpipe installations monitoring the Vermont Seams.
- Three standpipe installations monitoring the interburden strata.
- Five standpipe installations monitoring the Leichhardt Seams.
- Two Vibrating Wire Piezometer (VWP) installations, VWP1 and VWP2.
- Packer Testing at bore holes WS3189 (from 35 m to 61 m) and WS3182 (from 85 m to 95 m).
- Horizontal and vertical core hydraulic conductivity testing (in laboratory) of the overburden and underburden of the coal seams samples.
- TEM survey (Appendix A).

The bores target a range of hydrostratigraphic units, including:

- Quaternary alluvium;
- Cainozoic sediments (regolith);
- Rewan Group (Triassic);
- coal seams, interburden and overburden material of the Rangal Coal Measures; and
- coal seams, interburden and overburden material of the Fort Cooper Coal Measures.

Extensive hydraulic testing was conducted on all major geological units. This included testing of core samples for vertical and horizontal hydraulic conductivity (anisotropy), slug testing (rising/falling head tests) and packer testing for horizontal hydraulic conductivity, as well as documented airlift yields (Appendix A).

To assist with further definition of alluvium in the vicinity of the Project, Groundwater Imaging (2019) completed a TEM survey. The TEM survey results are presented in Appendix A.

Extensive baseline groundwater monitoring and investigation programs previously undertaken for surrounding developments, for which Whitehaven WS has existing data sharing agreements, have also been used.

Regional Hydrology

The Project is located within the headwaters of the Isaac sub-catchment of the greater Fitzroy Basin. The major rivers and tributaries of the Fitzroy catchment include the Fitzroy, Dawson, Nogoa, Comet, Isaac and Mackenzie Rivers.

The Isaac River is the main watercourse that is east of the Project area and flows in a north-west to south-east direction, passing the township of Moranbah and the surrounding developments upstream of the Project (Appendix B).

The Project is within the greater Isaac-Connors sub-catchment area, that is approximately 22,364 km^2 (to the Mackenzie River confluence). This sub-catchment represents approximately 15% of the overall Fitzroy River catchment (142,665 km^2) (Appendix B).

The catchment area of the Isaac River to the Project area is around 4,100 km^2. This represents around 2.9% of the overall Fitzroy River catchment and 18.3% of the Isaac-Connors sub-catchment (Appendix B).

The Isaac River is a seasonally flowing watercourse, typically with surface flows in the wetter months from November to April, reducing to shallow sub-surface flows from about May to October. All other waterways and drainage lines in the vicinity of the Project area are understood to be ephemeral and experience flow only after sustained or intense rainfall in the catchment (Appendix B).

Stream flows are highly variable, with most channels drying out during winter to early spring when rainfall and runoff is historically low, although with some pools expected to hold water for extended periods. Therefore, physical attributes, water quality, and the composition of aquatic flora and fauna communities are also highly variable over time (Appendix B).

Local Hydrology

There are six waterways mapped in the vicinity of the Project area, including (Appendix B) (Figure 4-5):

- the Isaac River located to the east of the Project, with Strahler stream order of six;
- Cherwell Creek located to the north of the Project, with a Strahler stream order of five;
- Ripstone Creek located to the south of the Project, with a Strahler stream order of two/three; and
- three waterways with Strahler stream orders of one/two, one watercourse in the north of the Project area and two drainage features that drain through the Project area directly to the Isaac River.

The majority of the Project area drains directly to the Isaac River through various unnamed drainage features and minor tributaries. Other than the Isaac River, the closest local named watercourses are Cherwell Creek and Ripstone Creek (Figure 4-5).

Ripstone Creek runs west to east, south of the Project. The Ripstone Creek pre-mining catchment area is approximately 286 km^2 with predominant land use within the catchment being stock grazing and open cut mining. The existing Peak Downs Mine has approval to release to Ripstone Creek upstream of the Project. The Olive Downs Project has approval to divert Ripstone Creek around an open cut mining area downstream of the Project.

Surface Water Users

Information regarding individual licences for Isaac River surface water users was obtained from DNRME (now DRDMW) (Appendix B).

Details regarding the volume, source and purpose of the licences are presented in Appendix B.

Groundwater Regime

A conceptual hydrogeological model of the groundwater regime was developed by SLR (2021) based on the available groundwater data, and the results of the groundwater investigation program and TEM survey (Groundwater Imaging, 2019).

The hydrogeological regime relevant to the Project comprises the following hydrogeological units (Appendix A):

- Cainozoic sediments:
  - Quaternary alluvium – unconfined aquifer localised along Isaac River; and
  - regolith – unconfined and largely unsaturated unit bordering alluvium;
- Triassic Rewan Group – aquitard.
- Permian coal measures with:
  - hydrogeologically 'tight' interburden units; and
  - coal sequences that exhibit secondary porosity through cracks and fissures.

The indicative strata (not including Cainozoic sediments) over the Project area is shown on Figures 2-18b and 2-18c and the hydrogeological units are described below.

Alluvium

Alluvium is present outside of the Project area, to the north and east. The extent and thickness of the unconsolidated sediments were assessed using a TEM survey conducted in March 2019 and verified with site geological logs (Appendix A).

Drill-hole WSN206 occurs 3 km north-east of the Project within the mapped extent of the alluvium. The drill-hole log shows sand present, occurring from the surface to a depth of 22 m, where it overlies siltstone.

Drill-holes intercepting Isaac River alluvium around the Olive Downs Project indicate that it comprises a heterogeneous distribution of fine- to coarse-grained sands interspersed with lenses of clays and gravels (Appendix A). These sediments, while spatially variable, generally comprise four main stratigraphic sequences:

- upper soil and clay layer (up to 13 m thick);
- sand and sandy clay unit (up to 24 m thick);
- sand and gravel unit (up to 8 m thick); and
- basal clay unit (up to 10 m thick).

Regolith

The surficial regolith material covering much of the Project area comprises Cainozoic (Quaternary to Tertiary) aged sediments, including alluvium and colluvium. Based on site geological logs, the regolith comprises a heterogeneous distribution of fine- to coarse-grained sand, clay, sandstone and claystone. The regolith material is generally 25 m thick and is all recorded as being highly weathered, with the depth of weathering extending to a maximum of 100 m below ground level, into the underlying coal measures (Appendix A).

Exploration drilling across the Project area indicates that the regolith is not commonly saturated. Groundwater monitoring conducted within the extent of the groundwater model at surrounding developments includes four monitoring bores intersecting the regolith (GW06s, GW12s, GW16s and GW21s), two of which have remained dry between June 2017 and February 2019 (GW06s and GW16s) (Appendix A).

Overall, the regolith is considered to be largely unsaturated, with the presence of water restricted to lower elevation areas along the Isaac River. Where the regolith is saturated, flow is likely a reflection of topography, flowing towards nearby drainage lines (Appendix A).

The regolith material comprises low permeability strata (i.e. clay and claystone), which likely restricts rainfall recharge. Groundwater discharge is likely to occur primarily via evapotranspiration, with some baseflow to streams from the regolith under wet climatic conditions. Vertical seepage through the regolith is likely to be limited by the underlying low-permeability Rewan Group and other aquitards (Appendix A).

Triassic (Rewan Group)

The Triassic sediments include an isolated pocket of Clematis Group approximately 7 km east of the Project area, and the more regionally extensive Rewan Group. The outcrop of Clematis Group is approximately 300 m thick and forms a localised topographic high at an elevation of around 450 mAHD (Appendix A).

Given its relative distance from the Project, this unit is not considered hydrogeologically relevant in terms of potential Project impacts.

Regionally, the Rewan Group unconformably overlies the Permian coal measures as in-fill material. The Rewan Group is largely absent where the Permian coal measures occur at outcrop and thickens towards the Isaac River. At the Project, the weathered Rewan Group unit occurs at the outcrop. Drill logs indicate the weathered Triassic strata has an average thickness of 25 m (Appendix A).

The closest bore to the Project screened within the Rewan Group is bore RN141383 (MB3), which is part of the Eagle Downs Mine groundwater monitoring network to the west of the Project. Also, a VWP (GW01d) that monitors the Rewan Group, which is part of the Olive Downs Project groundwater monitoring network, is approximately 5 km to the east of the Project (Appendix A).

In general, the occurrence of the Rewan Group can vary regionally, based on the structural setting and comprises low hydraulic conductivity lithologies, and is typically considered an aquitard (Appendix A).

Groundwater elevations within the Rewan Group in the Project area and surrounds are above those recorded within the deeper Permian coal measures, indicating a downward hydraulic gradient. However, due to the low hydraulic conductivity of the Rewan Group, the unit is considered an aquitard (i.e. restricts groundwater flow) (Appendix A).

Permian Coal Measures

The Permian coal measures underlie the Rewan Group and surficial cover, and outcrop along the ridgelines to the east and west of the Project area.

In increasing depth (age) order, the major Permian coal measures of the Blackwater Group in the area include the:

- Rangal Coal Measures;
- Fort Cooper Coal Measures; and
- Moranbah Coal Measures.

The shallowest Permian coal measures, the Rangal Coal Measures, has an average thickness of 60 m with a maximum thickness of 195 m at the Project. The depth of the Rangal Coal Measures ranges from 5 m to 310 m below ground level. The Rangal Coal Measures contain the target seams for the Project (i.e. Leichhardt Seam and Vermont Upper and Middle Lower Seams).

The Rangal Coal Measures comprise coal seams and non-coal portions including; light grey, cross-bedded, fine- to medium-grained, labile and well-cemented sandstones, grey siltstones, mudstones and shales.

The Yarrabee Tuff is a basin-wide marker bed comprising weak, brown tuffaceous claystone, and drill logs indicate the tuff has an average thickness of 0.7 m within the Project area (Appendix A).

The Fort Cooper Coal Measures conformably underlie the Rangal Coal Measures and occur at the subcrop, within the Project area. Both the Rangal Coal Measures and Fort Cooper Coal Measures (e.g. Vermont Middle Lower Seam) contain the target seams for the Project. The transition between the Rangal Coal Measures and the Fort Cooper Coal Measures is marked by the Yarrabee Tuff which immediately overlies the Vermont Lower Seam (Appendix A).

The Moranbah Coal Measures conformably underlie the Fort Cooper Coal Measures. These Permian coal measures occur at the subcrop, west of the Project where they are targeted as part of the Peak Downs Mine and Saraji Mine (Appendix A).

Groundwater occurrence within the Permian coal measures is largely restricted to the more permeable coal seams that exhibit secondary porosity through fractures and cleats (Appendix A).

The water levels in the Permian coal measures within the Project area generally follow the downstream flow gradient of the Isaac River, with south-easterly trending hydraulic gradients. Groundwater elevations range from around 188 mAHD in the north-west, down to 155 mAHD in the south-east (Appendix A).

Groundwater within the Permian coal measures is confined and sub-artesian. For the shallower Permian coal measures, groundwater elevations are generally at or below groundwater elevations within the overlying unconfined sediments, indicating a downward hydraulic gradient. However, with increased depth of cover and pressure, the hydraulic gradient reverses (Appendix A).

Recharge to the Permian coal measures occurs at the subcrop. Due to the low hydraulic conductivity of the interburden material, groundwater largely flows horizontally within the Permian coal measures, along the bedding plane of the coal seams. Groundwater discharge occurs via evaporation and abstraction from extraction activities (Appendix A).

Groundwater Users

A search of the Queensland Government's Groundwater Bore Database and the BoM National Groundwater Information System (NGIS) was carried out for registered bores within the extent of the groundwater model. The search indicated that there are 310 registered bores, of which 177 bores are used for groundwater monitoring and investigations, and 83 bores are used for water supply. The remainder of bores have an unknown use or resulted from exploration activities.

Two field bore censuses have previously been carried out within the extent of the groundwater model. The earlier survey, a field bore census of groundwater bores and wells within 20 km of the groundwater model was conducted from September to November 2017 as part of the groundwater assessment for the Olive Downs Project (HydroSimulations, 2018). A field bore census of groundwater bores and wells was also conducted for the Moorvale South Project (Golder Associates, 2019).

Across the two bore censuses, a total of 131 bore locations were assessed. Of the 131 bores:

- 47 bores were found to be existing and in use;
- 37 bores are existing but not in use;
- 8 bores were of unknown status (could not access); and
- 39 bores were abandoned and destroyed.

Of the existing and unknown bores with water use information available, 52 are used for stock water supply, 19 are used for groundwater monitoring and six are used for domestic water supply. For the existing and unknown bores with geological information available, 22 intersect alluvium, 10 are within regolith material and 30 intersect Permian coal measures (Rangal Coal Measures, Blackwater Group and Back Creek Group).

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are described separately in Section 4.6 and Appendix F.

Calibrated Numerical Groundwater Flow Model

Whitehaven WS has data sharing agreements with the owners of the Olive Downs Project and Moorvale South Project, which allows for the sharing of data, models and documentation.

The existing 3D numerical groundwater flow model that was developed for the Olive Downs Project and Moorvale South Project, was adopted for the Project and updated with site-specific data (Appendix A).

The groundwater model is centred over the Project and is elongated in the north-west to south-east direction to follow geological strike. The groundwater model is approximately 65 km by 70 km at its widest extents (Figure 4-6). The model domain was selected based on the following considerations:

- The western and eastern boundaries are represented by the outcrop of the Back Creek Group, which is considered the regional low permeability basement for the purpose of this modelling and is expected to be outside the range of predicted Project-related drawdown.
- The northern boundary contains the primary aquifers being mined by the Project and is at least 10 km away from the proposed open cut pits and is expected to be outside the range of predicted Project-related drawdown.
- The southern boundary is at least 35 km from the Project and is expected to be far outside the range of predicted Project-related drawdown.

Geological fault features are represented by mesh refinement in the model to allow for sensitivity analysis. Over the 14 model layers, the total active cell count for the model is 787,789 (Appendix A), with over 1,000,000 total cells (i.e. including pinch-out areas).

The model was calibrated and verified to existing groundwater levels, using reliable measurements from representative bores within the groundwater model domain. Both steady-state and transient calibration models have been developed:

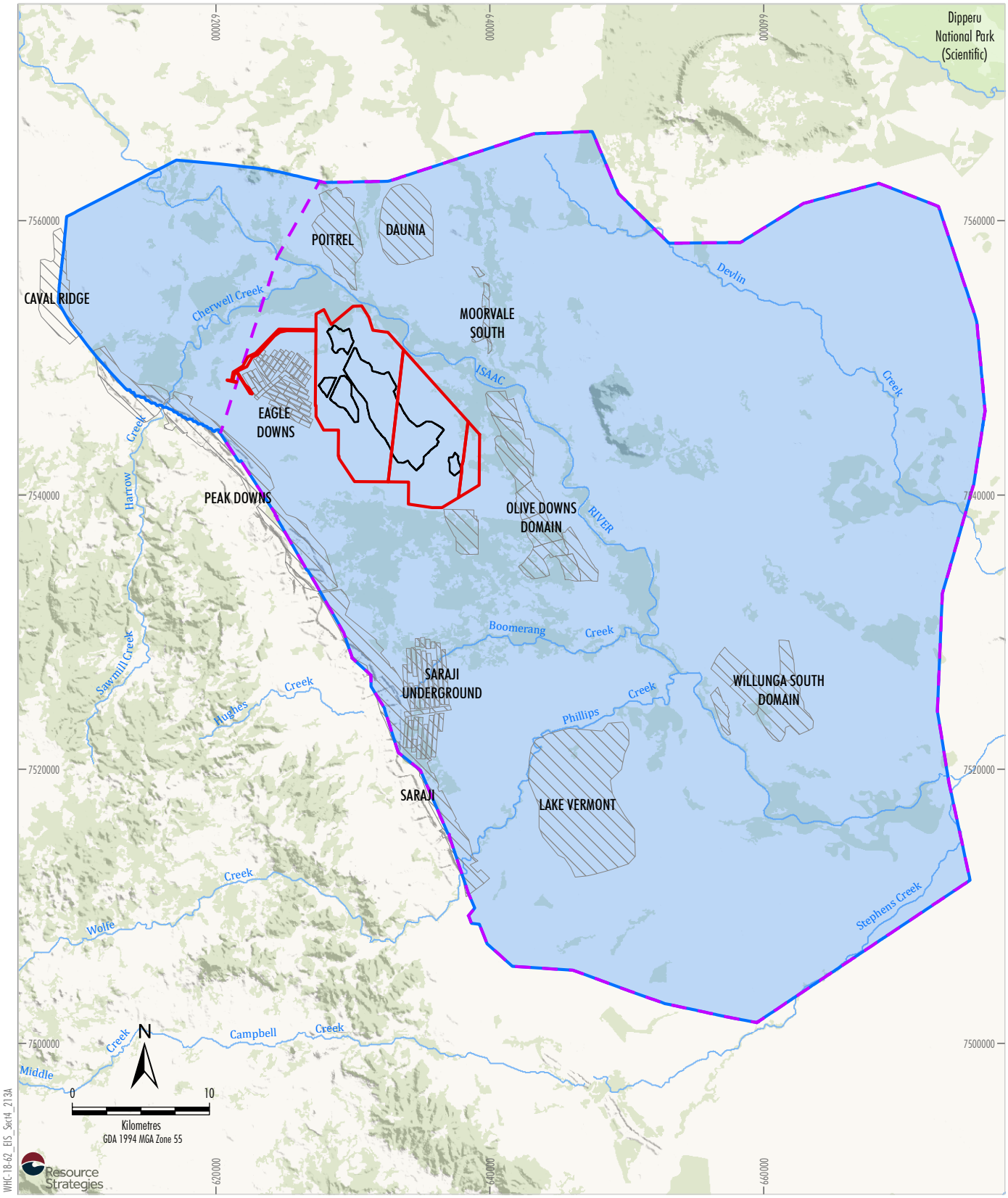
- Steady-state model of average pre-2006 conditions.
- Transient model calibration based on temporal pre-mining data at quarterly time intervals from January 2006 to December 2019.

The objective of the calibration was to replicate the observed groundwater levels in accordance with the modelling guidelines developed by Barnett *et al.*, (2012). The methodology to meet the objective included using available data and information obtained from the baseline datasets as part of the groundwater monitoring and investigation programs, as well as the sharing of baseline datasets with surrounding developments.

Utilising the available datasets, the steady-state and transient calibrations achieved 6.6% and 5.2% scaled root mean square (SRMS) errors, respectively. This indicates a suitable calibration and is within the standard indicator of less than 10% SRMS (Middlemis *et al.*, 2001; Barnett *et al.*, 2012) (Appendix A).

The groundwater modelling results also validated the extent of the groundwater model was appropriate to predict the potential impacts of the Project.

Sensitivity analysis was conducted to understand how changes to a range of the groundwater flow model assumptions and variables might influence the model predictions. This included assessment of the influence of selected physical properties (hydraulic conductivity, specific yield and recharge).



LEGEND
- Mining Lease Application Boundary
- Project Numerical Groundwater Model Extent
- Previous Numerical Groundwater Model Extent
- Surrounding Mining Operations
- Indicative Extent of Open Cut

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

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Numerical Groundwater Model Extent

Figure 4-6

A more complex Monte Carlo style uncertainty analysis was also undertaken where numerous model inputs were simultaneously changed, and presents the resulting probabilities for:

- predicted spatial drawdown extents (i.e. bores affected by more than 1 m drawdown or more);
- transient stream (enhanced) leakage; and
- alluvium water take (direct and indirect).

The results of the sensitivity analysis and uncertainty analysis are detailed in the Groundwater Assessment (Appendix A).

4.2.3 Potential Impacts

Surface Water Flow and Flooding Regimes

Flooding

There would be no significant impacts on flood levels and velocities in the Isaac River channel and floodplain during operations and post-mining (Appendix B).

The Project would only interact with the Isaac River for the rarer flood events (1% AEP and rarer design events), with the impacts identified on the Isaac River floodplain for these rare events generally localised and relatively minor in magnitude (Appendix B).

There would be no impacts on flood levels and velocities in Ripstone Creek, as the Project is located well outside of the Ripstone Creek floodplain.

Catchment Excision

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 are provided in Table 4-3.

The maximum catchment areas excised by the Project represent:

- up to approximately 1.5% of the Isaac River catchment (to the confluence with Ripstone Creek); and
- up to approximately 6% of the Ripstone Creek catchment (to the confluence with the Isaac River).

Table 4-3
Maximum Captured Catchment Area

Phase (Project Year)	Maximum Captured Catchment Area (km²)	
	Isaac River (to Confluence with Ripstone Creek)	Ripstone Creek (to Confluence with Isaac River)
Phase 1 (Years 1 to 5)	16	-
Phase 2 (Years 6 to 11)	32	1
Phase 3 (Years 12 to 18)	62	9
Phase 4 (Years 19 to 23)	68	9
Phase 5 (Years 24 to 29)	76	16

Source: Appendix B.

The loss of catchment flows in the Isaac River and Ripstone Creek during the Project would be indiscernible. Therefore, the potential impact on water quantity in the Isaac River and Ripstone Creek due to the excision of catchment during the Project is considered to be negligible (Appendix B).

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 14 km² 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 14 km² (compared to pre-mining conditions), a decrease of less than 0.3%.
- The catchment draining to Ripstone Creek would reduce by around 8 km² (compared to pre-mining conditions), a decrease of less than 3%.

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 (Appendix B).

Influence on Baseflow (Groundwater)

The Isaac River is ephemeral in nature, with flows following rainfall events that generate runoff.

The Isaac River is largely a losing system with seepage of surface water into the underlying alluvium (Appendix A). Changes to water levels induced by mining activities for the Project would increase the hydraulic gradient between the Isaac River and associated alluvium.

The numerical groundwater model conservatively predicted the rate of seepage from the Isaac River to the underlying alluvium would increase by less than 4 ML/year over the life of the Project (Appendix A).

When the Isaac River flows, an average of 161,863 ML/year of surface water is discharged downstream. Therefore, the increased seepage from the Isaac River to the alluvium due to the Project would be insignificant (Appendix A).

Regional Water Availability

A significant proportion of site water requirements would be sourced from water collected on-site, including rainfall runoff and groundwater inflows to the open cut pits. Collected water would be stored in the mine-affected water storages for recycling and reuse (Appendix B).

The results of the water balance modelling indicate there is greater than a 75% probability that an external water supply of 3,800 ML would be sufficient to meet all site water demands in any year of the Project (Appendix B).

Whitehaven WS would source water from either an external water supplier (e.g. Sunwater) via a water supply pipeline or via water sharing with surrounding mining operations. Therefore, there would be no material impacts to regional water availability due to the Project.

Cumulative Impacts

An assessment of the dilution ratio of controlled releases to the Isaac River flow has been undertaken, where the dilution ratio is the daily volume of the Isaac River flow divided by the daily volume of controlled releases to the Isaac River (Appendix B).

Given that the Project mine-affected water releases would be managed within an overarching strategic framework for management of cumulative impacts of mining activities, the proposed management approach for mine water from the Project is expected to have negligible cumulative impact on surface water quality and associated environmental values (Appendix B).

The Project would result in a loss of catchment to the Isaac River during operations and post-mining and the surface runoff volume lost from the catchment would generally be in proportion to the excision of the catchment area. The Project area is less than 1.5% of the catchment area of the Isaac River to the Isaac River/Ripstone Creek confluence, with approximately 70% proposed to be managed through the erosion and sediment control measures and then released to the downstream environment following treatment (Appendix B).

The cumulative impact assessment included additional mining operations within the Isaac River catchment that are adjacent, upstream and downstream of the Project. The catchment of the Isaac River to the Stephens Creek confluence is around 7,782 km^2. There are approximately 17 existing coal mines upstream of the Project that also capture runoff from the Isaac River catchment (Appendix B).

The total estimated captured area of all these developments (including the Project) combined represents around of 9.8% of the Isaac River catchment to the Isaac River/Stephens Creek confluence. If the same percentage of erosion and sediment control measures for the Project is applied to the other mines, then the estimated captured catchment areas reduce to around 30% of the total area (around 2.9% of the Isaac River catchment to the Isaac River/Stephens Creek confluence) (Appendix B).

In addition, these mines have licence to discharge which returns captured surface water, as well as groundwater collected in underground workings, to the Isaac River catchment and would reduce the impacts on water resources. When considering potential discharges from the operating mines in accordance with their current release rules, the overall loss of catchment area and associated stream flow is relatively small (Appendix B).

As described in Section 4.1.3, the regional cumulative impacts of the Project on geomorphic characteristics of streams would also be negligible (Appendix B).

Direct Groundwater Inflows/Interception

The total annual volumes of groundwater predicted to be intercepted as part of the Project are presented in Appendix A.

The total groundwater inflows are predicted to peak in Year 8, with approximately 1 ML/day (352 ML/year) of groundwater inflows to the open cut pits. The average groundwater inflows over the life of the Project are predicted to be approximately 0.5 ML/day (183 ML/year) (Appendix A).

The Project would not directly intercept groundwater from the Quaternary alluvium under the Water Plan, and therefore no direct take from Groundwater Unit 1 would occur from the mining operations (Appendix A).

All direct groundwater take predicted by the model (i.e. up to 352 ML/year) would be from Groundwater Unit 2 under the Water Plan (Appendix A).

Post-mining, the residual voids would accumulate water over time due to rainfall runoff and groundwater inflows. There would also be evaporation from the lakes that would form within the residual voids. The model predicted that there would be negligible direct or indirect take from Groundwater Unit 1, and 104 ML/year of direct take from Groundwater Unit 2 under the Water Plan in the long-term, post-mining.

Groundwater Drawdown

The numerical groundwater modelling results indicate there would be negligible drawdown within the Isaac River alluvium due to the Project (Appendix A).

Impacts on Groundwater Users

The numerical groundwater modelling predicted no privately-owned bores in the vicinity of the Project would experience more than 1 m drawdown (Appendix A).

Cumulative Groundwater Depressurisation and Drawdown

Cumulative impacts associated with approved and foreseeable open cut and underground coal mines surrounding the Project were modelled (Appendix A), including:

- Olive Downs Project;
- Moorvale South Project;
- Eagle Downs Mine;
- Daunia Mine;
- Poitrel Mine;
- Peak Downs Mine;
- Saraji Mine;
- Caval Ridge Mine; and
- Lake Vermont Mine.

The numerical groundwater model indicated that the contribution of the Project to the cumulative drawdowns in the Quaternary alluvium would be negligible (Appendix A).

The numerical groundwater model indicated that the zone of drawdown in the regolith from the Project would only interact with the zone of drawdown from the Eagle Downs Mine and Pit 9 at the Olive Downs Project located immediately west and south-east of the Project, respectively (Appendix A).

The numerical groundwater model indicated that the zone of drawdown in the Leichhardt and Vermont Seams from the Project would only interact with the zone of drawdown from Pit 9 at the Olive Downs Project located immediately south-east of the Project (Appendix A).

Based on the modelling results, cumulative groundwater drawdown extents from the Bowen Gas Project are predicted to be greater than depressurisation and drawdown produced by the Project alone (Appendix A).

Residual Voids

Following the cessation of mining at the Project, there would be four residual voids (Section 6.2.3). Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff and groundwater (Appendix B).

A GOLDSIM model (separate to the OPSIM model used for the operational modelling) was used to assess the likely long-term water level behaviour of the residual voids (Appendix B).

The residual void locations are described in detail and shown in Section 6.2.3. In summary, the residual void modelling results show the following (Appendix B):

- North-west Void:
  - The water level reaches equilibrium between 152 mAHD and 162 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 47 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 215,500 µS/cm.
- West Void:
  - The water level reaches equilibrium between 115 mAHD and 128 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 74 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 163,700 µS/cm.
- Main Void:
  - The water level reaches equilibrium between 150 mAHD and 161 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 48 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 147,500 µS/cm.
- South Void:
  - The water level reaches equilibrium between 127 mAHD and 142 mAHD after around 150 years and generally remains at these levels throughout the remainder of the simulation.
  - The maximum modelled water level is around 55 m below the level at which overflows would reach the receiving environment.
  - The modelled salinity reaches a peak concentration of 183,600 µS/cm.

The peak salinity for the residual voids reported were those observed during the modelling simulation period. As with all closed-system residual voids, the salinities would continue to increase over time until saturation limits are met.

The post-mining flood modelling identified that based on the final landform design, flood waters would not enter any of the residual voids in events up to and including the probable maximum flood (PMF) event (Appendix B).

Additional analysis on the residual void behaviour was undertaken to assess extreme storm events with rainfall depths equivalent to the 1 in 100 AEP, 1 in 1,000 AEP and probable maximum precipitation (PMP) design events (Appendix B).

The analysis indicated that there would be minimal impact on the water level in the residual voids from such an event, with simulated water level increases in the order of 6 m to 12 m (well below the residual void overflow level).

The residual void modelling indicates that the expected water levels are below the total storage volume levels (e.g. level at which overflows would reach the receiving environment) for each residual void (Appendix B), and the residual voids would remain as long-term groundwater sinks (Appendix A).

4.2.4 Mitigation Measures, Management and Monitoring

Water Flow Management Measures

Up-Catchment Diversions

Details of up-catchment diversion structures to be developed for the Project are discussed in Section 2.7 and the locations are shown on Figures 2-2 to 2-6.

Sediment Dams

Sediment dams would contain runoff from waste rock emplacements, as well as areas of initial and established rehabilitation. The sediment dams would allow for gravity settling of sediment prior to release of water off-site.

Sediment dams would be designed based on the *Best Practice Erosion and Sediment Control Guideline* (IECA, 2018) as described in Appendix B.

Sediment dams would be maintained until such time as vegetation within the catchment of the sediment dams successfully establishes, and where runoff has similar water quality characteristics to areas that are undisturbed by mining activities. Sediment dams may be maintained in rehabilitated areas when site water demand requires it.

Controlled Releases

Conditions have been developed for potential controlled water releases to the Isaac River, based on the *Guideline - Model mining conditions* (DES, 2017a) and *Model water conditions for coal mines in the Fitzroy basin* (DES, 2013).

The proposed water release conditions are provided in Table 4-4, based on flow and EC monitoring at the Deverill gauging station on the Isaac River, and the proposed Project controlled release points (RP1, RP2 and RP3).

The proposed controlled releases strategy comprises MWD, CC Dam and Railway Pit water storages, which would have the ability to discharge water to the Isaac River through a gravity pipe or pumping system. There would be three controlled release points for the Project.

The release point dams are proposed to be turkey's nest type dams around 5 m deep (not including the Railway Pit water storage). A gravity discharge solution is preferred as it allows for an efficient discharge mechanism and can provide significant discharge capacity during the relatively short discharge opportunities for the Isaac River flow regime (with the exception of the Railway Pit that would use a pumping system). Potential pump solutions to supplement the gravity release system would be considered during the detailed design process.

Water Supply and Licensing (Surface Water)

Whitehaven WS would seek to obtain adequate external water requirements through water sharing with surrounding mining operations or sourcing from an external water supplier (e.g. Sunwater).

Associated Water Take and Underground Water Impact Report

Underground water rights would be exercised for the life of the Project. As described in Section 4.2.3, the aquifers potentially affected by the Project are partitioned according to the two units of the Isaac Connors GMA, as delineated in the Water Plan, and are:

- Isaac Connors Groundwater Unit 1 (containing aquifers of the Quaternary alluvium); and
- Isaac Connors Groundwater Unit 2 (sub-artesian aquifers).

Appendix A provides a summary of the predicted groundwater inflows (i.e. the associated water take). The predicted indirect take from the Isaac Connors Groundwater Unit 1 (alluvium) during the Project is considered negligible (i.e. less than 0.01 ML/year). Over the life of the Project, the associated water take from the Isaac Connors Groundwater Unit 2 (sub-artesian aquifers) would vary, with an allocation of up to 352 ML/year required (Appendix A).

Post-mining, there would be evaporation from the lakes that would form within the residual voids. The model predicted that there would be negligible direct or indirect take from Groundwater Unit 1 (alluvium), and 104 ML/year of direct take from Groundwater Unit 2 (sub-artesian aquifers) under the Water Plan in the long-term, post-mining.

Table 4-4
Proposed Controlled Release Conditions

Flow Rate	Receiving Water Flow Criteria (Isaac River*)	Maximum Release Rate (Controlled Release Points Combined Flows)	Electrical Conductivity Limit (At Release Point)
Medium	4 m^3/s	0.5 m^3/s	1,000 µS/cm
	10 m^3/s	1.0 m^3/s	1,200 µS/cm
High	50 m^3/s	2.0 m^3/s	4,000 µS/cm
	100 m^3/s	3.0 m^3/s	6,000 µS/cm
Very High	300 m^3/s	5.0 m^3/s	10,000 µS/cm

Source: Appendix B.

* Deverill Gauging Station.

Whitehaven WS would prepare an Underground Water Impact Report (UWIR) in accordance with Chapter 3 of the Water Act. The UWIR would be based on the information contained in the Groundwater Assessment (Appendix A), and would describe, make predictions about and manage the impacts of underground water extraction by the Project.

Adaptive Management

The results of the Surface Water and Flooding Assessment (Appendix B) represent the application of the adopted mine water management system rules over the life of the Project.

Over the life of the Project, there would be numerous options for adaptive management of the mine water management system to accommodate climatic conditions. For example, temporary adjustments to pumping arrangements could be made to accommodate very wet or dry periods.

These alternative management approaches would be used to reduce the risks to the Project associated with climatic variability.

Surface Water Monitoring Program

As described in Section 4.1.4, Whitehaven WS would implement a surface water monitoring program for the Project, and would include monitoring of surface water resources.

Section 10.7 of Appendix B (refer to Figure 10.3) provides the proposed surface water monitoring locations for the Project.

Groundwater Level and Pressure Monitoring

Monitoring of groundwater levels from existing monitoring bores and VWPs would continue and would enable natural groundwater level fluctuations (such as responses to rainfall) to be distinguished from potential groundwater level impacts due to depressurisation resulting from proposed mining activities. Several bores within the extent of proposed mining operations would continue to be monitored until they are no longer available due to mine progression.

Section 8.2 of Appendix A (refer to Figure 8-1) provides the groundwater monitoring locations for the Project.

Groundwater Level Triggers and Data Review

A groundwater monitoring program would be established and would continue throughout the life of the Project. Recording of groundwater levels from existing monitoring bores and VWPs would continue and would allow natural groundwater level fluctuations (such as responses to rainfall) to be distinguished from potential groundwater level impacts of the Project.

An annual review of groundwater level trends would be conducted by a suitably qualified person. The review would assess the change in groundwater levels over the year, compared to historical trends and impact assessment predictions. The annual review would discuss any groundwater trigger exceedances or where data trends show potential for environmental harm.

Water Resource Auditing, Reporting, Corrective and Preventative Actions

Whitehaven WS would generally undertake the following process for any exceedance identified to water resources:

1. Confirm the timing of the exceedance(s) and general location of the exceedance(s).
2. Report exceedances to the appropriate regulatory authorities within regulatory timeframes.
3. Confirm the climatic conditions at the time of the exceedance(s) (where relevant).
4. Identify any potential contributing factors, including consideration of current mine activities.
5. Assess the monitoring results for any anomalies or causes and develop appropriate mitigation and management strategies with assistance from appropriate specialists.
6. Implement the mitigation and management strategies, based on the results of the above investigations.
7. Review of follow up results and report the outcomes of the review to the appropriate regulatory authorities.

Groundwater Model Validation

Every five years, the validity of the groundwater model predictions would be assessed and, if the data indicates significant divergence from the model predictions, the groundwater model would be updated for simulation of mining.

Water Management Plan

A Water Management Plan would be prepared cognisant of the DES guideline for the *Preparation of water management plans for mining activities* (DERM, 2010) and would include, but not necessarily be limited to:

- a description of the water management system for the Project;
- corrective actions and contingency procedures for emergencies; and
- a program for monitoring and review of the effectiveness of the Water Management Plan.

Further detail on the Water Management Plan is presented in Section 4.1.4.

Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan would be developed and implemented throughout construction and operations for the Project (Section 4.1.4).

The Erosion and Sediment Control Plan would be reviewed and revised by an appropriately qualified person and implemented throughout the Project life to minimise erosion and the release of sediment to receiving waters, and management of stormwater.

Receiving Environment Monitoring Plan

A REMP would be developed for the Project in accordance with the *Guideline - Model mining conditions* (DES, 2017a). The REMP would be implemented to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. Further detail on the REMP is provided in Section 4.1.4.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for water resources. This is described further in Section 7.

Proposed surface water and groundwater monitoring locations are shown on Figure 8-1 of Appendix A and Figure 10.3 of Appendix B.

4.3 FLOODING AND REGULATED STRUCTURES

4.3.1 Methodology, Environmental Objectives and Performance Outcomes

Potential flooding impacts related to the Project have been considered in the Surface Water and Flooding Assessment prepared by WRM (2021) (Appendix B) and was peer reviewed by Tony Marszalek (Attachment 3).

The modelling results from the Surface Water and Flooding Assessment have also been used in the Geomorphology Assessment prepared by Fluvial Systems (2020) (Appendix B).

The relevant environmental objectives as stated in the Terms of Reference for flooding and regulated structures are:

> *The construction and operation of the project should aim to ensure the risk of, and the adverse impacts from flooding hazards or dam failure are avoided, minimised or mitigated to protect people, property and the environment.*
>
> *The performance outcomes corresponding to the objectives are outlined in DES EIS Guideline – Structures which are dams of levees constructed as part of the environmentally relevant activities.*

A description of existing environmental values associated with flooding, including past flood studies and existing/approved structures relevant to flooding is provided in Section 4.3.2. Section 4.3.3 describes the potential flooding impacts related to the Project including cumulative impacts and Section 4.3.4 outlines the proposed mitigation measures, management and monitoring.

Regulated structures (including dams and levees) are described in detail in Section 4.3.5.

The Surface Water and Flooding Assessment (Appendix B) provides details of the mine-affected water dams and a description is provided in Section 4.3.

4.3.2 Description of Environmental Values

The Project is located within the headwaters of the Isaac River catchment of the greater Fitzroy Basin (Appendix B). The environmental values for water quality and water resources are described in Sections 4.1.2 and 4.2.2.

Past Flood Studies and Existing and Approved Structures

Various flooding and surface water related reports in the Isaac River catchment were reviewed and considered in the Surface Water and Flooding Assessment for the Project.

Whitehaven WS has also considered information and data obtained from the surrounding developments which they have established data sharing agreements with (i.e. Moorvale South Project, Olive Downs Project and Eagle Downs Mine).

The Surface Water and Flooding Assessment (Appendix B) presents the current flood risk for a range of annual exceedance probabilities (i.e. 5%, 1% and 0.1%) up to the PMF for potentially affected waterways for the Isaac River (and associated tributaries in the vicinity of the Project) and Ripstone Creek.

The flood hydrology model includes the main branch and tributaries of the Isaac River covering an approximate area of 4,000 km^2, with 104 sub-catchments ranging in size from 0.6 km^2 to 204 km^2 (Appendix B).

The hydrology model has been calibrated against data at the Deverill and Goonyella gauging stations for three historical flood events (i.e. February 2008, December 2010 and March 2017). The calibration results for the developed flood hydrology model were considered to be satisfactory (Appendix B).

Based on the review of past flood studies for surrounding developments, four existing or approved levees were identified in the region (i.e. Poitrel Mine, Daunia Mine, Moorvale South Project and Olive Downs Project) with the Lake Vermont levees located outside the extent of the hydraulic model (Appendix B).

The calibrated Isaac River hydraulic model was used to estimate design peak flood levels, depths, extents and velocities along the Isaac River and its tributaries for various events from a 5% AEP design event to the PMF.

The hydraulic model for Ripstone Creek was used to estimate design peak flood levels, depths, extents and velocities along Ripstone Creek and its tributaries for the 0.1% AEP design event. For the 0.1% AEP, ten temporal patterns were adopted from Jordan *et al*. (2005).

All dams and levees proposed or existing within the Project area have been listed and described in the Surface Water and Flooding Assessment (Appendix B).

4.3.3 Potential Impacts

The Surface Water and Flooding Assessment (Appendix B) describes the current flood risk for a range of annual exceedance probabilities up to the PMF for potentially affected waterways, and assesses (through flood modelling) how the Project may potentially change flooding characteristics and be affected by floods.

Design flood hydrographs for events with AEPs of 5%, 1% and 0.1%, as well as the PMF, were developed based on design rainfalls and the calibrated hydrology model (Appendix B). In accordance with the requirements of the Terms of Reference, the PMP was used to estimate the peak flow for the PMF in the Isaac River (Appendix B).

Three cases were modelled by WRM (2021) (Appendix B):

- the base case (pre-mining with existing and approved infrastructure);
- the developed case (during operations with all infrastructure); and
- the post-mining case (permanent stable landforms with temporary levees removed).

The impact of the Project on flood levels, flow velocity and stream geomorphology for each of the above cases has been evaluated (Appendix B) and is summarised below.

Temporary Flood Levees

The temporary flood levees for the Project would interact with the Isaac River floodplain during operation, preventing the inundation of the open cut pits. The results of the modelling indicate that the temporary flood levees would not interact with peak water levels up to and including the 5% AEP design event, and interaction with the Project would only occur for 1% AEP design events and higher (Appendix B).

During operations, the changes in flood levels due to the temporary flood levees for the 1% AEP and 0.1% AEP design events are generally localised within the Project area and off-site changes to flood levels would be negligible (Appendix B).

The Project would not result in any significant impacts on flow velocities in the Isaac River channel and floodplain (Appendix B).

As there would be no changes to Isaac River flood levels or velocities at any key infrastructure (e.g. residences, roads or rail), the Project would not result in any flooding impacts to key infrastructure (Appendix B).

There are no impacts on flood levels and velocities in Ripstone Creek, as the Project is located well outside of the Ripstone Creek floodplain (Appendix B).

Final Landform

The potential impacts as a result of the post-mining conditions landform configuration are generally minimal and would not greatly affect the natural channel morphology of the Isaac River for events up to the 1% AEP. The Isaac River has minimal interaction with the final landform for the 1% AEP event (Appendix B).

During extreme events, such as the 0.1% AEP, impacts on the floodplain as a result of the landform configuration are minor and generally confined to within the Project area (Appendix B).

Peak velocities and water levels along the Isaac River and associated floodplain for the 0.1% AEP event, in the vicinity of the Project, are similar to existing conditions with some minor localised changes. These impacts dissipate well before reaching the surrounding operations and are not expected to cumulatively impact on the flooding regime in Isaac River (Appendix B).

The peak velocity along the interface between the flood extent and the final landform for the 0.1% AEP event is generally less than 0.3 m/s (Appendix B). Therefore, erosion potential of the 0.1% AEP event on the final landform is negligible.

The flood modelling results indicate that the residual voids would be outside the PMF design event, and therefore would not be inundated post-mining (Appendix B).

Stream Geomorphology

The Geomorphology Assessment (Appendix B) prepared by Fluvial Systems (2020) assessed the potential impacts of the Project on the geomorphic characteristics of the Isaac River and Ripstone Creek, and concluded that potential impacts of the Project would be negligible.

Cumulative Impacts

The Surface Water and Flooding Assessment (Appendix B) considered any existing and approved structures that may affect flood behaviour, as well as structures proposed as part of the Project.

Cumulative impacts on flooding are not expected to lead to any adverse impacts on human populations, property or other environmental or social values (Appendix B).

4.3.4 Mitigation Measures, Management and Monitoring

Provided the Project is developed in accordance with the features and control strategies described below, the flooding impacts of the Project on people, property and the environment are considered to be avoided, minimised or mitigated.

Flood Management Infrastructure Design

The temporary flood levees that would be constructed for the Project were based on the 0.1% AEP design event flood protection for open cut pits in accordance with the *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a).

Temporary Flood Levees

Detailed design plans of the proposed temporary flood levees together with a consequence assessment and certification by a suitably qualified and experienced person(s) would be prepared prior to construction for assessment and approval by the administering authority in accordance with proposed environmental authority conditions.

During the detailed design phase, the model results would be used to identify potential locations of high flow velocity and scour potential. This information would be used to inform the appropriate level of scour protection along the proposed temporary levees.

Final Landform

Whilst the peak flood velocities are not considered excessive, appropriate scour protection measures would be considered as part of the final landform detailed design process (Appendix B).

4.3.5 Regulated Structures

The *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) defines the methodology and assessment criteria to determine if a structure associated with an ERA should be regulated under the EP Act.

The *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) details the hydraulic design requirements for regulated structures and has been used as a reference in the preliminary design of the water management system and preliminary sizing of dams associated with the Project (Appendix B).

All proposed mine-affected water dams which overflow internally (i.e. do not discharge to the receiving environment) have been assigned a preliminary category of low consequence due to the low risk of significant consequence in the event of a failure to contain or dam break (Appendix B).

There are only two mine-affected water dams, that would be regulated structures, that can discharge to the receiving environment:

- MWD; and
- CC Dam.

These dams have been assessed against Table 1 of the *Manual for assessing consequence categories and hydraulic performance of structures* (DES, 2016a) and have been assigned a low consequence category for the failure to contain criteria based on the predicted water quality results from the water balance model (Appendix B).

Mitigation Measures and Management

Notwithstanding the 'low' consequence categories, Whitehaven WS would implement a number of mitigation and management measures including:

- operational measures that would allow for the practical limitations of being able to redistribute stored volumes across the containment system (including operability of equipment under extreme weather conditions);
- annual inspections to assess the condition and adequacy of all components of the regulated structures; and
- establishing and maintaining a register of regulated structures.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for regulated structures. This is described further in Section 7.

4.4 SOCIAL VALUES

4.4.1 Methodology and Environmental Objectives

A SIA was undertaken for the Project by SMEC (2021), and is presented in Appendix C.

The SSRC Act sets out consistent mandatory requirements for SIA under the SDPWO Act and EP Act.

The object of the SSRC Act is to ensure that residents of communities in the vicinity of large resource projects benefit from the construction and operation of those projects. This is supported by three key elements, namely:

- prohibition of 100% FIFO workforce arrangements on operational large resource projects;
- prevention of discrimination against locals in the future recruitment of workers; and
- the requirement for SIA.

The SSRC Act applies to 'large resource projects' that have a 'nearby regional community'. A 'large resource project' is either:

- a resource project for which an EIS is required; or
- a resource project that holds a site-specific environmental authority under the EP Act, and has a workforce of 100 or more workers; or
- a smaller workforce, as decided by the Coordinator-General.

A 'nearby regional community' is a town any part of which is within a 125 km radius of the main access to a large resource project and has a population of more than 200 people. The Office of the Coordinator-General has discretion to also apply a greater or lesser radius and/or a smaller population.

The SSRC Act requires preparation of a SIA for large resource projects. The SIA prepared as part of this EIS has been prepared in accordance with the SSRC Act, and in consideration of the DSDMIP's *Social Impact Assessment Guideline* (2018).

Potential impacts of the Project on the social values of the local and regional communities were identified through direct engagement with potentially affected stakeholders and analysis of the existing social environment.

As described at the start of Section 4, Whitehaven WS is investigating automation of the fleet for the Project. The SIA considered both the automated and non-automated cases, and therefore is considered to provide for a conservative and robust assessment should the level of automation change at some point during the Project.

A description of the existing social values is provided in Section 4.4.2 and the potential impacts of the Project on social values are described in Section 4.4.3.
Section 4.4.4 presents consideration of appropriate management measures, mitigation and monitoring, while the Social Impact Management Plan is summarised in Section 4.4.5.

The environmental objectives relevant to social values, as described in the Terms of Reference for the Project, are:

> *The construction and operation of the project should aim to:*
>
> *(a) avoid or mitigate adverse social impacts arising from the project*
>
> *(b) enhance benefits for local and regional communities.*

4.4.2 Description of Environmental Values

Social Impact Assessment Study Area

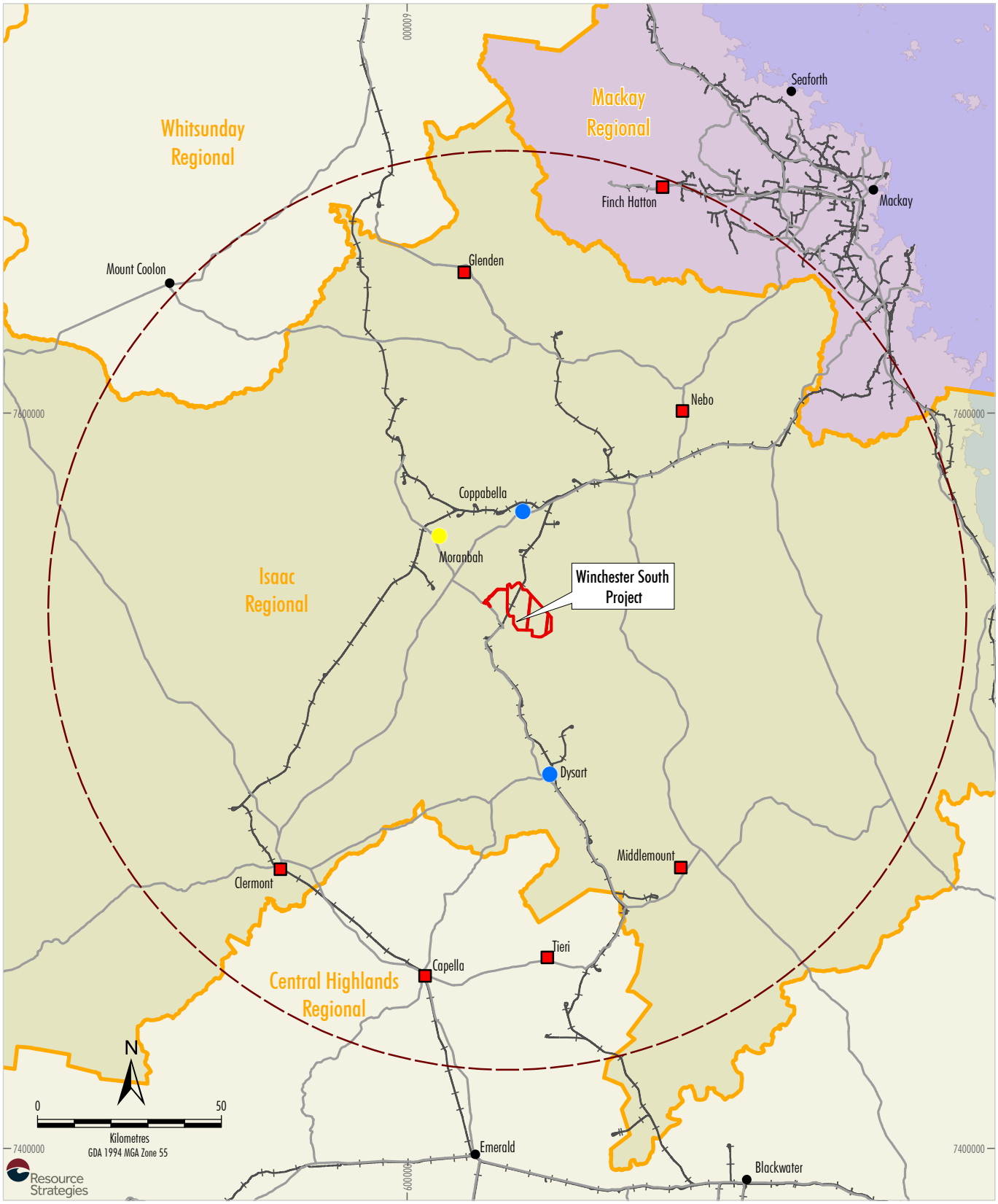
The SIA considered two study areas, with reference to the SSRC Act requirements. This included a regional study area and a local study area.

The regional study area included regional communities within a 125 km radius of the Project (Figure 4-7).

The SIA study areas were defined following consideration of various factors. As well as Project specific factors, such as the location of the Project (refer above discussion on the 125 km radius) and feedback from the Isaac Regional Council and the Office of the Coordinator-General, key consideration was given to the requirements of the Terms of Reference, the SSRC Act and DSDMIP's *Social Impact Assessment Guideline* (2018).

This resulted in two local study areas and a third regional study area being established (Appendix C).

The Primary Study Area (local) includes the populated area in closest proximity to the Project, i.e. the township of Moranbah (Figure 4-7).



WHC-18-62_EIS_Sect4_226B

LEGEND

- Mining Lease Application Boundary
- 125 km Buffer from Project Entrance
- Other Urban Centres and Localities within 125 km Buffer
- Other Urban Centres and Localities outside 125 km Buffer
- Major Road
- Railway

Local SIA Study Area

- Primary
- Secondary

Regional SIA Study Area

- Isaac Local Government Area
- Mackay Local Government Area

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

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Social Impact Assessment
Study Area and Affected Communities

Figure 4-7

The Secondary Study Area (local) includes those communities located within a safe commuting distance from the Project's main access point, which are Dysart and Coppabella (Figure 4-7). Dysart meets the criteria for a 'nearby community' as defined by the SSRC Act. While Coppabella does not meet the definition of a 'nearby regional community' (it is not an urban centre or locality as defined by the Australian Bureau of Statistics [ABS]), it is included in the Secondary Study Area (local) as workers could reside in Coppabella and safely commute to the Project on a daily basis (Appendix C).

The Regional Study Area adopted for the SIA is the Isaac LGA and Mackay LGA (Figure 4-7). The Isaac LGA stretches from the central Queensland coast to the Bowen Basin coalfields. The Isaac LGA includes the townships of Moranbah, Dysart, Middlemount, Coppabella, Nebo, Clermont and Glenden, all identified as 'nearby regional communities' for the Project.

Mackay is approximately 180 km from the Project by road and is the principal service centre for the broader region. It is anticipated that the Isaac and Mackay LGAs would be integral to the Project as a source of employees, construction services, labour and equipment, supply of goods and services, supply of social infrastructure and services for Project employees and families (Appendix C).

The Mackay Isaac Whitsunday region (comprised of the Mackay, Isaac and Whitsunday LGAs, Figure 4-8) were considered with respect to the labour force and business supply chains. This included consideration of labour availability in the Central Queensland region (Appendix C).

Stakeholder Engagement and Community Consultation Program

Consultation for the Project has included targeted engagement undertaken for the SIA, as well as a broader consultation program for the EIS (Section 1.6). Both of which informed the SIA (Appendix C).

Stakeholders consulted as part of the SIA included:

- Isaac Regional Council and Mackay Regional Council;
- State agencies, including the Office of the Coordinator-General, Coordinated Project Delivery Division, DATSIP (now DSDSATSIP), DSDMIP and DESBT;
- local and regional employment and training providers;
- public and private housing providers;
- local and regional commerce and community development groups including Barada Barna Aboriginal Corporation (Plate 4-1) and a variety of local business owners;
- social and public service providers;
- emergency services; and
- health services.


WHITEHAVEN COAL

COMMUNITY NEWSLETTER

NOVEMBER 2019

Barada Barna People get a taste of partnership possibilities

Representatives of the Barada Barna People of Central Queensland recently had the opportunity to gather ideas for future engagement with Whitehaven during a visit to Gunnedah and Narrabri.

The Barada Barna People are the Traditional Owners of the land in Queensland where our Winchester South Project is located, and recently learned about our engagement with the Gomeroi People.

The group visited the Winanga-Li Aboriginal Child and Family Centre in Gunnedah, which has been able to expand its operations with our support, and also met with other groups including the Kamilaroi Dance and Choir Group, the Clontarf Foundation, the Gomeroi Narrabri People Charitable Trust Fund, and Indigenous-run suppliers like Crockett Moodie and Murri United Fencing Contractors - all of whom shared their experiences and illustrated how our communities have grown and become stronger over the past decade.

Working together through drought

Like all Australians, our thoughts are with those who are doing it tough as a result of the historic drought. We have and will continue to contribute to community-based organisations to support those facing hardship and also to maintain economic activity in North West NSW.

As always, we are working with community members, CCCs, neighbours, local businesses, all levels of government and regulators to cooperatively tackle the challenges posed by the drought.

Community members can direct any questions regarding water management to our Community Relations Manager Darren Swain on (02) 6741 9302.

You can also find out more about how we manage water at whitehavencoal.com.au/water-management

Narrabri mine update

The mine has continued to produce coal from the longwall 108 with more than 600,000 tonnes being mined in September.

The mine is planning for a longwall relocation to longwall 109 in the coming months, which will reduce the amount of coal being produced for up to six weeks while major equipment is relocated underground.

The workforce numbers at the mine have been maintained over the past few months with 249 Whitehaven employees and 211 mostly specialised short-term contractors working on site. Since July the mine has transferred 12 local trainees from a training contractor to direct employment with Whitehaven.

Narrabri extension project

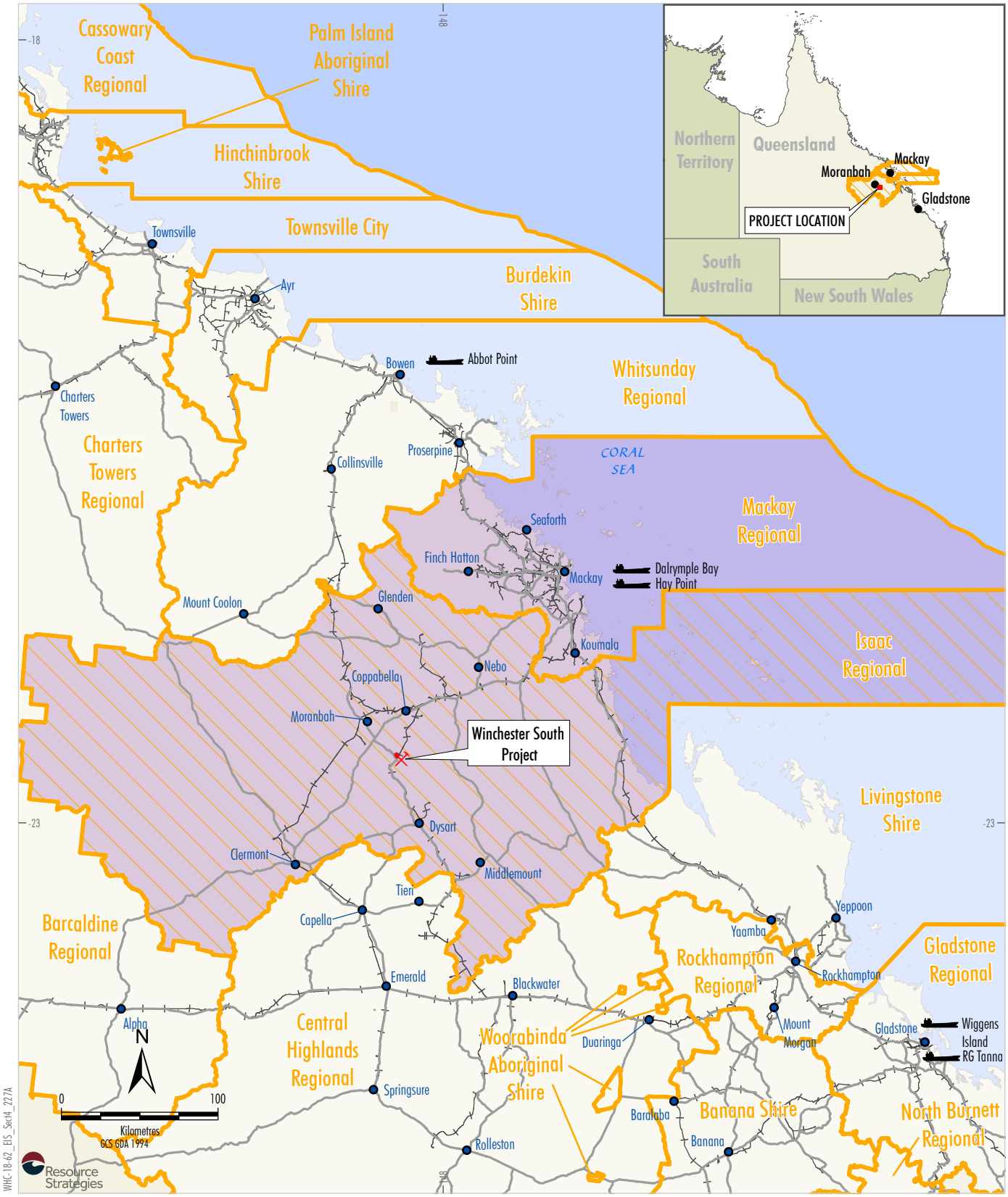
The Narrabri extension project is a proposal to increase the life of the existing underground mine from 2031 to 2045, providing continued employment for hundreds of people.

The NSW Department of Planning, Industry and Environment has issued the project with its environmental assessment requirements; we are now commissioning a range of independent studies to prepare the Environmental Impact Statement, which we expect to lodge in 2020. Find out more at: whitehavencoal.com.au/narrabri-mine

Plate 4-1 – November 2019 Community Newsletter Cover

The SIA has also been informed by extensive and ongoing engagement with directly affected landholders.

The primary means of SIA engagement was via semi-structured interviews and meetings with key stakeholders. This has been shown to be the most effective means of capturing genuine insights into what is currently occurring in the community, how the Project might interact with social values and processes, and how this can best be managed (Appendix C).



LEGEND
- Local Government Area Boundary
- Road
- Railway
- Town/Locality
- Region
- Local
- Coal Terminal

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

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Mackay, Isaac and Whitsunday Local Government Areas

Figure 4-8

Most stakeholders considered that the Project would make a positive contribution to the local economy by generating local employment and providing opportunities for local business and industry. Whilst there are multiple projects currently being advanced in the Bowen Basin, stakeholders were particularly supportive that Whitehaven (as an experienced Australian operator) should establish in the Bowen Basin (Appendix C).

A summary of the topics and considerations discussed with stakeholders is presented in Table 4-5. Other stakeholders engaged with as part of the EIS consultation program are listed in Section 1.6 and Attachment 4.

The Public Consultation Report provided in Attachment 4 of this EIS includes a comprehensive description of all consultation conducted for the Project (in addition to the consultation conducted for the SIA). The Public Consultation Report lists the stakeholders consulted, the intent and key outcomes of the meeting and the date of consultation. A summary of the consultation process conducted by Whitehaven WS prior to the EIS lodgement is provided in Section 1.6.

The stakeholder engagement process undertaken as part of the SIA is described in detail in Appendix C.

Table 4-5
Summary of Social Impact Assessment Stakeholder Consideration

Stakeholder	SIA Consultation Topics and Considerations
Office of the Coordinator-General	▪ Scope of SIA and stakeholder engagement process. ▪ Regulatory process. ▪ Queensland Government agency engagement. ▪ SIA guidelines. ▪ Impact assessment findings and significance evaluation. ▪ Management plans.
DTMR (Department of Transport and Main Roads)	▪ Potential changes to road infrastructure. ▪ Traffic management planning. ▪ Landholder access (e.g. quarry and agricultural land).
DHPW (Department of Housing and Public Works) (now DCHDE)	▪ Housing affordability. ▪ Any demand locally for social housing. ▪ Potential for cumulative impacts to cause rapid change to housing availability and affordability.
DCDSS (Department of Communities, Disability Services and Seniors) and DATSIP (Department of Aboriginal and Torres Strait Islander Partnerships) (now DSDSATSIP)	▪ Social and health infrastructure capacity to provide services. ▪ Recruiting and retention. ▪ Employment of First People. ▪ Use of Indigenous businesses in supply chain. ▪ Health of First People.
DESBT (Department of Employment, Small Business and Training)	▪ No longer a TAFE campus or CQ University campus in Moranbah. ▪ Retention and training of young people.
Queensland Treasury	▪ Job creation. ▪ Royalties.
DSDTI (Department of State Development, Tourism and Innovation) (now part of DSDILGP and DTIS)	▪ Regional Economic Development team – can facilitate relationships with local businesses. ▪ Economic Development Queensland may have an interest.

Table 4-5 (Continued)
Summary of Social Impact Assessment Stakeholder Consideration

Stakeholder	SIA Consultation Topics and Considerations
Social service providers (State agencies), including: ▪ Education Queensland. ▪ Moranbah State High School. ▪ Queensland Health. ▪ Queensland Police Service. ▪ Queensland Ambulance Service. ▪ Queensland Fire and Emergency Service.	▪ Workforce profile and labour availability. ▪ Skill gaps and training opportunities. ▪ Business opportunities. ▪ Indigenous training, employment and business opportunities. ▪ Social and health infrastructure capacity. ▪ Emergency service capacity and demand. ▪ Vulnerable population groups. ▪ Social housing. ▪ Cumulative impacts.
Isaac Regional Council	▪ Scope of assessment. ▪ Workforce recruitment, management and accommodation. ▪ Community values, trends and issues. ▪ Changes to the housing market. ▪ Impacts on community facilities and service access. ▪ Local employment and training needs. ▪ Local supply issues. ▪ Road safety and community safety issues. ▪ Waste management. ▪ Social Impact Management Plan. ▪ Land use post-closure. ▪ Management strategies.
Mackay Regional Council	▪ Workforce recruitment, management and accommodation. ▪ Community values, trends and issues. ▪ Changes to the housing market. ▪ Impacts on community facilities and service access. ▪ Local employment and training needs. ▪ Local supply issues. ▪ Road safety and community safety issues.
Social infrastructure providers and non-government organisations	▪ Community health and safety. ▪ Mental health. ▪ Service capacity. ▪ Changed access/demand for health and medical services. ▪ Effects on community services and facilities. ▪ Workforce composition. ▪ Local employment and training opportunities. ▪ Impacts / benefits to community values. ▪ Housing impacts. ▪ Access to community and health services. ▪ Local supply issues. ▪ Road safety.

Table 4-5 (Continued)
Summary of Social Impact Assessment Stakeholder Consideration

Stakeholder	SIA Consultation Topics and Considerations
Landowners	▪ Land ownership and use. ▪ Access, connectivity and amenity. ▪ Property impacts and mitigations. ▪ Land use post-closure.
Local businesses	▪ Local and regional supply opportunities. ▪ Effects on local business and economic vitality. ▪ Labour draw and workforce impacts. ▪ Economic development.
Operators of the Civeo Camp	▪ Forward planning – provision of accommodation to larger work force. ▪ Cumulative impact on accommodation resources with other projects in the area.
Community groups and members, including: ▪ Fitzroy Partnership for River Health. ▪ Fitzroy Basin Association. ▪ Moranbah Men's Shed.	▪ Workforce composition. ▪ Local employment and training opportunities. ▪ Impacts / benefits to community values. ▪ Housing impacts. ▪ Access to community and health services. ▪ Local supply issues. ▪ Road safety.
CFMEU Mining and Energy	▪ Job creation/stability. ▪ Health and safety. ▪ Advocate for workers.
Barada Barna People	▪ Identification of native title interests. ▪ Possible development of an Indigenous Land Use Agreement (ILUA). ▪ Cultural Heritage management. ▪ Indigenous community goals. ▪ Employment and business capacity and opportunity.

Source: After Appendix C.

Population and Demography

As at June 2018, the Isaac LGA had an estimated resident population of 20,934 people while the population of the Mackay LGA was 116,539 residents. Collectively, the regional study area (comprising the two LGAs) had a total of 137,473 persons.

From 2013 to 2018, the Isaac and Mackay LGAs experienced a decrease in population with average annual growth rates of 2.1% and -0.4%, respectively. Moranbah's Statistical Area 2 (SA2) population declined from 9,151 to 9,088 (-0.1%) over the same period. In contrast, Queensland experienced an increase in population with an average annual growth rate of 1.5% from 2013 to 2018 (Appendix C).

Population decreases between 2013 and 2018 resulted from contraction in both direct local employment (the result of mining industry redundancies and an increase in FIFO employment) and indirect employment (as businesses supported by construction and mining had less capacity to employ) (Appendix C).

As of the 2016 ABS Census, the Dysart and Coppabella populations were 2,991 and 466 persons respectively (Appendix C).

Community Values

Based on respondent's views communicated during the SIA consultation process, the residents of the local communities of Moranbah and Dysart agreed that their communities are resilient, family-orientated and cohesive. The results indicate a very strong sense of community spirit and pride (Appendix C).

Indigenous social values include traditional owners' cultural values (relevant to past and present relationships with the land and waters), and social values relevant to community wellbeing and economic participation, including (Appendix C):

- a strong focus on improving Indigenous peoples' capacity and opportunities for employment (prioritising sustainable employment pathways for traditional owners and not just employing Aboriginal people from anywhere in order to meet targets/quotas) and business development;
- active involvement in the protection of cultural heritage; and
- training and employment opportunities to restore social and economic wellbeing in the Indigenous community.

A detailed description of the existing social environment of the local and regional communities is provided in Appendix C.

Social Baseline Characteristics Summary

Table 4-6 presents a summary of the social baseline characteristics identified as part of the SIA.

The identification of social baseline characteristics relied upon a number of sources, including:

- ABS census data and other relevant reports;
- feedback from stakeholders during consultation;
- research and analysis conducted by the government agencies and industry bodies;
- other SIAs prepared for relevant mining projects in the region; and
- other relevant published reports.

4.4.3 Potential Impacts

Appendix C provides a detailed assessment of the potential positive and adverse impacts of the Project on the existing social environment, including on:

- employment;
- population;
- housing;
- social infrastructure;
- local business participation;
- community values;
- community wellbeing;
- cumulative impacts; and
- the potential impacts of Project closure.

SMEC (2021) concluded that the Project would have various social impacts and benefits, primarily accruing in the Isaac LGA, but with employment opportunities and benefits for businesses extending to other regions including the Mackay LGA.

The Project would not have a significant impact on temporary or permanent housing availability or affordability. As the Project would only result in a predicted 61 additional persons residing in local communities, the effect on service provision is expected to be negligible (Appendix C).

Whitehaven has a proven record of maximising local employment and actively supports members of the workforce at its NSW operations to live locally.

SMEC (2021) assessed the significance of the predicted social benefits and adverse impacts. A total of 18 adverse impacts and eight positive impacts were identified by SMEC. Of the adverse impacts, there was one which retained a residual risk rating of medium, ten with a low rating and seven with a negligible rating.

Table 4-6
Summary of Social Baseline Characteristics

Baseline Indicator		Findings[1]			
		Isaac LGA	Moranbah	Dysart	Coppabella
Demography and Housing	Population	20,940	8,735	2,991	466
	Indigenous community	3.6% (744)	3.9% (342)	4.5% (134)	4.7% (22)
	Non-resident population	12,075	2,465	1,790	Not available
	Age	32	30	31	38
	Families	53.5%	57.8%	52.8%	54.5%
	Unoccupied private dwellings	34.5%	29.2%	41.4%	41.6%
	Housing rental rate	63.5%	76.6%	69.2%	77.8%
	Median weekly rental cost	$280 / week (3 bed house)	$320 / week (3 bed house)	$180 - $203 / week (house)	Not available
	Rental vacancy rate	Not available	< 2%	4.9%	Not available
	Workforce Accommodation Village Beds	32,208 approved 19,052 built	15,020 approved 6,411 built	3,670 approved 3,275 built	5,712 approved 3,831 built
	Percentage of Population in Least disadvantaged quintile	21.6%	36.8%	Not available	Not available
	Percentage of Population in Most disadvantaged quintile	3.9%	0%	Not available	Not available
	Incomes (Household)	$2,138 / week	$2,421 / week	$2,152 / week	$2,328 / week
Business and Industry	Unemployment rate	2.2%	2.0%	6.1%	1.4%
	Mining employment	Mining was the largest industry by employment in the Isaac LGA in 2016, providing 6,024 jobs out of the total 14,328 (42%).			
	Occupation	The Isaac LGA's largest occupational group at the time of the 2016 ABS Census was machinery operators and drivers at 23.7%, followed by technicians and trades workers at 20.7% and managers at 12.9%.			
	Economic strength	Isaac LGA's economic strengths include significant thermal and metallurgical coal deposits; a long standing agricultural industry; strong international export market focus for coal, agriculture, aquaculture, sugar cane and beef.			
	Business profile	98% of Isaac LGA's registered businesses were small businesses with fewer than 20 employees in June 2018.			
Community Health and Safety	Health indicators	Health indicators show that people in Isaac LGA have higher chronic disease and health risks relating to personal lifestyle and behaviour (including smoking, drinking, obesity, no/low exercise levels or high blood pressure). Isaac LGA had lower than average rates of admission for other diagnoses including cancers, mental health-related conditions, circulatory system disease and respiratory disease.			
	Health services	Residents in the Isaac LGA have access to district level hospitals (three hospitals in total in the LGA) in Moranbah and Dysart and a community health centre in Middlemount. General Practitioners (GPs) are located in Moranbah and Dysart, with visiting or on-call services in Middlemount and Nebo. There are a number of allied health practitioners in the region. Most of specialist services are not available in the Isaac region; hence, Isaac LGA's residents seek higher-order health services in Mackay or other regional health services.			
	Community safety	There are some social concerns relating to alcohol and substance abuse and domestic violence. The offence rate per 100,000 persons in the Isaac LGA for 2018-2019 (7,362) was lower than the overall rate for Queensland (10,084). Moranbah has a lower rate of offences against the person than in the Isaac LGA, but a higher rate of offences against property.			
	Road safety	Traffic volumes have led to ongoing road safety issues in the Isaac LGA, with particular concern about the Peak Downs Highway's poor safety record.			

Source: After Appendix C.

[1] Data presented is the average of each location.

All identified impacts with a significance rating higher than 'low' are summarised in Table 4-7. Further detail on the remaining risks (i.e. those categorised as low or negligible) is provided in Appendix C. The level of significance reflects the level of risk or benefit for social resources that support quality of life and social sustainability (e.g. secure employment, business prosperity, housing affordability, social infrastructure access or community cohesion). Table 4-7 also presents key management and enhancement measures for each identified impact. These measures form the basis of the commitments in the Social Impact Management Plan.

Cumulative Impacts

SMEC (2021) conducted a cumulative assessment of potential social impacts in consideration of the existing operations and the following new or proposed projects in the region:

- Red Hill Mining Lease Project;
- Saraji East Mining Lease Project;
- Olive Downs Project;
- Isaac Downs Project;
- Eagle Downs Mine;
- Moranbah South Project; and
- Lake Vermont Meadowbrook Project.

The assessment concluded that potential cumulative impacts during construction and operation of the Project include:

- competition for construction labour;
- increases in the number of non-residential workers in the Isaac LGA, potentially exacerbating existing community concern about the presence of non-local workers;
- increase in traffic on local and state roads in the Isaac LGA;
- increase in demand on local health services, Queensland Police, Ambulance, and Fire and Emergency Services;
- increase in demands on Council infrastructure such as water and wastewater systems and municipal services;
- labour draw from other businesses and industries who are dependent on construction labour and skills;
- population growth of several thousand people in the Isaac LGA, with potential for significant growth in Moranbah and Dysart in particular;
- impacts on housing availability and cost;
- increases in employment rates, labour force participation and socio-economic wellbeing for communities in the Isaac LGA; and
- overall increase in patronage for retail, hospitality, fuel and food venues in Moranbah (which would be a positive impact for local businesses).

4.4.4 Mitigation Measures, Management and Monitoring

Mitigation and management measures for potential impacts on social values were derived following the assessment of the level of significance attributed to respective identified potential impacts. Enhancement measures were also derived to enhance the benefits of the Project.

The management and enhancement measures were identified through direct consultation with the community, the examination of the potential impacts of the Project and stakeholder negotiations. Measures for potential social impacts with a significance rating greater than "low" are summarised in Table 4-7. Measures for all potential social impacts are described in detail in Appendix C.

Consistent with the DSDMIP's *Social Impact Assessment Guideline* (2018), a Social Impact Management Plan (SIMP) has been prepared as part of the SIA (Appendix C). The SIMP is further described in Section 4.4.5.

Table 4-7
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Workforce Management	Increased employment opportunities for residents of local and regional communities. This includes opportunities for traditionally underrepresented groups such as women, and Aboriginal and Torres Strait Islander (ATSI) persons.	Positive (Medium)	▪ Implement a recruitment hierarchy, which prioritises employment of local residents. ▪ Scheduling of recruitment will be staggered in accordance with the recruitment hierarchy. ▪ Employment opportunities to be advertised in ways tailored to local communities. ▪ Establish a Project office in either Moranbah or Mackay to oversee Project recruitment processes and provide a point of contact for prospective employees. ▪ Engage with the Barada Barna Aboriginal Corporation to develop targeted ATSI employment initiatives. ▪ Ensure Indigenous cultural heritage surveys are fully funded and supported and undertaken by the rightful parties. ▪ Identify specific positions which qualify for job share/ flexible shift arrangements. ▪ Provision of ongoing training and skills development for the workforce.	Medium
Workforce Management	Enhanced skills and capacity in local communities due to targeted training and skills development initiatives.	Positive (Low)	▪ Provide incentives for staff to make a long-term commitment to the Project through career pathways supported by training and skills development. ▪ Directly contribute to the advancement of Science, Technology, Engineering and Maths (STEM) skills in the local community through funding positions dedicated to the integration of STEM into the primary school curriculum (commitment of $35,000 per annum for each school, for the life of the Project). ▪ Collaborate with the Barada Barna Aboriginal Corporation, DSDSATSIP, DESBT and other government agencies to design and implement programs (such as 'Skilling Queenslanders for Work') which support target groups such as youth to access employment opportunities supported positions rather than on casual contracts. ▪ Provide ongoing training and skills development for the workforce through continuous implementation of the existing Whitehaven training programs.	Medium

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Workforce Management	Economic benefits for local businesses due to incidental expenditure by members of the Project workforce (e.g. clothing, food, entertainment).	Positive (Low)	▪ Provide opportunities for camp accommodated workers to occasionally access local businesses.	Medium
Local Business and Industry Procurement	Economic benefits for local businesses due to opportunities to provide goods and services for the Project. This will include targeted opportunities for ATSI-owned businesses.	Positive (Medium)	▪ Prepare and adopt a procurement policy and plan consistent with the values of the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation National Framework*. ▪ Maximise opportunities for local businesses to provide goods and services to the Project. ▪ Prepare and maintain a Local and Regional Business Register for internal use and distribution to all major contractors. ▪ Establish a register of ATSI-owned businesses in the region, and collaborate with DSDSATSIP to develop an effective engagement strategy. ▪ Collaborate with the Barada Barna Aboriginal Corporation, DESBT, DSDSATSIP and any other appropriate stakeholders to facilitate and support delivery of tender readiness program for Indigenous businesses.	Medium
Health and Community Wellbeing	Contribution to social capital building and community resilience.	Positive (Low)	▪ Develop and implement code of conduct which describes positive behavioural outcomes and prohibits negative behaviours – establishes expected standards of behaviour with clear ramifications for non-conformance. ▪ Support community culture and wellbeing through the Whitehaven Community Fund which invites community organisations to apply for annual funding. ▪ Maximise local employment through application of the recruitment hierarchy.	Medium

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Health and Community Wellbeing	Amenity and health impacts for surrounding landholders and nearby communities due to fugitive dust emissions.	Adverse (Medium)	▪ Development of a monitoring and management program to monitor and manage dust issues associated with the Project. ▪ Implement a complaints mechanism to identify, track, and seek to resolve community complaints associated with dust generating activities.	Medium
Health and Community Wellbeing	Increased economic wellbeing in local communities through contributing to community development.	Positive (Low)	▪ Maximise local employment through application of the recruitment hierarchy. The scheduling of recruitment will be staggered in accordance with the recruitment hierarchy. ▪ Prepare and adopt a procurement policy and plan consistent with the values of the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation Framework*. ▪ Support community culture and wellbeing through the Whitehaven Community Fund which invites community organisations to apply for annual funding.	Medium
Workforce Management	Loss of employment opportunities and associated redundancies following the conclusion of operations.	Adverse (Medium)	▪ Prepare and implement a post-closure management plan. ▪ Provide workers with advanced notice of the impending conclusion of operations. ▪ Consult with employees regarding potential impacts and identify strategies to avoid economic hardship for those affected. ▪ Where possible, redeploy workers to other Whitehaven WS-operated projects.	Low

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Workforce Management	Health and wellbeing of the workforce and their families affected through employment conditions, shift scheduling, accommodation and work stress.	Adverse (Medium)	▪ Manage the workforce health and safety through implementation of the Whitehaven Coal Health and Safety Management Systems, including in relation to fatigue management, management of risks associated with drugs and alcohol, and workforce hygiene. This comprises a broad range of measures which directly avoid the need for non-resident workers to access hospital services. ▪ Ensure all members of the workforce are fully inducted and trained through implementation of the Whitehaven Coal Induction and Training Standard – which establishes minimum training standards for employees, contractors and visitors who perform work for Whitehaven WS. ▪ Provision of on-site first aid facilities for workers with appropriately trained personnel available that can assist with attending to minor workforce health issues, as well as providing first response services for emergency situations and site accidents. ▪ Annual financial contribution to support employees and families through mental health and suicide prevention programs. ▪ Regular engagement with Worker Accommodation Village operators to encourage and support workforce health programs targeting mental health, obesity, drug and alcohol use. ▪ Establishment of an Employee Assistance Program tailored to suit the needs of the workforce.	Low
Housing and Accommodation	Stimulate housing investment due to an increase in the workforce housing and accommodation demand.	Positive (Low)	▪ Minimise effects on local housing market through maximising local employment as per the measures outlined in the Workforce Management Plan. ▪ Provide support to members of the workforce seeking to reside locally including a housing register, connections advice and support networks.	Low
Housing and Accommodation	Increased business opportunities for housing and accommodation providers such as Worker Accommodation Villages and rental houses.	Positive (Low)	▪ Utilise established Worker Accommodation Villages in the local area rather than building a new Worker Accommodation Village. ▪ Offer all members of the workforce the choice of camp style accommodation or permanent housing which is subsidised through the Live Local Initiative.	Low

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Housing and Accommodation	Reduced housing and accommodation availability due to increased demand generated by an influx of mining workers from the Project and other mining projects in the area.	Adverse (Medium)	▪ Reduce inflationary effects on the housing market in Moranbah through investing in permanent housing stock. ▪ Provide genuine housing and accommodation choice to the workforce through the provision of subsidised housing costs for members of the workforce who choose to live locally and of high-quality workforce accommodation to non-resident personnel. ▪ Actively engage and collaborate with the Isaac Regional Council and other stakeholders with respect to housing and accommodation impacts and remediation actions.	Low
Housing and Accommodation	Economic hardship for lower-income rental market tenants who have less capacity to cope with increased housing expenses. This may result in increased demand on social welfare, and out-migration to lower-cost communities.	Adverse (Medium)	▪ Ensure the Project does not adversely affect the affordability and availability of housing in local communities through: (i) facilitating the construction of new housing in Moranbah dedicated to Project employees with a maximum of 20-34 houses built between Year 1 and Year 11; and (ii) provide a financial contribution of $500,000 over the Project life to the Isaac Affordable Housing Trust and/or Emergency and Long-Term Accommodation Moranbah Inc for the construction of additional affordable housing in Moranbah.	Low
Health and Community Wellbeing	Increased demand for early childhood education and care services by the Project workforce, resulting in increased burden for service providers and reduced level-of-service for existing residents.	Adverse (Medium)	▪ Collaborating with the Isaac Regional Council to determine the most effective contribution which may be made to a childcare solution (maximum of $200,000 within Years 1 to 5 of the Project). ▪ Monitoring workforce demands on childcare and education services and working with Isaac Regional Council to support solutions to cumulative demands on social services. ▪ Communicate with relevant stakeholders (including Isaac Regional Council and childcare providers) in managing the potential impacts associated with increased population resulting in additional pressure on the existing early childhood education and care services.	Low
Health and Community Wellbeing	Increased demand for emergency services by the Project workforce, resulting in increased burden for service providers and reduced level-of-service for existing residents.	Adverse (Medium)	▪ Provision of on-site first aid facilities for workers with appropriately trained personnel available that can assist with attending to minor workforce health issues, as well as providing first response services for emergency situations and site accidents. ▪ Monitor staff access to emergency services. ▪ Maintain regular communication with the Isaac Regional Council and the Queensland Government with respect to predicted police and emergency services requirements and capacity in local towns.	Low

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Health and Community Wellbeing	Amenity and health impacts for surrounding landholders due to increased noise and vibration from activities such as earthmoving and blasting.	Adverse (Low)	▪ Implement noise and vibration mitigation and monitoring measures as described in Section 4.7.4. ▪ Implement a complaints management procedure.	Low
Health and Community Wellbeing	Impacts on mental health for community members.	Adverse (Medium)	▪ Support positive mental health outcomes through providing a contribution of $30,000 per year for the life of the Project local and regional mental health, domestic violence and suicide prevention programs. ▪ Provide members of the workforce with access to mental health support and monitor workforce demand on health and mental health services. ▪ Actively manage all aspects of workforce health and safety through implementation of the Whitehaven Coal Health and Safety Management System.	Low
Health and Community Wellbeing	Public safety affected by increased exposure to anti-social or illegal behaviours by members of the Project workforce.	Adverse (Medium)	▪ Require all members of the workforce to abide by a stringent code-of-conduct which will include disciplinary measures (ranging from informal warnings to dismissal) for any demonstrated breaches. ▪ Investigate and respond to any relevant complaints that are received via the complaint management procedure. ▪ Establish contacts between local stakeholders and Whitehaven WS with regard to workforce behaviour.	Low

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Health and Community Wellbeing	Increased likelihood of vehicle collisions (and associated injuries) due to increased volume of heavy vehicles and driver fatigue.	Adverse (Medium)	▪ Use of shuttle buses to transport non local workers from Worker Accommodation Villages to the Project, to minimise the Project-related traffic on the road network. ▪ Coordinate vehicle movements for delivery of materials and equipment on access roads. ▪ Install temporary traffic control measures and signage for safe movement of vehicles. ▪ Signposting speed limits on the private access roads for the Project, as well as Eagle Downs Mine Access Road approaching the access intersection. ▪ Education of the workforce through inductions on road safety. ▪ Transport hazardous and dangerous goods in compliance with requirements of the Whitehaven Hazardous Chemicals and Dangerous Goods Standard. ▪ Implement a Fatigue Management Standard for workers including a swipe card system to monitor hours worked, use of buses to transport workers, and coordinated car-pooling arrangements.	Low
Community and Stakeholder Engagement	Deterioration of community and stakeholder relationships, resulting in reputational impacts, becoming negatively regarded by local communities which affects employee satisfaction and Project progress.	Adverse (Low)	▪ Implement commitments in the SIMP to enhance project-related opportunities and benefits for local and regional communities (for example employment, training and business opportunities) and regularly communicating these to the community. ▪ Implement community engagement and stakeholder management actions outlined in the Community and Stakeholder Engagement Plan.	Negligible
Workforce Management	Shortage of employment and skills in other industries due to additional demand for workers created by the Project.	Adverse (Low)	▪ Provide additional training opportunities for young people from local communities through funding an education-based traineeship for each year of operation. ▪ Provide career progression pathways for the workforce through provision of an upskilling and employment development program.	Negligible

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Housing and Accommodation	Increased housing and accommodation demand due to the influx of the Project's workforce.	Adverse (Low)	▪ Implement measures detailed in Housing and Accommodation Plan to enhance local employment opportunities and reduce reliance on FIFO. ▪ Accommodate non-resident workforce in established Worker Accommodation Villages. ▪ Monitor workforce satisfaction with accommodation and take corrective actions as required. ▪ Collaborate with the Isaac Regional Council and other stakeholders in the annual review of housing conditions and contribution to corrected measures as required.	Negligible
Local Business and Industry Procurement	The potential to monopolise goods and services if the Project's demand exceeds the capacity of the local supply chain. This may impact residents of local communities by increasing costs and reducing availability of necessary goods and services.	Adverse (Low)	▪ Prepare and adopt a procurement policy and plan consistent with the values of the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation Framework*. ▪ Collaborate with Moranbah Traders Association, Local Content Leaders Network, the Regional Industry Network and any other appropriate stakeholders in establishing a local supplier listing tailored to the Project.	Negligible
Health and Community Wellbeing	Disruption to community cohesion, sense of place and cultural identity due to workforce integration.	Adverse (Low)	▪ Develop and implement code of conduct which describes positive behavioural outcomes and prohibits negative behaviours – establishes expected standards of behaviour with clear ramifications for non-conformance. ▪ Implement complaints management procedure as outlined in the Community and Stakeholder Engagement Plan.	Negligible

Table 4-7 (Continued)
Summary of Key Social Impacts/Benefits and Management/Enhancement Measures

Impact Description		Impact Nature (Significance)	Key Management/Enhancement Measures	Managed Significance
Health and Community Wellbeing	Increased demand for hospital and health services by the Project workforce, resulting in increased burden for service providers and reduced level-of-service for existing residents.	Adverse (Low)	▪ Reduce additional demands on local health services through the provision of on-site first aid facilities for workers with appropriately trained personnel available that can assist with attending to minor workforce health issues, as well as providing first response services for emergency situations and site accidents. ▪ Providing contribution as required to address identified equipment deficiencies at Moranbah Hospital and Moranbah District Mental Health Service. ▪ Support community health outcomes through partnering with the Moranbah Hospital, Moranbah District Mental Health Service and other key health service providers.	Negligible
Health and Community Wellbeing	Amenity impacts for community members due to increased Project-related traffic, resulting in increased congestion and road surface impacts.	Adverse (Low)	▪ Provide shuttle buses to transport workers from the proposed Worker Accommodation Villages to the Project. ▪ Coordinate vehicle movements for delivery of materials and equipment on access roads. ▪ Install temporary traffic control measures and signage for safe movement of vehicles. ▪ Notify stakeholders of any material Project traffic related activities (such as road closures due to road works). ▪ Implement a complaints mechanism to identify, track and remediate (in accordance with any conditions of the environmental authority) community complaints associated with traffic generating activities from the Project's construction and operation phases.	Negligible

Source: After Appendix C.

4.4.5 Social Impact Management Plan

The SIMP is comprised of the following sub-plans:

- **Workforce Management Plan.**
- **Housing and Accommodation Plan.**
- **Local Business and Industry Procurement Plan.**
- **Health and Community Wellbeing Plan.**
- **Community and Stakeholder Engagement Plan.**

The sub-plans are described in detail in Appendix C. A summary of the objectives, potential benefits and key commitments for each of the sub-plans is provided below.

Workforce Management Plan

The objectives of the Workforce Management Plan are to:

- Prioritise and maximise local employment.
- Maintain a stable and skilled long-term workforce.
- Provide members of local and regional communities access to equal employment opportunities.
- Improve skills and capacity of local and regional communities and existing workforce through training and skills development initiatives.
- Support the health and wellbeing of the workforce and their families.
- Minimise economic hardships for affected employees and their households due to loss of employment opportunities and associated redundancies following the conclusion of operations.

Potential benefits associated with workforce management include:

- Increased employment opportunities for residents of local and regional communities. This includes opportunities for traditionally under-represented groups such as women and ATSI persons.
- Enhanced skills and capacities in local communities due to the movement of a skilled workforce into the local area, further supported by targeted training and skills development initiatives.
- Economic benefits to local businesses due to incidental expenditure by members of the Project workforce (e.g. clothing, food, entertainment, etc.).

Key commitments made by Whitehaven WS with regard to workforce management include:

- Implementing a recruitment hierarchy which prioritises employment of local residents.
- Applying the Whitehaven Equal Employment Opportunities Policy to all employment aspects of the Project.
- Identifying specific positions which qualify for job share/flexible shift arrangements. Such jobs may be made available as both full-time or job share/flexible shift and will be advertised in local towns as a priority.
- Not advertising any job opportunities as FIFO only.
- Collaborating with the Barada Barna Aboriginal Corporation, DSDSATSIP, DESBT and other government agencies to design and implement programs (such as 'Skilling Queenslanders for Work') which support target groups such as youth.
- Providing on-site first aid facilities for workers with appropriately trained personnel available that can assist with attending to minor workforce health issues, as well as providing first response services for emergency situations and site accidents.
- Ongoing consultation and collaboration with police, workforce accommodation providers and other stakeholders to identify and address any antisocial or disruptive workforce behaviour in local communities.
- Managing workforce health and safety through implementation of the Whitehaven Coal Health and Safety Management System.

Housing and Accommodation Plan

The objectives of the Housing and Accommodation Plan are to:

- Minimise impacts on housing affordability and availability in communities affected by the Project.
- Minimise Project effects on the local housing market.
- Provide genuine housing and accommodation choice to the workforce.

Potential benefits associated with housing and accommodation include:

- Stimulation of housing investment which provides stability to the local housing market.
- Increased business opportunities for housing and accommodation providers such as Workforce Accommodation Villages and rental houses.

Key commitments made by Whitehaven WS with regard to housing and accommodation include:

- **Facilitating the construction of a maximum of 34 new houses in Moranbah dedicated for Project employees.**
- **Providing a financial contribution of $500,000 over the Project life to the Isaac Affordable Housing Trust and/or Emergency and Long-Term Accommodation Moranbah Inc for the construction of additional affordable housing in Moranbah.**
- **Providing subsidised housing costs for members of the workforce who choose to live locally.**
- **Providing high quality workforce accommodation to non-resident personnel and monitoring workforce satisfaction with the provided accommodation.**
- **Providing support to members of the workforce seeking to move to local communities (e.g. providing connections to local advice and support).**

The 'Live Local' housing subsidy will be used as a mechanism to both encourage employees to live in local towns whilst also managing potential effects on the local housing market.

Local Business and Industry Procurement Plan

The objectives of the Local Business and Industry Procurement Plan are to:

- Maximise opportunities for local businesses to provide goods and services to the Project.
- Minimise Project effects on the local housing market.
- Provide genuine housing and accommodation choice to the workforce.

Potential benefits associated with local business and industry procurement include:

- Economic benefits for local and regional businesses due to opportunities to provide goods and services to the project. This will include targeted opportunities for ATSI-owned businesses.

Key commitments made by Whitehaven WS with regard to local business and industry procurement include:

- Preparing and adopting a procurement policy and plan consistent with relevant regulations.
- Collaborating with the Moranbah Traders Association, Local Content Leaders Network, Regional Industry Network and any other appropriate stakeholders in establishing a local supplier listing tailored to the Project.
- Maximising opportunities for local businesses to provide goods and services to the Project.
- Facilitating and supporting delivery of a tender readiness program for Indigenous businesses, in collaboration with Barada Barna Aboriginal Corporation, DESBT, DSDSATSIP and any other appropriate stakeholders.

Health and Community Wellbeing Plan

The objectives of the Health and Community Wellbeing Plan are to:

- Avoid and then mitigate adverse impacts on the level of service provided to local and regional communities by existing social services, facilities and infrastructure.
- Mitigate potential health and wellbeing impacts on local communities.
- Enhance community cohesion and contribute to the community through supporting local communities' activities.

Potential benefits associated with health and community wellbeing are summarised as follows:

- Enhanced community cohesion and resilience due to influx of long-term residents.
- Enhanced community resilience through financial and in-kind contributions to community development initiatives.

Key commitments made by Whitehaven WS with regard to health and community wellbeing include:

- Collaborating with the Isaac Regional Council to determine the most effective contribution which may be made to a childcare solution (maximum of $200,000 within Years 1 to 5 of the Project).
- Monitoring workforce demands on childcare and education services and working with the Isaac Regional Council to support solutions to cumulative demands on social services.
- Supporting the establishment of, and participating in, a Moranbah Cumulative Reference Group which is appropriately represented across government and industry, providing a forum for a partnered approach to cumulative effects.
- Providing a contribution of $30,000 per year for the life of the Project, split between local mental health, domestic violence and suicide prevention programs.
- Monitoring and managing dust, noise and vibration issues associated with the Project, including preparation of an Air Quality Management Plan, and regularly communicating the results with the local community.
- Providing shuttle buses to transport a portion of workers for the Project.
- Notifying stakeholders of material Project traffic related activities, such as closures due to roadworks, and implementing a complaints mechanism to identify, track and remediate (in accordance with any conditions of the environmental authority) community complaints.
- Developing and implementing a workforce code of conduct describing positive behavioural outcomes and prohibiting negative behaviours.
- Ongoing consultation and collaboration with police, workforce accommodation providers and other stakeholders to identify and address any antisocial or disruptive workforce behaviour in local communities.
- Providing a contribution to support community culture and wellbeing through the Whitehaven Community Fund, which would invite community organisations to apply for annual funding.

Examples of initiatives that have benefited from the Whitehaven Community Fund in FY20 include (Whitehaven, 2020):

- chambers of commerce, service clubs, schools, health services, and sponsorship of community events across both the Gunnedah and Bowen Basin, which received discretionary donations of approximately $50,000;
- Westpac Rescue Helicopter (of which Whitehaven is a major sponsor), which received a corporate and employee combined donation of more than $50,000; and
- Narrabri Hospital, which received a donation of approximately $15,000 towards the purchase of a portable ultrasound machine.

Community and Stakeholder Engagement Plan

The objectives of the Community and Stakeholder Engagement Plan are:

- to identify stakeholder groups that could be affected or may have an interest in the Project;
- to identify the interests, concerns and needs of the stakeholder groups;
- to ensure opportunities are provided for engagement between stakeholders and the Project;
- to establish a framework for strong and cooperative relationships with local communities and stakeholders;
- to provide a complaint mechanism to allow affected communities and other stakeholders to register complaints, queries or comments and have them addressed in a timely manner by the Project;
- to ensure Project planning and delivery are informed by stakeholder views; and
- to ensure engagement supports adaptive management of social impacts.

Key commitments made by Whitehaven WS with regard to community and stakeholder engagement include:

- Maintaining a Project officer as a dedicated community contact point.
- Continuing to engage with local and surrounding landholders to monitor overall Project impacts.

- Continuing to engage with local service providers including schools, health and other social services regarding Project related activities that have potential to impact on the community (e.g. blasting or road closures).
- Establishing, publicising and maintaining a readily accessible community complaints and resolution process.
- Establishing and maintaining long-term respectful relations with the Barada Barna Aboriginal Corporation, including managing cultural heritage in accordance with the CHMP and meeting the requirements of any native title agreement.
- Regularly engaging with the Isaac Regional Council to monitor the implementation of the SIMP.

Monitoring, Review and Update of Social Impact Management Plan

The SIMP provided in Appendix C of the EIS includes a monitoring framework which details the Key Performance Indicators (KPIs) to be used to measure the Project's success in meeting the objectives sought for each key impact and/or benefit area over the life of the Project.

The SIA and SIMP recognise that the social context of the Bowen Basin can change due to the cyclical nature of the mining industry. Subsequently, each action as detailed in the SIMP is assigned a monitoring and reporting framework to ensure ongoing effectiveness and relevancy of actions, and if required, amending ineffective actions.

Monitoring of each action is assigned the following:

- Responsibility: identification of the party responsible for monitoring of action.
- Frequency: identification of how often monitoring of the action will take place.
- KPI: identification of indicator/s used to measure the extent to which the action is achieving the established objective.
- Reporting requirement: identification of how monitoring of the action is reported to relevant stakeholders.

The SIMP as a whole would also be reviewed regularly to assess the effectiveness and relevancy of the SIMP. Whitehaven WS will review, and, if necessary, revise the SIMP every two years for the first four years of the Project and every three years up to Year 10 of the Project. The SIMP may be reviewed and revised within a shorter period of time should Whitehaven WS consider the amendment of the SIMP necessary.

Should the manned operations workforce scenario be implemented (operational workforce of 750 personnel), Whitehaven WS would review and amend the SIMP (if necessary), including relevant mitigation and management measures for potential impacts associated with the Project (e.g. childcare services and social services), to reflect the workforce. Whitehaven WS would consult with relevant stakeholders to revise the SIMP to ensure actions accurately reflect the existing socio-economic context and updated operational elements, such as additional workers.

4.5 FLORA AND FAUNA

4.5.1 Methodology, Environmental Objectives and Performance Outcomes

A Terrestrial Ecology Assessment for the Project was undertaken by E2M (2021) and is presented in Appendix D. An Aquatic Ecology and Stygofauna Assessment was also prepared for the Project by ESP (2021) and is presented in Appendix E.

The Terrestrial Ecology Assessment and Aquatic Ecology and Stygofauna Assessment were prepared in accordance the Terms of Reference and the following guidelines:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (DES, 2018a) and associated *Terrestrial Vertebrate Fauna Survey Field Data Sheets* (DES, 2018b);
- *Flora Survey Guidelines – Protected Plants* (DES, 2020a);
- *Methodology for Survey and Mapping Regional Ecosystems and Vegetation Communities in Queensland, Version 5.1* (Neldner *et al.*, 2020);
- *Guide to Determining Terrestrial Habitat Quality* (DES, 2020b);
- *Queensland Australian River Assessment System (AusRivAS) Sampling and Processing Manual* (DNRM, 2001);

- *Queensland Wetland Definition and Delineation Guideline – Part A: A Guide to Existing Wetland Definitions and the Application of the Queensland Wetlands Program* (DERM, 2011a);
- *Queensland Wetland Definition and Delineation Guideline – Part B: Delineation and Mapping Guideline* (DERM, 2011b);
- *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES, 2018c);
- *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DES, 2015);
- *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c);
- *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (DEHP, 2014); and
- other various species-specific targeted survey guidelines and conservation and listing advice for threatened ecological communities.

Section 4.5.2 describes the environmental values relating to biodiversity (flora and fauna) in the vicinity of the Project. Section 4.5.3 provides an assessment of the potential impacts of the Project on flora and fauna, while Section 4.5.4 describes measures to avoid and mitigate residual impacts. Section 4.5.5 describes the proposed Biodiversity Offset Management Strategy.

Terrestrial Flora and Fauna Surveys

Flora and fauna surveys were previously undertaken by Ecological Survey and Management (EcoSM) in 2011 and 2012 of the area within MLA 700049, MLA 700050, MLA 700051 and MLA 700065. These surveys provided a good initial characterisation of the terrestrial ecology values and data has been used as relevant to inform the E2M (2021) assessment.

E2M (2021) undertook additional detailed surveys, in a "Study Area" encompassing the Project area and surrounds (approximately 13,746 ha). The Study Area was defined by applying a suitable buffer (between 100 m and 500 m) to each of the MLAs, as required, where access was allowed for. A buffer did not extend beyond the north-eastern boundaries of MLA 700049, MLA 700050 and MLA 700051, as this area had been already mapped as part of the Olive Downs Project by DPM Enviros ciences (DPM Enviros ciences, 2018). Notwithstanding, this area is also approved for disturbance as part of the Olive Downs Water Pipeline (EPBC 2017/7870) and the Olive Downs Rail Spur (EPBC 2017/7868).

Flora and fauna survey sites were selected within the Study Area based on the outcomes of a desktop review completed by E2M (2021). The desktop review utilised aerial imagery, regional ecosystem (RE) mapping, and geological data to stratify the Study Area. Sites which best represented the Study Area were then selected.

Flora survey sites were selected in accordance with the *Methodology for Survey and Mapping Regional Ecosystems and Vegetation Communities in Queensland, Version 5.1* (Neldner *et al*., 2020).

Fauna survey sites were selected in accordance with the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (DES, 2018a).

Flora surveys were undertaken across multiple seasons within the Study Area, in accordance with relevant Commonwealth and State guidelines, including the *Methodology for Survey and Mapping Regional Ecosystems and Vegetation Communities in Queensland, Version 5.1* (Neldner *et al*., 2020), *Flora Survey Guidelines – Protected Plants* (DES, 2020a), *Guide to Determining Terrestrial Habitat Quality* (DES, 2020b) and Commonwealth conservation and listing advice for potential threatened ecological communities.

Survey techniques included a combination of tertiary and quaternary vegetation surveys, ground-truthing of regional ecosystems, BioCondition assessments, threatened ecological community assessments, targeted searches for threatened species and opportunistic observations (Appendix D).

E2M (2021) undertook fauna surveys across multiple seasons in accordance with relevant State and Commonwealth survey guidelines (including but not limited to DSEWPaC, 2011a, 2011b; Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010a, 2010b; DAWE, 2020b; Commonwealth Department of the Environment (DotE), 2014a; DES, 2018a and 2018b). A detailed reconciliation of the survey effort undertaken by E2M (2021) against the guidelines (including limitations) is presented in Section 3.3 of Appendix D.

Survey methods employed during the terrestrial fauna surveys included:

- establishing systematic trap sites (i.e. pitfall, funnel, elliot cage and camera traps) for catch and release of fauna;
- nocturnal spotlighting and call playback surveys;

- auditory and visual bird surveys conducted early morning and evening;
- Anabat detectors to detect and record the echolocation calls emitted by bats;
- diurnal active searches;
- fauna habitat surveys; and
- opportunistic observations.

A detailed description of the methodology employed by E2M (2021) is provided in Appendix D.

Aquatic Ecology and Stygofauna Surveys

Aquatic ecology within MLA 700049, MLA 700050 and MLA 700051 was previously surveyed by frc environmental in November 2011 (early-wet season) and during April to May 2012 (post-wet season). Rainfall was recorded prior to and during these surveys (Appendix E).

Aquatic ecology surveys were undertaken by ESP (2021) during May and October 2019 in the late and early-wet seasons respectively. A total of 36 sites were surveyed, located upstream, within and downstream of the Project area.

Aquatic ecology surveys completed for the Project included an assessment of aquatic habitat conditions (in accordance with the Australian River Assessment System [AUSRIVAS] habitat assessment protocol described in the *Sampling and Processing Manual* [DNRM, 2001]), water quality sampling (including sediment quality) and surveys of aquatic macroinvertebrates, vertebrates and plants.

ESP (2021) also reviewed previous aquatic ecology studies undertaken in the Study Area and surrounds by frc environmental in 2011 and 2012 and by DPM Enviroscienes Pty Ltd (DPM Enviroscienes) in 2016 and 2017.

Sampling for stygofauna was undertaken in May and October 2019, and January 2020 in accordance with the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DES 2015). A total of eleven groundwater bores were sampled during surveys.

Each sampled groundwater bore was established at least six months prior to stygofauna sampling and contained groundwater at the time of survey. *In-situ* water quality measurements for EC and pH were also taken at each groundwater bore.

A detailed description of the methodology employed by ESP (2021) is provided in Appendix E.

Environmental Objectives and Performance Outcomes

As defined by the Terms of Reference, relevant flora and fauna environmental objectives to the Project are as follows:

Flora and Fauna

> *Biodiversity including matters of state environmental significance are identified and appropriately safeguarded to support healthy and resilient ecosystems and ensure the sustainable, long-term conservation of biodiversity and the social, economic, cultural and environmental benefits it provides.*

Wetlands

> *Development is planned, designed, constructed and operated to protect environmental values of Queensland waters and supports the achievement of water quality objectives.*
>
> *The environmental objectives to be met under the EP Act are that the activity (project) be operated in a way that:*
>
> *…*
>
> *(b) protects the environmental values of wetlands…*

Aquatic communities

> *The construction, operation and decommissioning of the project should aim to meet the following objectives:*
>
> *…*
>
> *(b) environmental flows, water quality, in-stream habitat diversity, and naturally occurring inputs from riparian zones to support the long-term maintenance of the ecology of aquatic biotic communities….*

Groundwater Dependant Ecosystems

> *Development is planned, designed, constructed and operated to protect environmental values of Queensland waters and supports the achievement of water quality objectives.*
>
> *The environmental objectives to be met under the EP Act are that the activity (Project) be operated in a way that:*
>
> *…*
>
> *(c) protects the environmental values of groundwater and any associated surface ecological systems….*

The construction, operation and decommissioning of the project should aim to meet the following objectives:

…

(d) volumes and quality of groundwater are maintained, or alternate water supply is provided and current lawful users of water (such as entitlement holders and stock and domestic users) and other beneficial uses of water (such as surface water users, spring flows and groundwater-dependent ecosystems) are not adversely impacted by the development.

Additionally, the Project would achieve the relevant performance outcomes identified in Part 3 of Schedule 8 of the EP Regulation, as follows:

Flora and Fauna

2 All of the following apply—

(a) activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land;

…

1 Both of the following apply –

(a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;

(b) the activity does not have an adverse effect beyond the site.

2 Both of the following apply—

(a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;

(b) critical design requirements will prevent emissions having an irreversible or widespread impact on adjacent areas.

Wetlands

1 There will be no potential or actual adverse effect on a wetland as part of carrying out the activity

2 The activity will be managed in a way that prevents or minimises adverse effects on wetlands.

Aquatic communities

1 All of the following apply –

…

(f) any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland; …

Groundwater Dependant Ecosystems

2 The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.

4.5.2 Environmental Values

Regional and Local Setting

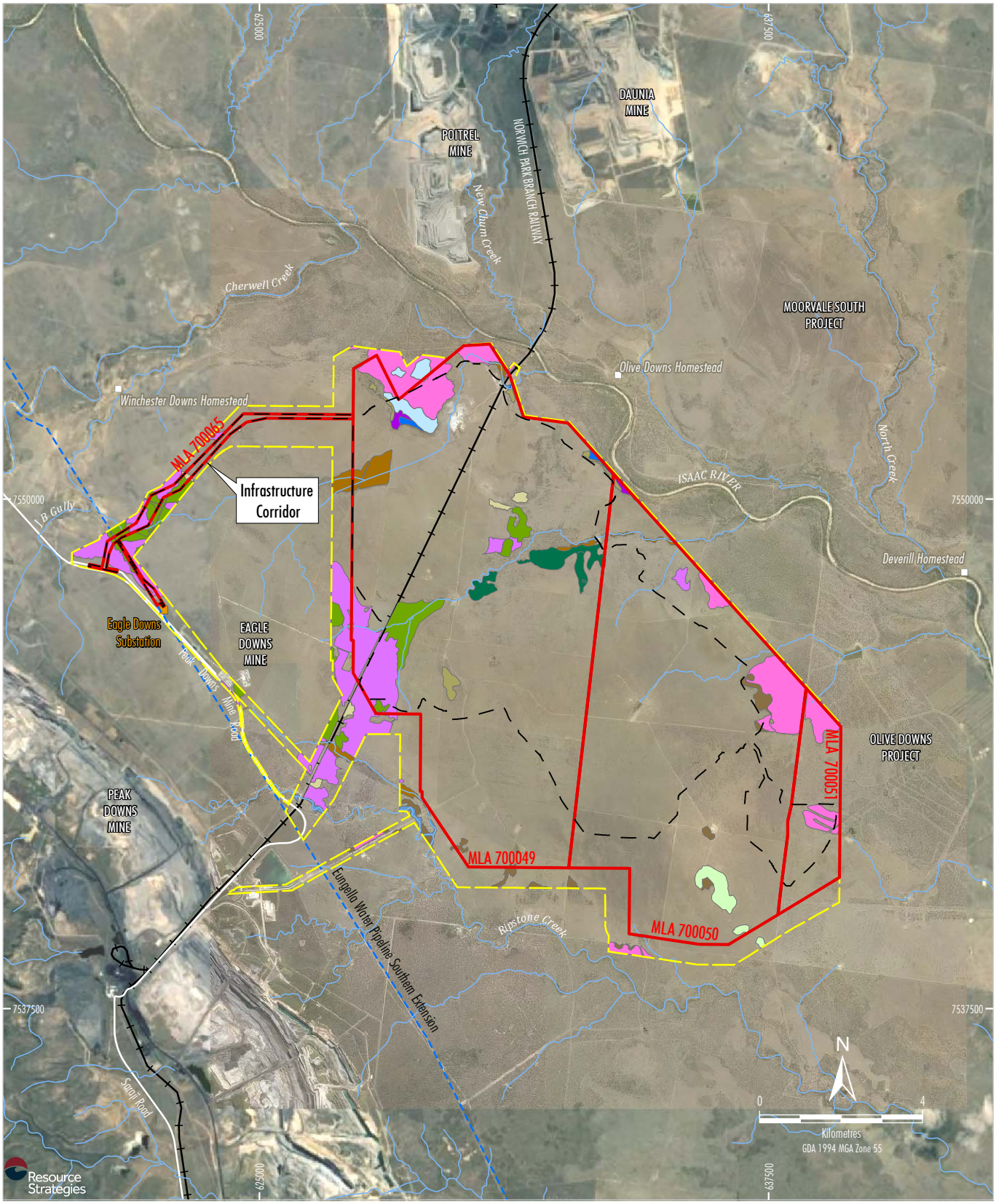
The Project area is located within Brigalow Belt North Bioregion as defined by the IBRA (DEE, 2019a). The Project area spans across two Biogeographic Subregions, the Northern Bowen Basin Subregion to the north-west, and the Isaac-Comet Downs Subregion to the south-east.

The Project area is located within the headwaters of the Isaac River catchment of the greater Fitzroy Basin. The Project is bordered by the Isaac River to the north-east and with drainage lines occurring within the landscape. A number of these drainage lines have been modified by the construction of farm dams.

Regional Ecosystems

The majority of vegetation within the Project area (approximately 6,408.6 ha, 90%) has been historically cleared in favour of livestock grazing and agriculture and exists in a non-remnant state (Appendix D).

A total of 13 remnant REs were identified within the Study Area (Figure 4-9), comprising four 'Endangered' REs, three 'Of Concern' and six 'Least Concern' REs under the VM Act.



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LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Railway
- Eungella Water Pipeline Southern Extension
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Eucalypt woodlands on alluvials (BVG 16)

- *E. tereticornis* and *E. camaldulensis* on fringing drainage lines (11.3.25)
- *E. coolabah* woodland (11.3.3c)
- *E. tereticornis* and *Eucalyptus* spp. on alluvials (11.3.4)

E.populnea/E.melanphloia woodlands on sandplains (BVG 17)

- *E. populnea* woodland on alluvial plains (11.3.2)
- Eucalypts on sandplains and/or remnant surfaces (11.5.3)
- *E. melanophloia* and *E. orgadophila* on sedimentary rock (11.9.2)

Eucalypt woodlands on sand or depositional plains (BVG 18)

- *E. crebra* and other eucalypts on sandplains and/or remnant surfaces (11.5.9)

Acacia harpophylla woodlands on heavy clay (BVG 25)

- *A. harpophylla* and/or *C. cristata* on heavy clay (11.3.1)
- *E. cambageana* with *A. harpophylla* + *A. argyrodendron* on clay (11.4.8)
- *A. harpophylla* with *Terminalia oblongata* on clay (11.4.9)
- *A. harpophylla* and/or *C. cristata* on sedimentary rock (11.9.5)

Tussock grasslands on forblands (BVG 30)

- *Dichanthium* spp. and/or *Astrebla* spp. grassland on Cainozoic clay plains (11.4.4)
- *Dichanthium* spp. and *Astrebla* spp. grassland on sedimentary rock (11.9.3)

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

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WINCHESTER SOUTH PROJECT

Ground-truthed Regional Ecosystems (Remnant)

Figure 4-9

The 13 identified remnant REs can be defined within five broad vegetation groups (Figure 4-9) (Appendix D):

- Eucalypt woodlands on alluvials (BVG 16);
- *E. populnea/E. melanophloia* woodlands on sandplains (BVG 17);
- Eucalypt woodlands on sand or depositional plains (BVG 18);
- *Acacia harpophylla* woodlands on heavy clay (BVG 25); and
- Tussock grasslands on forblands (BVG 30).

The majority of the Project area and surrounds consists of improved/disturbed pasture dominated by non-native grasses and *Acacia harpophylla* regrowth shrublands (Plate 4-2) (Appendix D).

Plate 4-2 – Modified/Disturbed Non-Remnant and Young Regrowth

A detailed description of each RE and associated mapping is provided in Appendix D.

Endangered and Of Concern Regional Ecosystems

Of the 13 REs identified within the Study Area, four have a conservation status of 'Endangered' (RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.9.5), and three have a conservation status of 'Of Concern' under the VM Act (RE 11.3.3c, RE 11.3.4 and RE 11.3.2) (Figure 4-9).

Least Concern Regional Ecosystems

Six REs located within the Study Area have a conservation status of 'Least Concern' under the VM Act (RE 11.3.25, RE 11.5.3, RE 11.9.2, RE 11.4.4, RE 11.5.9 and RE 11.9.3), and are generally dominated by Poplar Box (*E. populnea*) and Brigalow (*A. harpophylla*) (Plate 4-3 and Figure 4-9).

Plate 4-3 – RE 11.9.2 *Eucalyptus melanophloia +/- Eucalyptus orgadophila* woodland on fine-grained sedimentary rocks

Threatened Ecological Communities Listed under the EPBC Act

Three threatened ecological communities listed under the EPBC Act were recorded within the Study Area, namely *Brigalow (Acacia harpophylla dominant and co-dominant)* threatened ecological community (Brigalow TEC), *Natural Grasslands of the of the Queensland Central Highlands and Northern Fitzroy Basin* threatened ecological community (Natural Grasslands TEC) and *Poplar Box Grassy Woodland on Alluvial Plains* threatened ecological community (Poplar Box Woodland TEC).

Of the above threatened ecological communities, the Project area includes only the Natural Grasslands TEC and the Poplar Box TEC (Figure 4-10).

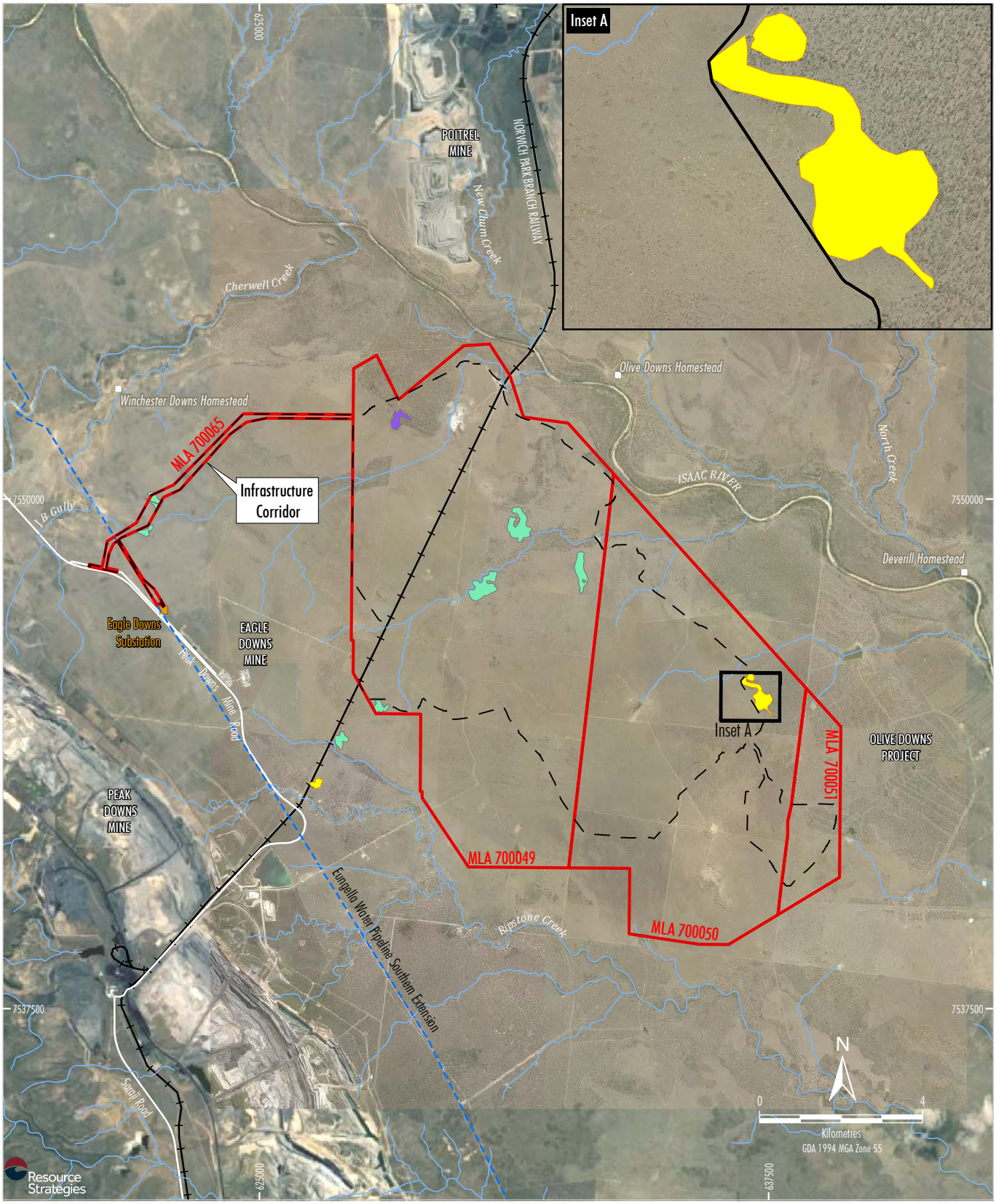
The Natural Grasslands TEC was recorded in a number of patches associated with RE 11.4.4 and RE 11.9.3 generally central within the Project area, with some smaller patches occurring within and surrounding the Project infrastructure corridor.

The Poplar Box TEC was recorded in association with RE 11.3.2 within the north-west of the Project area.

Threatened Flora Species

A small population of *Solanum adenophorum* plants (three individuals), listed as 'Endangered' under the NC Act, were identified within the Project area (Figure 4-11a).

No other conservation significant flora species under the NC Act or the EPBC Act were recorded in the Project area, or Study Area by E2M (Appendix D).



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Railway
- Eungella Water Pipeline Southern Extension
- Substation
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains
- Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin
- Brigalow (*Acacia harpophylla* dominant and co-dominant)

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

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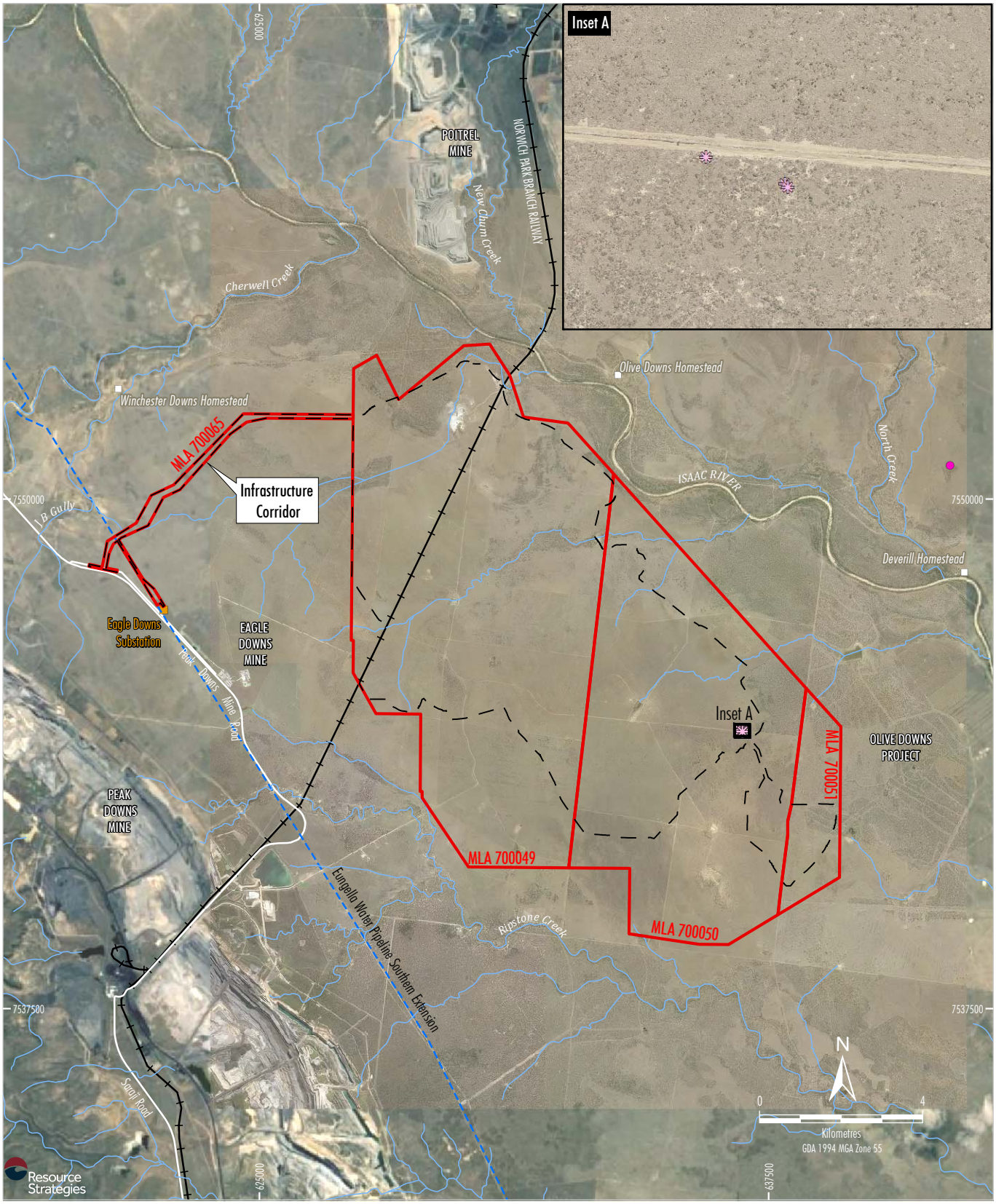
WINCHESTER SOUTH PROJECT

Matters of National Environmental Significance (MNES) - Threatened Ecological Communities

Figure 4-10



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Railway
- Eungella Water Pipeline Southern Extension
- Substation
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)

E2M (2021) Surveys

- Solanum adenophorum

Previous Surveys

- Solanum elachophyllum

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

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WINCHESTER SOUTH PROJECT

Threatened Flora Species Records within the Project Locality

Figure 4-11a

Introduced Flora

A total of 293 species of flora were identified in the Study Area, including 257 native and 36 introduced species (Appendix D). A detailed list of the flora species recorded is provided in Appendix D.

Five of the identified introduced flora species are listed as Category 3 Restricted Matters under the *Biosecurity Act 2014* (Appendix D), of which four are listed as Weeds of National Environmental Significance.

Groundwater Dependent Ecosystems

Appendix F provides a detailed, consolidated assessment of the potential impacts of the Project on GDEs (including terrestrial GDEs, ecosystems dependent on the subsurface presence of groundwater). Section 4.6.2 provides a summary of potential GDEs within the Project area and surrounds.

Environmentally Sensitive Areas

Endangered REs recorded within the Project area (RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.9.5) are Category B Environmentally Sensitive Areas (Figure 4-9).

Terrestrial Fauna Species

A total of 186 terrestrial fauna species were recorded by E2M (2021) during the field surveys within the Study Area, including 178 native species and eight introduced species. Bird species accounted for over half (61%) of the recorded fauna while mammals, reptiles and amphibians comprised 18%, 16% and 5% of records, respectively.

Of the terrestrial fauna species identified by E2M (2021), four conservation significant species were recorded within, or immediately adjacent to the Project area (all of which are vulnerable under the EPBC Act or NC Act) (Appendix D) (Figure 4-11b):

- Ornamental Snake (*Denisonia maculata*);
- Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*);
- Greater Glider (*Petauroides volans*); and
- Koala (combined populations of Queensland, NSW and the Australian Capital Territory [ACT]) (*Phascolarctos cinereus*).

Three conservation significant species were previously detected by EcoSM (2013), the Ornamental Snake, the Australian Painted Snipe (*Rostratula australis*) and Koala.

The EcoSM (2013) Australian Painted Snipe record is located within a brigalow lined waterway in the central portion of the Study Area, within habitat mapped for the species as intermittent foraging habitat (Appendix D).

Terrestrial Fauna Habitat

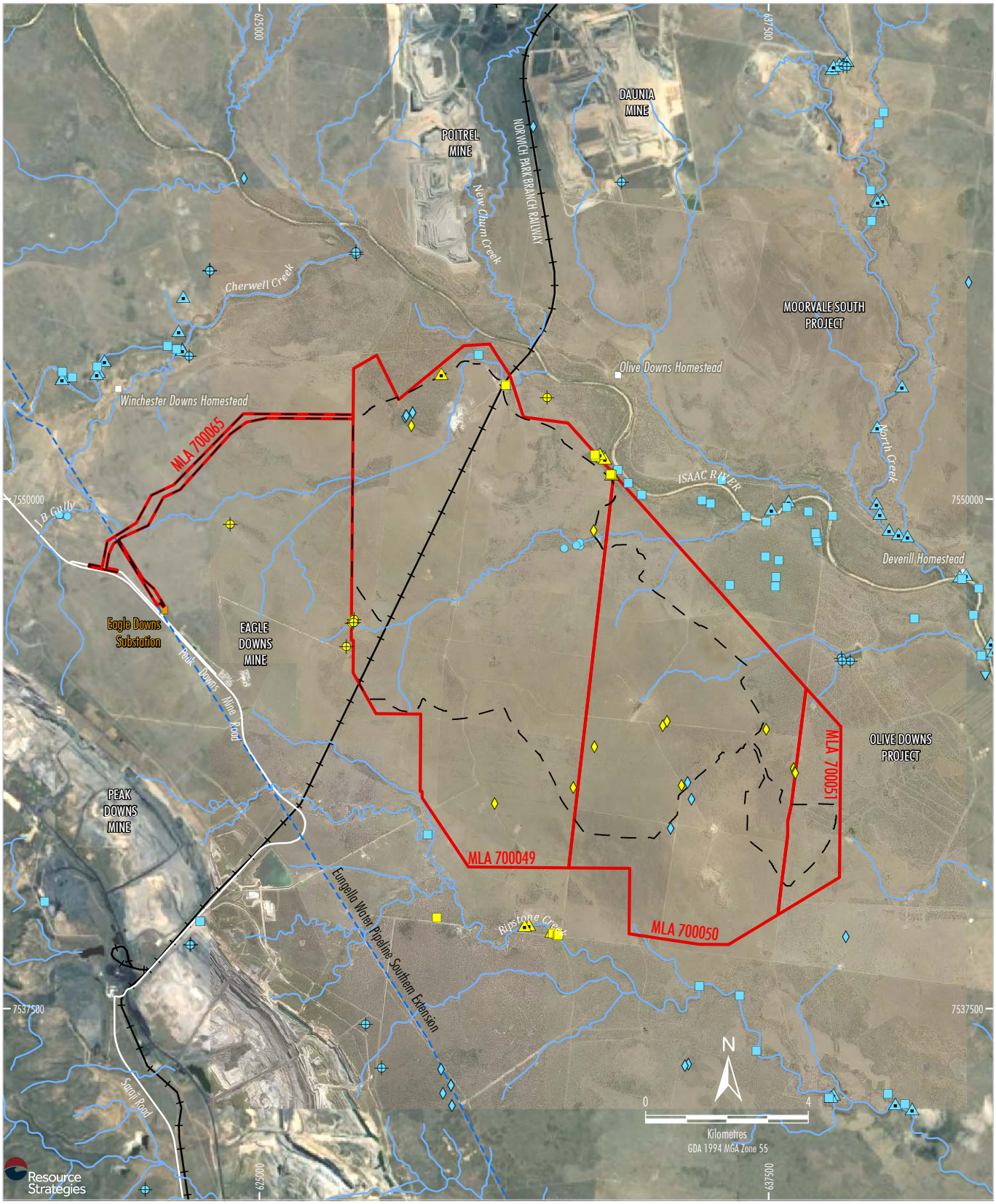
As previously described, the primary land use within the Project area is cattle grazing, as such the original habitats have been heavily cleared and modified. The majority of the vegetation within the Project area and surrounds is improved/disturbed pasture dominated by non-native grasses and *Acacia harpophylla* regrowth shrublands (Appendix D).

Eleven broad fauna habitat types were identified within the Project area, and are listed below (in order of abundance) (Figure 4-12):

- pastureland without gilgai (Habitat 6a);
- pastureland with gilgai (Habitat 6b);
- eucalypt woodland (Habitat 2a);
- native grassland (Habitat 5);
- mature regrowth / disturbed brigalow +/- *Eucalyptus* spp. woodland (Habitat 3b);
- brigalow regrowth (<2 m tall) (Habitat 3c);
- brigalow +/- *Eucalyptus* spp. woodland (Habitat 3a);
- mature regrowth / disturbed eucalypt woodland (Habitat 2b);
- farm dams;
- coolabah wetland (Habitat 1); and
- riparian blue gum open forest (Habitat 4).

Habitat connectivity is generally low within the Project area due to the highly fragmented and disturbed native vegetation.

A detailed description of each broad fauna habitat type is provided in Appendix D.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Railway
- Eungella Water Pipeline Southern Extension
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2020)
- Substation

E2M (2021) Surveys

- Greater Glider
- Koala
- Ornamental Snake
- Squatter Pigeon (southern subspecies)

Previous Surveys

- Australian Painted Snipe
- Common Death Adder
- Greater Glider
- Koala
- Ornamental Snake
- Squatter Pigeon (southern subspecies)

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

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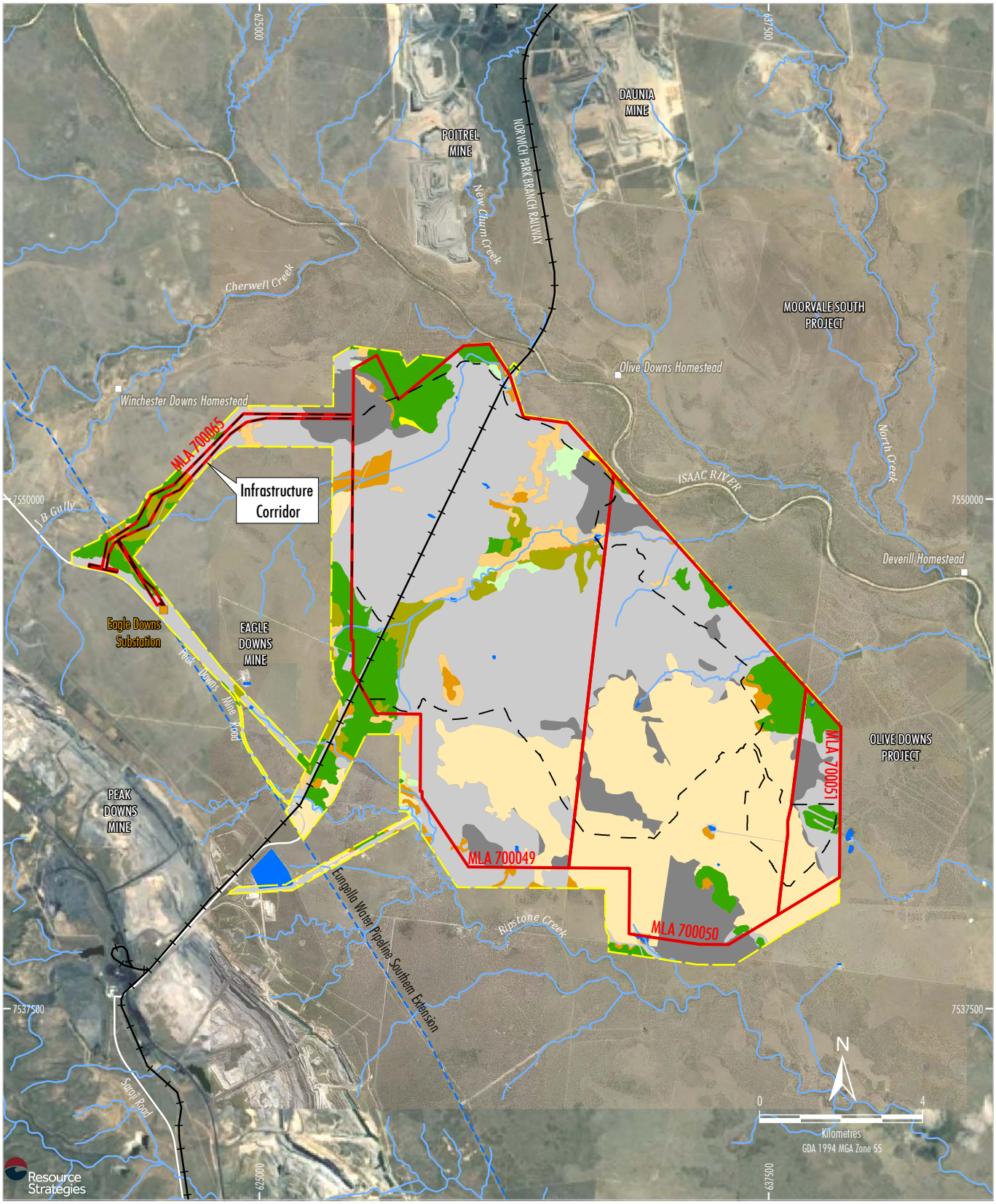
WINCHESTER SOUTH PROJECT

Threatened Fauna Species Records within the Project Locality

Figure 4-11b



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Railway
- Eungella Water Pipeline Southern Extension
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2019)
- Substation

Habitat Type

- 1 - Coolabah Wetland
- 2a - Eucalypt Woodland
- 2b - Mature Regrowth / Disturbed Eucalypt Woodland
- 3a - Brigalow +/- *Eucalyptus spp.* Woodland
- 3b - Mature Regrowth / Disturbed Brigalow +/- *Eucalyptus spp.* Woodland
- 3c - Brigalow Regrowth (<2m tall)
- 4 - Riparian Blue Gum Open Forest
- 5 - Native Grassland
- 6a - Pastureland without Gilgai
- 6b - Pastureland with Gilgai
- 7 - Farm dams

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

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WINCHESTER SOUTH PROJECT

Broad Fauna Habitat Types

Figure 4-12

Aquatic Habitat/Ecosystems

Waterways

The waterways within the Project area are generally ephemeral (i.e. dry for most of the year and flow for short periods during significant rain events) (Appendix E).

Several unnamed waterways (tributaries of the Isaac River) are within the Project area, including (Figure-4-9 and Appendix E):

- a northern unnamed waterway and its associated tributaries, the headwaters of which are crossed by the infrastructure corridor, and the downstream reach of which flows through MLA 700049;
- a central unnamed waterway and its associated tributaries, the headwaters of which flow through MLA 700049 and the downstream reach and downstream tributary which flow through MLA 700050; and
- a southern unnamed waterway and its associated tributaries, the headwaters of which originate just within MLA 700050 and MLA 700051.

Three waterways are located in the surrounding region of the Project, including the Isaac River which is located adjacent to (east of) the Project, Cherwell Creek which is located north of the Project, and Ripstone Creek, which is located south of the Project (Section 4.2.2).

Poor to fair aquatic habitat conditions were observed in the minor (low Strahler stream-order) 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 (Appendix E).

Better aquatic habitat conditions were observed in the major (higher stream order) waterways outside of the Project area (i.e. Cherwell Creek, Ripstone Creek and the Isaac River) with in-stream features observed in greater abundance, the presence of a variable substrate and moderate to high coverage of vegetation. Although bank and bed stability remained low to moderately disturbed due to cattle access and periodic high flows, the banks remain well vegetated with predominantly mature native vegetation (Appendix E).

These survey findings are consistent with frc environmental's (2012), which found erosion due to trampling from livestock at stream banks within MLA 700049, MLA 700050 and MLA 700051, with riparian vegetation mostly cleared along the unnamed waterways.

Wetlands

There are no RAMSAR protected wetland sites, nationally important wetland sites, or World Heritage areas within the Project area or vicinity (DAWE, 2020a).

Several State mapped lacustrine wetlands (wetlands associated with lakes) are mapped in the Project area and surrounds (DES, 2020d). These lacustrine wetlands were found to be man-made dams, either for agriculture or stock watering or mine water management (Appendix E).

ESP (2021) also assessed a number of other farm dams within the Study Area that are not mapped by DES (2020d). These farm dams were considered to meet the definition of a lacustrine wetland in accordance with the *Queensland Wetland Definition and Delineation Guideline – Part A: A Guide to Existing Wetland Definitions and the Application of the Queensland Wetlands Program* (DERM, 2011a).

Lacustrine wetlands identified during the field surveys were considered to provide low to moderate aquatic ecosystem value to aquatic flora and fauna (Plate 4-4) (Appendix E).

Plate 4-4 – Lacustrine Wetland within the Project Area (LW3), Upstream (October 2019)

Source: ESP (2021).

One palustrine wetland RE was identified within the Project area during the terrestrial ecology surveys. ESP (2021) assessed this patch of RE 11.3.3c (Plate 4-5) and considered that the RE technically meets the definition of a wetland as defined in DERM (2011a).

Plate 4-5 – Patch of RE 11.3.3c Palustrine Wetland within the Project Area

Source: E2M (2021).

However, the biodiversity values of this patch are considered to be largely terrestrial (i.e. provide limited aquatic values) due to the highly ephemeral nature of the inundation and the distance from the Isaac River, which would limit the aquatic connectivity of this wetland RE (Appendix E).

Several palustrine wetlands were identified in the vicinity of the Project area (Appendix E).

Aquatic Flora Species

No threatened aquatic flora species under the NC Act or the EPBC Act were recorded during the field surveys or were considered likely to occur in the vicinity of the Project based on known distribution and habitat preferences (Appendix E).

One introduced species of aquatic plant was recorded during the field surveys: White eclipta (*Eclipta prostrata*). White eclipta is not listed as a Weeds of National Significance or as an invasive plant under the *Biosecurity Act 2014*, and is considered naturalised across most of Queensland (Stephens & Dowling, 2002) (Appendix E).

Generally, aquatic plant diversity and coverage was low at most waterway (creek) and mapped palustrine wetland sites, with higher coverage and diversity at farm dam sites (Appendix E).

Aquatic Fauna

No listed threatened species aquatic fauna or flora species under the NC Act or the EPBC Act were recorded during the field surveys or were considered likely to occur in the vicinity of the Project based on known distribution and habitat preferences (Appendix E).

Fish

A total of 13 species of fish were recorded during field surveys from waterways and wetlands within the Study Area (Appendix E).

One pest species of fish was recorded, Mozambique Tilapia (*Oreochromis mossambicus*). Tilapia were recorded at most survey sites along the Isaac River and in two farm dams within the Project area.

Turtles

No threatened turtle species have been recorded in the vicinity of the Project (Atlas of Living Australia [ALA], 2020; Limpus *et al.*, 2011; frc environmental, 2012; ESP, 2021). The closest known records are from tributaries in the Connors River catchment in the Isaac River sub-basin approximately 80 km east north-east of the Project area (Appendix E).

Two species of turtles from one family (Chelidae) were recorded during field surveys; Krefft's River Turtle *(Emydura macquarii krefftii)*, and the Eastern Snake-necked Turtle (*Chelodina longicollis*), both listed as 'Least Concern' under the NC Act (Appendix E).

Platypus

No Platypus (*Ornithorhynchus anatinus*) were recorded during the field surveys, and no evidence of platypus (such as burrows) were observed within the Study Area (Appendix E).

Overall, given the habitat requirements of the species and its distributional range, it is considered unlikely that Platypus would occur in the waterways in the vicinity of the Project area (Appendix E).

Macroinvertebrates

Macroinvertebrates are animals that do not possess a spinal column and can be seen with the naked eye.

At each comprehensive aquatic ecology site that held sufficient water one AUSRIVAS sample (standard kick sweep method within a 10 m section [DNRM, 2001]) and replicated sampling (five replicate samples each within a 30 centimetre [cm] by 30 cm area) were taken.

A total of 23,857 individuals from 83 taxa were collected by ESP (2021). These communities were primarily dominated by several major groups across the majority of sites, including fly larvae, beetle larvae and freshwater snails.

No threatened macroinvertebrate species are known from the Fitzroy River basin and Isaac River sub-basin or were recorded in previous surveys completed on waterways and wetlands in the vicinity of the Project (frc environmental, 2012; DPM Envirosciences, 2018).

Macroinvertebrate communities were in low to moderate condition relative to those expected in the broader region, and results indicated that a range of external factors influenced communities at most sites (Appendix E).

Stygofauna

Stygofauna are subterranean aquatic fauna that live part of, or all of, their lives in groundwater systems (DES, 2018d).

No stygofauna were recorded within the Study Area (Appendix E).

Matters of State Environmental Significance

Table 4-8 lists MSES, as prescribed under the *Environmental Offsets Regulation 2014*, of relevance to the Project and are shown on Figure 4-13.

4.5.3 Potential Impacts

The following subsections evaluate the likely impacts of the Project on flora and fauna including MSES. Proposed measures to avoid and mitigate potential impacts on flora and fauna are provided in Sections 4.5.4 and 4.5.5.

Section 5 provides an assessment of impacts to MNES.

Direct Impacts

Land Clearance – Vegetation

The majority of the Project area consists of improved/disturbed pastures dominated by non-native grasses and *Acacia harpophylla* regrowth shrublands, which have a long history of cattle grazing and the original habitats have been subject to past clearance and modification (Appendix D). Some pockets of remnant vegetation remain, as well as areas of regrowth (Appendix D).

The Project would require the clearance of various patches of remnant vegetation (to a total of approximately 719.9 ha) over the life of the Project (Table 4-9).

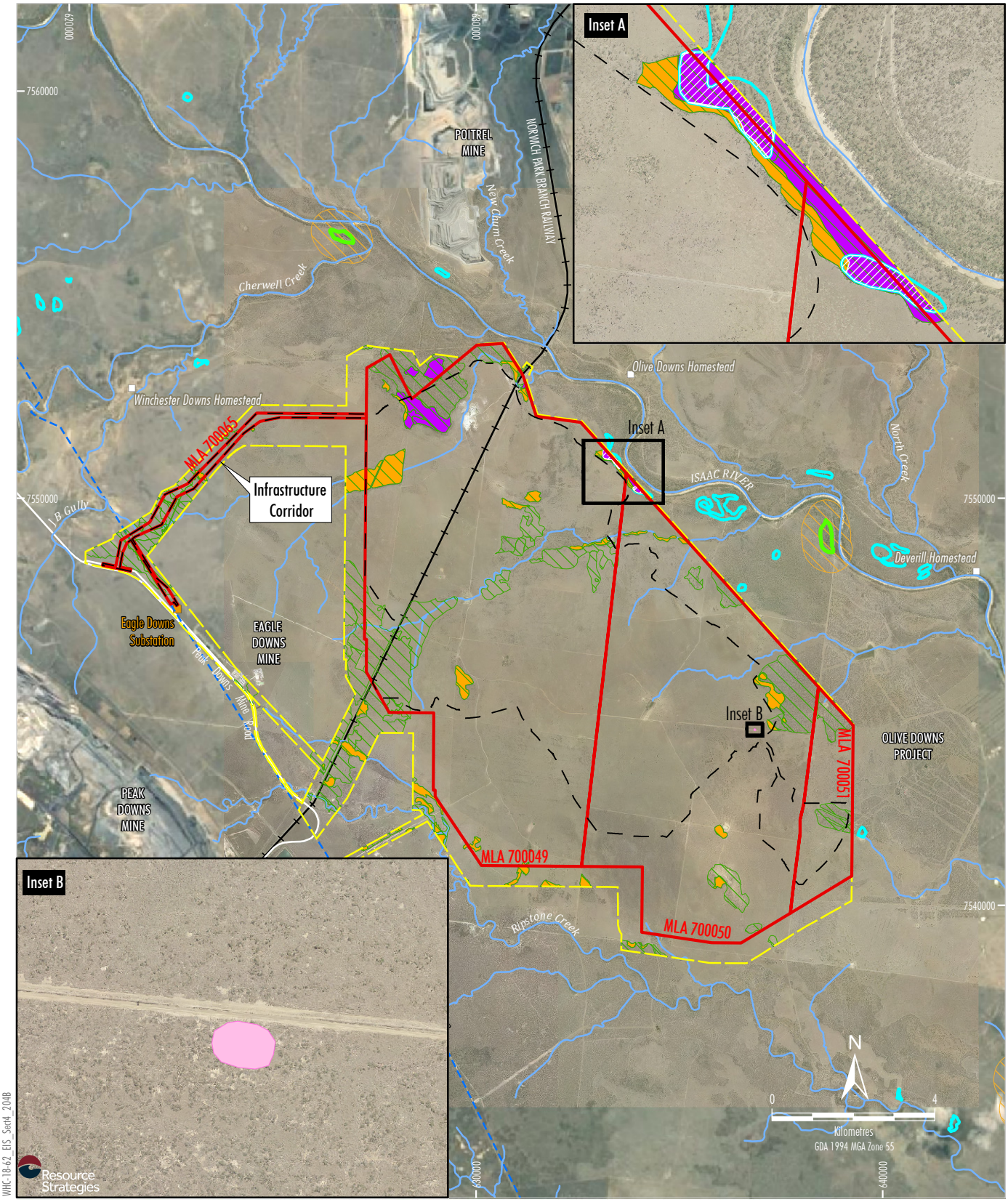
Native vegetation communities/regional ecosystems which would be cleared due to the Project occur more widely in the surrounding landscapes and subregions, less than 0.2% of the total remnant regional ecosystems within the Northern Bowen Basin and Isaac-Comet Downs subregions would be cleared by the Project (Appendix D).

Measures would be implemented by Whitehaven WS to avoid, mitigate and offset the impact of the Project on native vegetation, these are described in Section 4.5.4.

Land Clearance – Terrestrial Fauna Habitat

The native vegetation communities/REs proposed to be cleared for the Project comprise of the following fauna habitat types listed below (in order of abundance within the Project area) (Figure 4-12):

- approximately 4,220.9 ha of pastureland without gilgai (Habitat 6a);
- approximately 1,433.1 ha of brigalow regrowth (<2 m tall) (Habitat 3c);



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Terrestrial Ecology Study Area Boundary
- Railway
- Vegetation Management Watercourse/Drainage Feature Mapping (DES, 2020)
- Substation

Matters of State Environmental Significance

Regulated Vegetation

- Endangered Regional Ecosystem (11.3.1, 11.4.8, 11.4.9 and 11.9.5)
- Of Concern Regional Ecosystem (11.3.2, 11.3.3c and 11.3.4)
- Regional Ecosystem that Intersects a Mapped Vegetation Management Wetland
- Regional Ecosystem within the Defined Distance of a Vegetation Management Watercourse

Wetlands and Watercourses

- High Ecological Significance Wetland (DES, 2020)
- Vegetation Management Wetland Mapping (DES, 2020)
- Wetland Protection Area (DES, 2020)

Connectivity

- Remnant Vegetation

Protected Wildlife Habitat*

- *Solanum adenophorum* Habitat

**Note: The Protected Wildlife Habitat for species that are also Matters of National Environmental Significance (i.e. the Ornamental Snake, Squatter Pigeon, Koala and Greater Glider) are assessed and presented in Section 5, including Essential Habitat (Protected Wildlife Habitat for the Ornamental Snake).*

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

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WINCHESTER SOUTH PROJECT

Matters of State Environmental Significance (MSES) Relevant to the Project

Figure 4-13

Table 4-8
MSES of Relevance to the Project

MSES		Relevance to the Project
Regulated Vegetation	'Endangered' or 'Of Concern' regional ecosystem	The following Endangered or Of Concern REs occur in the Project area (Figure 4-13): ▪ RE 11.3.1 (Endangered); ▪ RE 11.4.8 (Endangered); ▪ RE 11.4.9 (Endangered); ▪ RE 11.9.5 (Endangered); ▪ RE 11.3.2 (Of Concern); ▪ RE 11.3.3c (Of Concern); and ▪ RE 11.3.4 (Of Concern).
	Regional ecosystem that intersects a mapped vegetation management wetland	**Not relevant** – No mapped Vegetation Management Wetlands occur in the Project are (Appendix D).
	Essential habitat	Essential habitat for the Ornamental Snake occurs in the Project area (Appendix D).
	Regional ecosystem within the defined distance of a vegetation management watercourse	Regional ecosystems within the defined distance of a vegetation management watercourse are present within the Project area (Figure 4-13).
Connectivity Areas		Remnant vegetation within the Project area has connectivity values (Appendix D) (Figure 4-13).
Wetlands and Watercourses		The Project area does not contain any wetlands within a wetland protection area or of High Ecological Significance, or any wetlands or watercourses in high ecological value waters (Figure 4-13) (Appendix E).
Designated Precinct in a Strategic Environmental Area		**Not relevant** – The Project area does not contain a designated precinct in a strategic environmental area.
Protected Wildlife Habitat	*Solanum adenophorum* (a herb)	Three individuals of *Solanum adenophorum* (listed as endangered under the NC Act) were observed within the Project area during field surveys (Appendix D).
	Ornamental Snake (*Denisonia maculata*)^	The Project area contains habitat for the Ornamental Snake (listed as vulnerable under the NC Act). The species was recorded 13 times within the Project area during both the 2019 and 2020 terrestrial ecology field surveys (Appendix D).
	Australian Painted Snipe (*Rostratula australis*)^	The Project area contains potential intermittent foraging habitat (gilgai soils and a wetland) for the Australian Painted Snipe (listed as endangered under the NC Act) (Appendix D). Although not recorded by E2M (2021) in the Study Area, the species was previously recorded along an unnamed drainage line in the northern extent of the Study Area (EcoSM, 2013).
	Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*)^	The Project area contains potential habitat for the Squatter Pigeon (southern subspecies) (listed as vulnerable under the NC Act) (Appendix D). The species was observed on a number of occasions within the Study Area, at a farm dam outside of the Project area (Appendix D).
	Koala (combined populations of Queensland, NSW and the ACT) (*Phascolarctos cinereus*)^	Remnant and regrowth woodland with food trees, considered to be suitable habitat for the Koala (listed as vulnerable under the NC Act), are present within the Project area. Evidence of the species (scats and scratches) was recorded at two locations within eucalypt dominated communities adjoining riparian areas outside the Project area (Appendix D).
	Greater Glider (*Petauroides volans*)^	Suitable eucalypt remnant and regrowth habitat for the Greater Glider (listed as vulnerable under the NC Act) is present within the Project area. E2M (2021) recorded the species within the Study Area, although outside the Project area.
Protected Areas		**Not relevant** – The Project area does not contain any protected areas.

Table 4-8 (Continued)
MSES of Relevance to the Project

MSES	Relevance to the Project
Highly Protected Zones of State Marine Parks	**Not relevant –** The Project area does not contain any highly protected zones of State marine parks.
Fish Habitat Areas	**Not relevant** – The Project area does not contain any area declared under the Fisheries Act to be a 'fish habitat area' (Appendix E).
Waterways Providing for Fish Passage	Waterways within the Project area provide for fish passage (Appendix E).
Marine Plants	**Not relevant** – The Project area does not contain any marine plants within the meaning of the Fisheries Act.
Legally Secured Offset Areas	**Not relevant** – The Project area does not contain any legally secured offset areas.

Source: Appendices D and E.

^ These species are also listed under the EPBC Act.

Table 4-9
Ground-truthed Regional Ecosystems

RE[#]	Description	Conservation Status[1]	Approximate Area within Project Area (ha)
BVG 16 – Eucalypt woodlands on alluvials			
11.3.3c	*Eucalyptus coolabah* woodland to open woodland (to scattered trees) with a sedge or grass understorey	OC	6.9
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	OC	39.8
BVG 17 – *Eucalyptus populnea/Eucalyptus melanophloia* woodlands on sandplains			
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	OC	9.6[A]
11.5.3	*Eucalyptus populnea +/- Eucalyptus melanophloia +/- Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	LC	111
11.9.2	*Eucalyptus melanophloia +/- Eucalyptus orgadophila* woodland on fine-grained sedimentary rocks	LC	167.1
BVG 25 – *Acacia harpophylla* woodlands on heavy clays			
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	E	64.5
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla or Acacia argyrodendron* on Cainozoic clay plains	E	2.4
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	E	23.1
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	E	17.7
BVG 30 – Tussock grasslands on forblands			
11.4.4	*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains	LC	112[B]
11.9.3	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks	LC	165.8[C]
Total			**719.9**

Source: E2M (2021).

Note: Totals may not add exactly due to rounding.

[#] REs are shown on Figure 4-9.

[1] Conservation status under the VM Act.

E Endangered

OC Of Concern

LC Least Concern

[A] Approximately 9.6 ha of RE 11.3.2 is also listed under the EPBC Act as E: Poplar Box TEC.

[B] Approximately 45.7 ha of RE 11.4.4 is also listed under the EPBC Act as E: Natural Grasslands TEC.

[C] Approximately 35.2 ha of RE 11.9.3 is also listed under the EBPC Act as E: Natural Grasslands TEC.

- approximately 426.3 ha of pastureland with gilgai (Habitat 6b);
- approximately 327.1 ha of eucalypt woodland (Habitat 2a);
- approximately 277.6 ha of native grassland (Habitat 5);
- approximately 244.9 ha of mature regrowth / disturbed brigalow +/- *Eucalyptus* spp. woodland (Habitat 3b);
- approximately 107.5 ha of brigalow +/- *Eucalyptus* spp. woodland (Habitat 3a);
- approximately 75.3 ha of mature regrowth / disturbed eucalypt woodland (Habitat 2b);
- approximately 7.8 ha of farm dams (Habitat 7); and
- approximately 7 ha of coolabah wetlands (Habitat 1).

Habitat Connectivity and Edge Effects

Edge effects occur when previously intact remnant vegetation is partially cleared, exposing a new boundary of vegetation for disturbance (Appendix D).

Habitat connectivity for the Project area and surrounds is low with a highly fragmented landscape and disturbance present throughout from historical clearing of native vegetation and cattle grazing (Appendix D). As such, E2M (2021) concluded that the Project is unlikely to materially increase the potential of edge effects in remaining vegetated areas as edge effects are likely to have already manifested (Appendix D).

There are no well-defined fauna movement corridors being impacted by the Project that would need to be retained, and the Project would be rehabilitated in a manner that results in the establishment of fauna habitat (patches of woodland in grassland) (Section 6.4 and Appendix D).

Furthermore, the majority of the Project area (approximately 59%, 4,220.9 ha) is pastureland without gilgai (Habitat 6a), containing little habitat value for fauna (Appendix D).

However, the Landscape Fragmentation and Connectivity tool was used to assess the Significance of Impact on connectivity areas as defined in the *Environmental Offsets Regulation 2014* (Appendix D). The assessment determined that the Project (including all its associated Actions) would result in a Significant Residual Impact on connectivity.

Appendix D provides further detail on edge effects and habitat connectivity.

Land Clearance – Aquatic Habitat

The Project would result in the removal of aquatic habitat comprising of three unnamed tributaries (drainage features), a patch of vegetated wetland (RE 11.3.3c) and six farm dams (Appendix E).

ESP (2021) concluded that the aquatic habitats to be removed are common and typical of the region, and the Project is not expected to significantly impact aquatic ecology on a regional scale (Appendix E).

Changes to Water Quality and Flow Regime

WRM (2021) assessed the potential for controlled releases and sediment dam overflows to impact on the water quality of the Isaac River and concluded that the Project is unlikely to have a measurable impact on the receiving water quality or environmental values as a result of sediment dam overflows. Further, WRM (2021) considered that controlled releases would have a negligible impact on Isaac River water quality.

The loss of catchment flows in the Isaac River and Ripstone Creek as a result of the Project would be indiscernible (Section 4.2.3). Therefore, the potential impact on water quantity in the Isaac River and Ripstone Creek due to the excision of catchment or the final landform is considered to be negligible (Appendix B).

Potential surface water quality and flow impacts as a result of the Project are described in Sections 4.1.3 and 4.2.3.

Based on the outcomes of the Surface Water and Flooding Assessment (WRM, 2021), impacts to aquatic ecosystems downstream of the Project area, or aquatic ecological values of the receiving environment, as a result of changes to water quality or flow regime are not expected (Appendix E).

Changes to Flood Regime

As described in Section 4.3.3, the results of flood modelling for the Project indicate that the Project would not result in any significant impacts on flow velocities in the Isaac River channel and floodplain.

Furthermore, there are no impacts on flood levels and velocities in Ripstone Creek, as the Project is located well outside of the Ripstone Creek floodplain (Section 4.3.3).

ESP (2021) concluded that impacts to aquatic flora and fauna are not likely to be significant in the context of impacts that already occur during significant flood events.

Groundwater Dependent Ecosystems

A detailed impact assessment for all potential GDEs is presented in Appendix F, and a summary of the impacts of the Project on potential GDEs is provided in Section 4.6.2.

The Project is not predicted to have any material impacts on potential or actual GDEs due to changes in groundwater quality or groundwater resources (Section 4.1.3).

Stygofauna

No stygofauna were detected during the surveys conducted by ESP (2021), consistent with previous studies conducted in the vicinity of the Project (DPM Envirosciences, 2018).

The unconsolidated sediments associated with the Isaac River alluvium (to the east of the Project) are considered to provide the most likely habitat for stygofauna (Appendix E).

The numerical groundwater modelling results indicate there would be negligible drawdown within the Isaac River alluvium due to the Project (Section 4.2.3).

Given the predicted impacts on the Isaac River alluvium would be negligible, it is considered unlikely that the Project would result in a significant impact to any stygofauna communities (if they were to occur) (Appendix E).

Indirect Impacts

Noise, Dust and Artificial Lighting

The Project would result in an increase in noise, dust, and artificial lighting within the surrounding landscape (Appendices D, G and H and Sections 4.7 and 4.8).

The landscape surrounding the Project is heavily cleared. Dust from the Project is unlikely to cause significant degradation to surrounding native vegetation given vegetation in the local area is already subjected to dust from exposed soils which have not led to any observed impacts on vegetation (Appendix D). Furthermore, it is also likely that seasonal rainfall in the locality would help wash dust from the vegetation and/or encourage new growth (Appendix D).

Noise emissions from mining operations and the CHPP are expected to be continuous and steady state in nature (Appendix G). Fauna that inhabit areas affected by construction and operational activities are predominantly common species that are more tolerant to some disturbance (Appendix D).

Any fauna within the local area are expected to exhibit initial fright behaviour and either adapt to disturbance levels or temporarily move to similar habitats in the adjacent landscape (Appendix D).

Vehicular Strike

Vehicular traffic associated with construction and operational activities due to the Project have the potential to lead to fauna injury or mortality (Appendix D).

There are no well-defined fauna movement corridors being impacted by the Project nor would the Project infrastructure corridor cross any waterways.

Measures to manage vehicle strike are described in Section 4.5.4.

Changes to Natural Fire Regimes

Accidental ignitions in the Project area may occur if not appropriately managed (e.g. from machinery or hot works). These ignitions have the potential to cause uncontrollable fires that can have pronounced impacts on vegetation and habitat within and adjacent to the Project area (Appendix D).

Mitigation and management measures would be implemented for the Project to reduce the potential for adverse changes in natural fire regimes (Section 4.5.4). As such, it is unlikely that the Project would increase the bushfire potential within the surrounding landscape (Appendix D).

Leaks and Spills

There is limited potential for groundwater contamination to occur with relation to workshops and fuel/chemical storage areas as each would be developed in accordance with current Australian Standards (e.g. adequate bunding and equipped for immediate spill clean-up) (Section 4.1.3).

Further, the PRA concluded that there is a 'low' risk of leaks and/or spills occurring during the life of the Project given the appropriate implementation of preventative and mitigation measures (e.g. surface water management plan, hazardous substances management, bunding of all chemical storage and use areas etc.) (Appendix N).

Where effective mitigation and management measures are in place, including management of hazardous chemicals and materials in accordance with Queensland and Commonwealth Government legislation or policy requirements (Section 2.5.11), the risk to the aquatic ecological values of the receiving environment is low (Appendix E).

Introduced Species

The presence and abundance of feral animals adversely impacts native fauna through increased competition for resources, predation and habitat degradation (Appendix D).

Introduced flora species disrupt ecosystems by outcompeting and replacing native species, resulting in an altered ecosystem diversity and function (Appendix D).

Mitigation and management measures would be implemented by Whitehaven WS to mitigate the potential increase of introduced species (Sections 4.5.4 and 4.14.3). As such, it is unlikely that the Project would result in an increase in weeds and feral animals within the surrounding landscape (Appendix D and E).

Cumulative

As described in Section 4.5.2, the majority of vegetation within Project area (approximately 6,408.6 ha, 90%) has been historically cleared in favour of livestock grazing and agriculture and exists in a non-remnant state (Appendix D).

The Project is located in a mining precinct comprising several existing and approved coal mining operations. In addition to potential cumulative impacts, these mining operations also have potential cumulative benefits in the form of offset areas.

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 (Appendix D).

The clearing for the Project would remove a further 719.9 ha of remnant vegetation (Table 4-9), representing approximately 0.2% of the remaining remnant vegetation, in the Northern Bowen Basin and Isaac-Comet Downs subregions (Appendix D).

The Project has been designed to avoid or minimise impacts to terrestrial environmental values, however, some residual impacts are likely. These residual impacts will be offset in accordance with the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c). Impacts to connectivity would be offset in accordance with the *Queensland Environmental Offsets Policy* (Section 4.5.5).

Offset areas to be established for the Project would also significantly increase the area of protected habitat that would be managed for conservation.

The Project is predicted to have a negligible cumulative impact on surface water and groundwater quality and quantity (Appendices A and B). As such, the Project is unlikely to result in a cumulative impact to the aquatic ecosystem resilience or aquatic flora and fauna of the Isaac River system, including floodplain wetlands, given the limited potential impacts associated with the Project and the mitigation and management measures summarised in Section 4.5.4 (Appendix E).

Matters of State Environmental Significance

A summary of potential significant residual impacts to the MSES identified in the Project locality (as described in Section 4.5.2) in accordance with the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (DEHP, 2014) is provided in Table 4-10.

Regulated Vegetation

Regulated vegetation associated with the Project include (Figure 4-13):

- 'Endangered' and 'Of Concern' regional ecosystems;
- regional ecosystems within the defined distance of a vegetation management watercourse; and
- essential habitat (in relation to the Ornamental Snake).

The clearance of regulated vegetation associated with the Project is outlined in Table 4-10. Impacts on regulated vegetation that are considered to be significant would be offset (Section 4.5.5).

Connectivity

Connectivity in the landscape is measured by the Landscape Fragmentation and Connectivity (LFC v1.6) tool designed by DES (2018c) (Figure 4-13).

The Landscape Fragmentation and Connectivity (LFC v1.6) tool determined that the Project is likely to have a significant residual impact on connectivity (Appendix D).

Protected Wildlife Habitat

The Project is considered to have a significant residual impact on the habitat associated with the following species, in accordance with DEHP (2014):

- *Solanum adenophorum*;
- Ornamental Snake;
- Squatter Pigeon (southern subspecies);
- Koala (combined populations of Queensland, NSW and the ACT); and
- Greater Glider.

All of the species, except *Solanum adenophorum*, are listed under both the NC Act and the EPBC Act and are assessed in Section 5.

Solanum adenophorum

Solanum adenophorum is a sprawling or prostate herb growing to approximately 0.3 m and is listed as Endangered under the NC Act. In Queensland the species has been recorded within the Dingo-Nebo-Clermont Areas as well as west and north-west of Rockhampton within *Acacia harpophylla* (Brigalow) and *Acacia cambargei* (Gidgee) woodland on deep cracking clays (Appendix D).

Three *Solanum adenophorum* individuals were recorded in a single location within the Project Area, associated with *Acacia harpophylla* shrubland on undulating clay plains. The species was recorded by E2M (2021) during the wet season surveys in 2019 and 2020 (Appendix D).

Potential habitat for *Solanum adenophorum* was observed within the Study Area, associated with both remnant and regrowth brigalow communities on clay plains. Approximately 0.2 ha of known habitat and 3,717.3 ha of potential habitat was mapped within the Study Area by E2M (2021) (Appendix D).

The Project would result in the removal of 0.2 ha of known *Solanum adenophorum* habitat and 1,487.2 ha of potential habitat within the Project Area. E2M (2021) concluded that this removal of habitat is considered to potentially lead to a long-term decrease in the size of a local population and would result in the Project having a likey significant residual impact on the species.

As such, in accordance with the *Queensland Environmental Offsets Policy Version 1.9* (DES, 2020c), significant residual impacts on *Solanum adenophorum* would be offset (Section 4.5.4 and 4.5.5).

Waterways for Fish Passage

The Project would result in the removal of portions of three unnamed ephemeral waterways mapped as low and moderate risk of adverse impacts to fish movements (Figure 4-14).

Based on the results of field surveys, these waterways are not considered to constitute, nor provide conduit to, fish habitat areas essential for the breeding and/or survival of native fish due to their ephemeral nature, limited connectivity, lack of important breeding, feeding or refuge areas (Appendix E).

ESP (2021) concludes that the impact to fish passage is considered insignificant and unlikely to have a measurable impact to aquatic ecology beyond the Project area.

Table 4-10
Likelihood of Significant Residual Impact on MSES

MSES			Total Area of Impact (ha)	DEHP (2014) Residual Significant Impact Test	Significant Residual Impact?
Regulated Vegetation	'Endangered' regional ecosystem	RE 11.3.1	64.5	Clearing exceeds 0.5 ha of a dense to mid-dense (structural category) regional ecosystem.	Yes
		RE 11.4.8	2.4		Yes
		RE 11.4.9	23.1		Yes
		RE 11.9.5	17.7		Yes
	'Of Concern' regional ecosystem	RE 11.3.2	9.6[1]	Clearing exceeds 2 ha of a sparse (structural category) regional ecosystem	Yes
		RE 11.3.3c	6.9		Yes
		RE 11.3.4	39.8		Yes
	Regional ecosystem within the defined distance of a vegetation management watercourse	RE 11.3.1	1.3	Clearing exceeds 0.5 ha of a dense to mid-dense (structural category) regional ecosystem. Clearing within 5 m of defining bank.	Yes
		RE 11.4.4	0.1[2]	Clearing does not exceed 5 ha where in a grassland (structural category) regional ecosystem.	No
		RE 11.9.3	3.1	Clearing within 5 m of defining bank.	No
	Essential habitat		1,834.2	As described in Section 4.5.2, the mapped known important habitat for the Ornamental Snake is considered to be essential habitat, as defined under the VM Act as the species was recorded in these areas and they contain suitable microhabitat features of which the species relies on (Appendix D). Assessment of whether impacts on essential habitat for the species are significant has been considered in the assessment of impacts on protected wildlife habitat for the Ornamental Snake.	Yes
Connectivity Areas			719.1	Application of the DES (2020e) *Environmental offset landscape connectivity assessment tool* determined that the Project is likely to have a significant impact on connectivity.	Yes
Protected Wildlife Habitat#	*Solanum adenophorum*		0.2	The Project is likely to result in a significant residual impact due to the potential long-term decrease in the size of the local population (Appendix D).	Yes
	Ornamental Snake (*Denisonia maculata*)[3]		1,834.2	The Project is likely result in a significant impact on the habitat associated with these endangered and vulnerable species (Refer to Section 5).	Yes
	Squatter Pigeon (southern subspecies) (*Geohaps scripta scripta*)[3]		261.2		Yes
	Koala (combined populations of Queensland, NSW and the ACT) (*Pharscolartos cinereus*)[3]		314.5		Yes
	Greater Glider (*Petauroides volans*)[3]		167.1		Yes
Waterways Providing for Fish Passage			N/A	Impacts on waterways that provide fish passage as a result of the Project are considered to be insignificant (Appendix E).	No

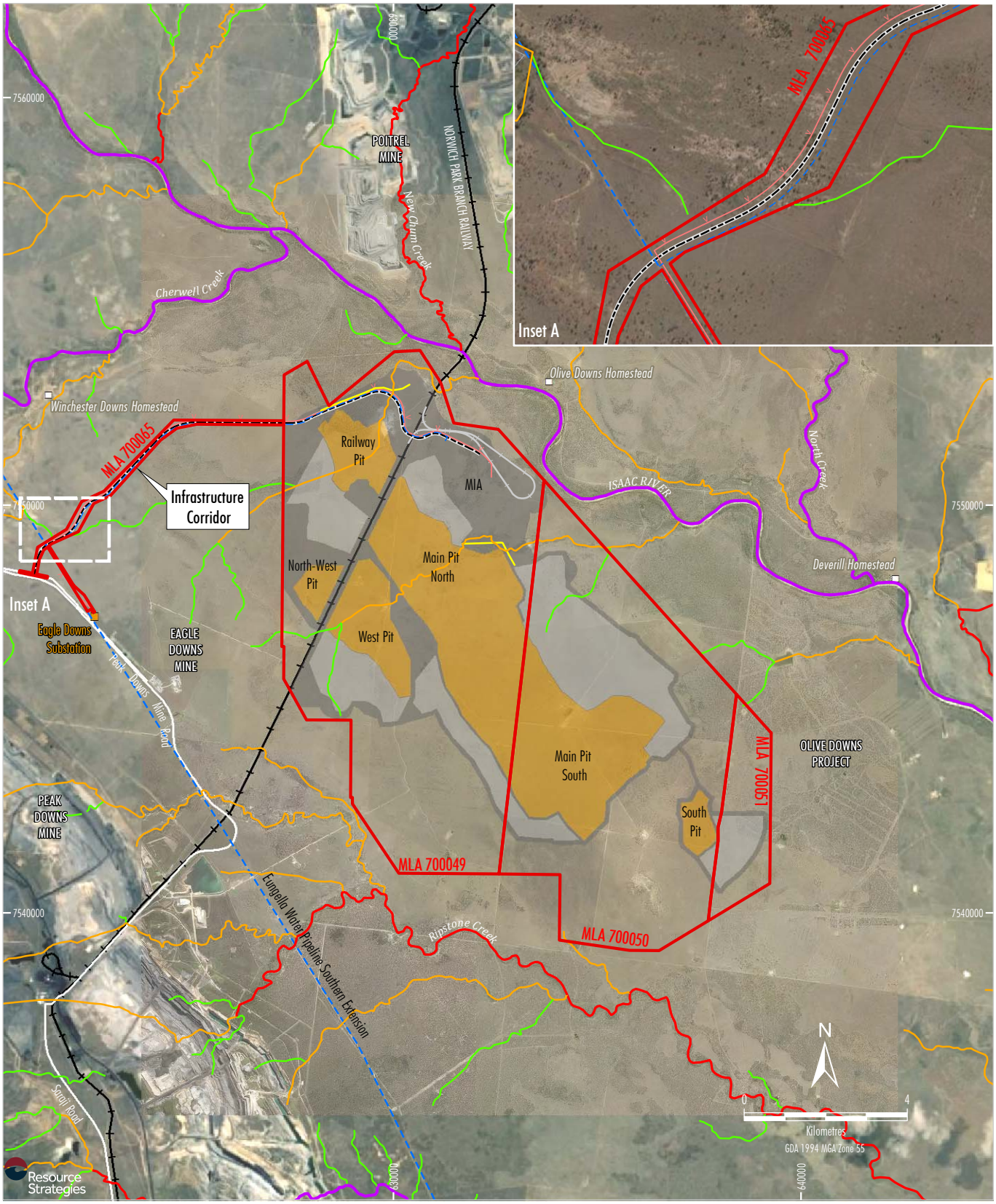
Source: Appendices D and E.

[1] The area associated with this MSES equates to the Poplar Box TEC under the EPBC Act (i.e. is also a MNES).

[2] The area associated with this MSES equates to the Natural Grasslands TEC under the EPBC Act (i.e. is also a MNES).

[3] This species is also listed under the EPBC Act (i.e. is also a MNES).

[#] The REs and species habitats overlap (i.e. the REs and species habitats are not mutually exclusive).



LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Waterways for Waterway Barrier Works (Fisheries Act, 1994)

- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Major

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

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

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Waterway Barrier Works as per the Fisheries Act, 1994

Figure 4-14

Cumulative Impacts – Matters of State Environmental Significance

The Project has been designed to avoid or minimise impacts to terrestrial and aquatic environmental values (Section 4.5.4), however, some residual impacts are likely. These residual impacts will be offset in accordance with the EPBC Act, EO Act, and the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c) and *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a).

The Project's impact on the environment is additive to that from past and present grazing, agriculture, rural/urban development, industrial and mining activities within the Northern Bowen Basin and Isaac Comet subregions. Evaluating the Project's impact on MSES on an incremental scale inclusive of other local and regional disturbances is often more realistic than assessing the Project impacts in isolation.

The change in potential cumulative impacts on MSES 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.

The Project is likely to impact the following MSES: protected wildlife habitat (Koala, Greater Glider, Squatter Pigeon, Ornamental Snake and *Solanum adenophorum*); essential habitat (Ornamental Snake) and regulated vegetation.

The cumulative impact on the MSES identified within the Project area was determined by comparing the Project's direct impact to the area of habitat present within the Northern Bowen Basin and Isaac-Comet subregions. The available habitat for each MSES was calculated across the Northern Bowen Basin and Isaac-Comet subregions using similar habitat definitions applied on the Project area.

Species profiles and listing advice were used to identify REs and Broad Vegetation Groups (BVGs) within both subregions that provide suitable habitat for relevant MSES. Where potential habitat occurred within mixed polygons, the relevant percentage from the *Regional Ecosystem Description Database Version 11.1* (Queensland Herbarium, 2019) was applied to estimate the area for each patch.

Based on the analysis of Project-specific disturbance and the available habitat/area in the region (Table 4-11), the Project is predicted to have negligible cumulative impacts on terrestrial flora and fauna (Appendix D).

Accurate and complete information on all approved and/or existing disturbance in the region is not publicly available. Therefore, Table 4-11 is limited to Project-specific disturbance and regional government mapping. Notwithstanding, any approved or existing disturbance would be required to be managed, mitigated, rehabilitated and/or offset under various relevant legislation and environmental approvals.

4.5.4 Avoidance and Mitigation Measures, Management and Monitoring

Measures to Avoid and Minimise Impacts

Although the location of the Project is determined by the presence of coal seams, Project elements have been located and designed to avoid or minimise potential biodiversity impacts where possible based on the outcomes of baseline survey work (Appendices D and E). Key measures to avoid or minimise impacts to vegetation and habitat, and fauna species include:

- Minimising the overall mine footprint by optimising backfilling of the open cut.
- Avoiding clearance of riparian vegetation associated with the Isaac River.
- Design of the Project to avoid the Brigalow TEC located adjacent to the Main Pit South out-of-pit waste rock emplacement.
- Design of the Main Pit South western out-of-pit waste rock emplacement to avoid disturbance of Ornamental Snake habitat.
- Avoiding creek crossings/waterways for the infrastructure corridor.
- Avoiding palustrine wetlands on the boundary of MLA 700049 and MLA 700050 and establishing a 50 m buffer from the two wetlands.
- Co-locating the mine access road, ETL and water pipeline within a single infrastructure corridor (where located within MLA 700065).

Where impacts cannot be avoided, Whitehaven WS proposes a suite of mitigation measures and management plans to assist with reducing potential adverse impacts due to the Project.

Table 4-11
Cumulative Impacts to Relevant MSES in the Locality

Relevant MSES		Potential Habitat Available within the Northern Bowen Basin and Isaac-Comet Subregions[1]	Winchester South Project Habitat Clearance	Winchester South Project Habitat Clearance Relative to Potential Habitat Available in the Subregions
Protected Wildlife Habitat	Ornamental Snake (*Denisonia maculata*)[2]	111,103 ha[3]	204.5 ha[3]	0.18%[3]
	Squatter Pigeon (southern subspecies) (*Geohaps scripta scripta*)[2]	431,721 ha	261.2 ha	0.06%
	Koala (combined populations of Queensland, NSW and the ACT) (*Pharscolartos cinereus*)[2]	1,052,403 ha	314.5 ha	0.03%
	Greater Glider (*Petauroides volans*)[2]	1,052,403 ha	167.1 ha	0.02%
	Solanum adenophorum	59,948 ha	0.2 ha	<0.01%
Essential Habitat	Ornamental Snake (*Denisonia maculata*)[2]	111,103 ha[3]	1,834 ha[4] / 204.5[3]	1.65%[4] / 0.18%[3]
Regulated Vegetation[5]	11.3.1 (Endangered)	28,593 ha	64.5 ha	0.23%
	11.4.8 (Endangered)	22,929 ha	2.4 ha	0.01%
	11.4.9 (Endangered)	23,855 ha	23.1 ha	0.10%
	11.9.5 (Endangered)	10,462 ha	17.7 ha	0.17%
	11.3.2 (Of Concern)	66,801 ha	9.6 ha	0.01%
	11.3.3c (Of Concern)	813 ha	6.9 ha	0.85%
	11.3.4 (Of Concern)	26,659 ha	39.8 ha	0.15%

1 Based on the REs identified as potential habitat on the Species Profile and Threats (SPRAT) Database (DAWE, 2020b).

2 This species is also listed under the EPBC Act (i.e. is also a MNES) and is discussed in Section 5.

3 Note regional mapping for the Ornamental Snake habitat has been based on REs associated with the species (DAWE, 2020b), and does not include consideration of habitat features, such as gilgai soils, which can be located within areas of non-remnant vegetation (approximately 85% of Ornamental Snake habitat within the Project area is located on gilgai soils within non-remnant vegetation). As such the Project habitat clearance presented provides a direct comparison to Ornamental Snake habitat in the subregions (i.e. based on remnant vegetation only).

4 Full Project clearance of Ornamental Snake habitat (i.e. including gilgai soils within non-remnant vegetation) for a conservative comparison.

5 Status under the *Vegetation Management Regulation 2012*.

Mitigation Measures

Mitigation measures proposed to be implemented for the Project relevant to MSES are summarised in below. Mitigation measures relevant to MNES are described in Sections 5.5.11, 5.6.8, 5.7.8 and Table 5-18.

Proposed MSES mitigation measures include:

- Boundaries of areas to be cleared and those not to be cleared would be defined during construction and operation (refer to vegetation clearance measures).
- Clearing of vegetation would be conducted progressively (refer to vegetation clearance measures).

Environmental Management Plans

Whitehaven WS would develop and implement environmental management plans outlining (amongst other things) vegetation clearing measures, weed management and monitoring, animal pest management. These environmental plans would include mechanisms for periodic review of implemented measures including their level of success and mechanisms to implement further management measures should success levels not be satisfactory.

The environmental management plans would be developed in accordance with the requirements of the relevant legislation and local strategic plans, including:

- the *Biosecurity Regulation 2016*;
- the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012); and
- the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

The environmental management plans would include the following measures related to biosecurity:

- identification of feral animal populations and weed infestations;
- strategies for preventing spread of feral animals (i.e. maintaining a clean, rubbish-free environment) and weeds (i.e. machinery wash-down, boot scrubbing facilities, appropriate disposal of weed material);
- prioritisation of treatment of weed infestations or weed species and ongoing treatment measures (as necessary);
- appropriately qualified persons would be engaged to undertake pest animal monitoring and recommended feral animal control strategies (e.g. baiting and trapping) and weed removal strategies (including those appropriate for aquatic habitats); and
- feral animal and weed monitoring protocols and follow-up control methods and protocols.

Vegetation Clearance Measures

A range of measures relating to vegetation clearance would be developed and implemented for the Project to reduce potential impacts on terrestrial ecology. These measures would include the following (Appendix D):

- Pre-clearance fauna surveys would be undertaken by suitably experience and qualified persons to identify individual fauna at direct risk from clearing activities.
- A suitably experienced and qualified fauna spotter/catcher would be present during the clearing of MSES and MNES habitat areas.
- Management of fauna identified during clearing and pre-clearance surveys would include relocating individuals to adjacent habitat or treating injuries.
- If a Koala is found, it would be left to move away from the clearance area on its own accord, if safe to do so.
- Boundaries of areas to be cleared, and those not to be cleared would be clearly defined during clearing activities.
- Select habitat features (e.g. hollow-bearing trees, woody debris, logs and rocks) would be salvaged for re-use in rehabilitation of the Project.
- Land clearing would be carried out progressively over the life of the Project to allow mobile fauna species the opportunity to disperse away from clearing areas.
- Directional clearing towards retained vegetation would be undertaken where practical to enable the movement of fauna into retained vegetation.
- During construction works, work areas and excavations (trenches) would be checked for fauna that may have become trapped.
- If trenches remain open after daily site works have been completed, fauna ramps would be put in place.

Authorities Required under State Legislation

Development of the Project is predicted to result in disturbance of animal breeding places. Whitehaven WS will prepare a species management program in accordance with section 335 of the NC Animals Regulation for approval by the DES prior to undertaking any activities that would disturb animal breeding places (Section 1.7).

In addition, a protected plant clearing permit is required to clear *Solanum adenophorum* (Section 1.7.2).

Rehabilitation

In accordance with the *Mined Land Rehabilitation Policy* (DEHP, DNRM and Queensland Treasury, 2017), the Project would be progressively rehabilitated as land becomes available.

General rehabilitation practices and measures that would be implemented for the Project are described in Section 6.4. These would include salvaging select habitat features (e.g. hollow-bearing trees, woody debris, logs and rocks) for use in rehabilitation to establish habitat for fauna.

Preliminary rehabilitation milestones and completion criteria, including monitoring and reporting activities are described in Section 6.6.

Weed and Feral Animal Management

Whitehaven WS would implement weed and pest management measures for the Project through an Environmental Management Plan. The Environmental Management Plan would outline various management measures for both weeds and feral animals identified at the Project (Appendices D and E).

Weed Management

During the life of the Project, the following management measures would be implemented, to mitigate the abundance and species of weeds in the Project area and surrounds and minimise the potential for weeds to spread into adjacent areas:

- Bi-annual surveying of tracks, revegetation (rehabilitation) areas and soil stockpiles, etc. (or more frequently as required), to identify weeds requiring control.
- Washdown of machinery and vehicles when moving to/from weed infested areas.
- Mechanical removal of identified weeds and/or the application of approved herbicides.
- Weed control methods in accordance with those specified by the DAF and the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

Feral Animal Management

During the life of the Project, the following feral animal management measures would be implemented (Appendix D):

- Maintaining a clean, rubbish-free environment to deter feral animals.
- Engaging appropriately qualified persons to undertake biannual pest animal monitoring in the Project mining lease areas, which may include coordination with adjoining mining operations/adjacent landowners.
- Feral animal control strategies (e.g. baiting and trapping) within the Project mining lease areas in accordance with relevant standards and the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

Section 4.14.4 provides further information regarding feral animal management measures.

Vehicle Strike

Whitehaven WS would implement management measures to reduce impacts to fauna species due to vehicular strike such as (Appendix D):

- designating speed limits for the Project area;
- developing a process for the removal of roadkill to minimise the risk of attracting fauna to the roadway; and
- developing a process for the management of fauna injured by vehicle strike.

Bushfire Management

Bushfire prevention and management measures for the Project would be undertaken consistent with those described in Section 4.13.4.

Receiving Environment Management Program

As described in Section 4.1.4, a REMP would be developed for the Project in accordance with the *Guideline - Model mining conditions* (DES, 2017a). The REMP would be implemented to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity.

Environmental Authority

The environmental authority for the Project would include reporting requirements for impacts to MSES and offset conditions, including monitoring and auditing requirements for rehabilitation. This is described further in Section 7.

Other Measures

Other measures Whitehaven WS would implement, which are relevant to reducing potential indirect impacts on biodiversity, include those relating to noise and air quality as described in Sections 4.7.4 and 4.8.4.

Furthermore, Whitehaven WS would implement artificial lighting in accordance with Australian Standards, and in a way that focuses on disturbance/work areas and minimises/avoids lighting of remnant vegetation (Appendix D).

4.5.5 Offset Management Strategy

Measures that are proposed to avoid and mitigate impacts from the Project on terrestrial and aquatic flora and fauna are described in Section 4.5.4 (MSES) and Section 5 (MNES).

The Project biodiversity Offset Management Strategy has been developed to address the potential residual impacts on biodiversity values associated with the Project in accordance the following Acts and policies:

- the EPBC Act;
- the EO Act;
- the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c); and
- the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a) (and supporting *Offsets Assessment Guide* [DSEWPaC, 2012b]).

Where the Project would result in a significant residual impact, Whitehaven WS would provide an environmental offset. The offset summarised below is based on a land-based proposal driven offset, however in practice the offset may be satisfied in combination with a financial settlement offset.

Attachment 5 of this EIS presents the biodiversity Offset Management Strategy for the Project.

Offsets would be established for the Project in stages, in accordance with the *Queensland Environmental Offsets Policy (Version 1.9)* (DES, 2020c), accounting for the progressive disturbance of the Project. Attachment 5 presents the disturbance associated with each of the proposed offset stages and incudes a breakdown of all potential MNES and MSES.

The extent of disturbance associated with each of the offset stages is illustrated on Figure 4-15.

The Project's Stage One Offset provides for disturbance associated with construction and operational activities up to and including approximately Project Year 9, with some additional areas allowing for operational flexibility.

4.6 GROUNDWATER DEPENDENT ECOSYSTEMS

4.6.1 Methodology and Environmental Objectives

The Integrated Assessment of Impacts on Groundwater Dependent Ecosystems (Appendix F) sources information and technical assessment of GDEs from the following assessments:

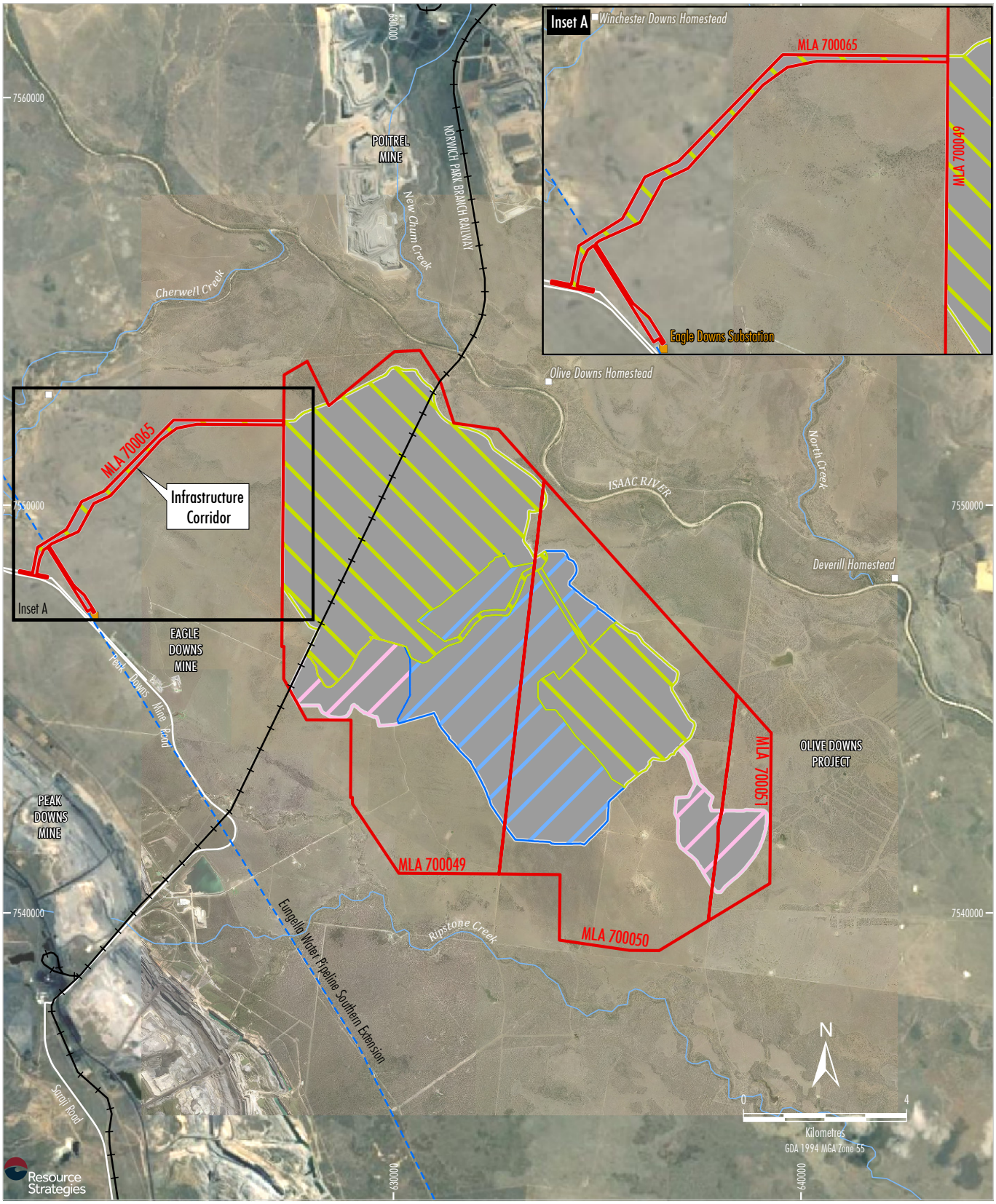
- Groundwater Assessment prepared by SLR (Appendix A);
- Surface Water and Flooding Assessment prepared by WRM (Appendix B);
- Terrestrial Ecology Assessment prepared by E2M (Appendix D); and
- Aquatic Ecology and Stygofauna Assessment prepared by ESP (Appendix E).

The Integrated Assessment of Impacts on Groundwater Dependent Ecosystems has been prepared to provide a detailed, consolidated assessment of the potential impacts of the Project on GDEs (Appendix F).

The relevant environmental objectives as stated in the Terms of Reference for flora and fauna, and therefore GDEs, are that the Project be operated in a way that:

> *Biodiversity including matters of state environmental significance are identified and appropriately safeguarded to support healthy and resilient ecosystems and ensure the sustainable, long-term conservation of biodiversity and the social, economic, cultural and environmental benefits it provides.*

A description of baseline data and the identification of potential GDEs in the vicinity of the Project is provided in Section 4.6.2. Section 4.6.2 also describes the potential impacts of the Project on GDEs and Section 4.6.3 outlines the proposed mitigation measures, management and monitoring.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Substation

Disturbance Associated with Offset Stages*

- Disturbance for Offset Stage 1
- Disturbance for Offset Stage 2
- Disturbance for Offset Stage 3

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.*

- The entirety of the Electricity Transmission Line (EPBC 2019/8458), Water Pipeline (EPBC 2019/8459), and the Access Road component of the Mine Site and Access Road (EPBC 2019/8460) is contained within the Disturbance Associated with Offset Stage 1.

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

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Biodiversity Offset Staging

Figure 4-15

4.6.2 Description of Environmental Values and Potential Impacts

GDEs are ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis for maintenance of the ecosystem (Richardson *et al.*, 2011). GDEs are classified by Doody *et al.* (2019) into three broad types:

- aquifer and cave ecosystems (i.e. subterranean GDEs);
- ecosystems dependent on the sub-surface presence of groundwater (i.e. terrestrial GDEs, including some riparian vegetation communities); and
- ecosystems dependent on the surface-expression of groundwater (i.e. aquatic GDEs).

GDEs can require access to groundwater on a permanent (obligate) or intermittent (facultative) basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services (Doody *et al.*, 2019).

Obligate GDEs are made up of species that depend entirely on the groundwater (Doody *et al.*, 2019). Obligate GDEs tend to occupy areas of the landscape that optimise access to groundwater, such as on or below the lower banks of waterways. Species with an obligate dependence on groundwater may not require access to groundwater at all times; however, in order to survive long periods of drought, access to groundwater is essential (Appendix D).

Facultative GDEs are those that use groundwater optionally or opportunistically rather than solely (Doody *et al.*, 2019). Facultative GDEs can utilise groundwater when it is available; however, will survive without it (Eamus *et al.*, 2006). Facultative groundwater dependent species are usually located on the upper banks and floodplains of waterways (Eamus *et al.*, 2006; Roberts and Marston, 2000).

A review of desktop (BoM, 2020b) and site-specific data was undertaken to characterise the potential aquatic and terrestrial GDEs and stygofauna (Appendix F). Detailed descriptions of the site-specific data collected for the Project and the identification of GDEs and stygofauna in the vicinity of the Project are provided in Appendices A, B, D and E, and are summarised in Appendix F.

Representative examples of the potential aquatic and terrestrial GDEs identified within the vicinity of the Project are shown in Figure 4-16.

A detailed impact assessment for all potential GDEs is presented in Appendix F, and a summary of the impacts of the Project on potential GDEs is provided below.

The aquatic in-stream ecosystems associated with the Isaac River and Cherwell Creek are largely not dependent on the surface-expression of groundwater. The wetlands and farm dams in the locality are not likely to be aquatic GDEs (Appendix F).

Groundwater modelling for the Project indicates that there would be negligible increased leakage from surface flows of the Isaac River to the underlying alluvium (Appendix A). Therefore, impacts to surface flows and subsequently aquatic ecosystems downstream of the Project are not expected (Appendix F).

Any dependency on groundwater for riparian vegetation associated with the Isaac River and Cherwell Creek is likely to be facultative (i.e. intermittent) during dry times (Appendix F).

Groundwater modelling for the Project indicates that there would be negligible drawdown in the alluvium along the Isaac River and Cherwell Creek, as well as no impacts to groundwater quality (Appendix A). Therefore, there would be no adverse impacts to riparian vegetation associated with the Isaac River and Cherwell Creek (Appendix F).

Any dependency on groundwater for riparian vegetation surrounding ephemeral wetlands is likely to be facultative. These ephemeral wetlands are not likely to be aquatic GDEs as these wetlands do not receive groundwater discharge; rather, the clay-rich substrates of these wetlands are likely to hold surface water runoff for extended periods (Appendix F).

Further, as there would be no impacts on groundwater quality and resources, there would be no adverse impacts to riparian vegetation surrounding these ephemeral wetlands (Appendix F).

Any dependency on groundwater is likely to be facultative for the woodland vegetation dominated by RE 11.3.2 on the floodplains on the Isaac River, Ripstone Creek and Cherwell Creek (Appendix F).

Wet Season Survey

Plate 1: Isaac River Site I1
(Outside of Project Area)

Plate 3: Palustrine Wetland Site PW4
(Outside of Project Area)

Plate 5: Lacustrine Wetland Site LW3
(Farm Dam within Project Area)

Dry Season Survey

Plate 2: Isaac River Site I1
(Outside of Project Area)

Plate 4: Palustrine Wetland Site PW4
(Outside of Project Area)

Plate 6: Lacustrine Wetland Site LW3
(Farm Dam within Project Area)

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Resource Strategies

Source: ESP (2021).

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Representative Potential Aquatic and Terrestrial GDEs

Figure 4-16

There would be no impacts to vegetation on the Isaac River, Ripstone Creek and Cherwell Creek floodplains (outside of wetlands) that may access water from the alluvium, as groundwater modelling for the Project indicates that there would be negligible drawdown to the alluvium and no changes to groundwater quality within the alluvium (Appendix F).

The Project would result in a predicted drawdown of up to 5 m in the regolith below the woodland vegetation mapped as a low potential terrestrial GDE to the north of the Project. Outside the alluvium, it is unlikely that these woodland patches would be dependent on groundwater due to the poor quality (high salinity) of the groundwater source (i.e. associated with the regolith). Therefore, a predicted drawdown of up to 5 m below the woodland to the north of Project is unlikely to have any material impacts on this woodland vegetation (Appendix F).

In summary, the Project is not predicted to have any material impacts on potential or actual GDEs due to changes in groundwater quality or groundwater resources (Appendix F).

4.6.3 Mitigation Measures, Management and Monitoring

Whitehaven WS would implement a range of mitigation measures, management and monitoring for water quality, water resources (e.g. flow, level, availability) and flora and fauna for the Project as described in Sections 4.1.4, 4.2.2 and 4.5.4. However, based on the detailed assessment (Appendix F), monitoring of potential or actual GDEs is not warranted nor necessary (Appendix F).

4.7 NOISE AND VIBRATION

4.7.1 Methodology, Environmental Objectives and Performance Outcomes

A Noise and Vibration Assessment for the Project was undertaken by Renzo Tonin & Associates (2021) and is presented as Appendix G.

Section 4.7.2 provides a description of the environmental values and assessment criteria. Section 4.7.3 provides a description of the potential impacts based on the modelling results. Section 4.7.4 outlines the proposed mitigation measures, management and monitoring for the Project.

Noise Measurement

The assessed noise levels presented in Appendix G and summarised in this section are typically expressed in A-weighted decibels (dBA). The logarithmic dBA scale simulates the response of the human ear, which is more sensitive to mid to high frequency sounds and relatively less sensitive to low frequency sounds. Table 4-12 provides information on common noise sources in dBA for comparative reference.

Measured or predicted noise levels are expressed as statistical noise exceedance levels (L_{AN}), which are the levels exceeded for a specified percentage of the interval period. For example, L_{A10} is the noise level that is exceeded for 10% of the sampling period and is also considered to be the average maximum noise level.

The equivalent continuous noise level (L_{Aeq}) refers to the steady sound level, which is equal in energy to the fluctuating levels recorded over the sampling period.

The environmental objectives relevant to noise and vibration, as described in the Terms of Reference for the Project, include:

> *The environmental objective to be met under the EP Act is that the activity will be operated in a way that protects the environmental values of the acoustic environment.*

Table 4-12
Relative Scale of Various Noise Sources

Noise Level (dBA)	Relative Loudness	Common Indoor Noise Levels	Common Outdoor Noise Levels
110 to 130	Extremely noisy	Rock band	Jet flyover at 1,000 m
100	Very noisy	Internal demolition work (jackhammer)	Petrol engine lawn mower at 1 m
90	Very noisy	Food blender at 1 m	Diesel truck at 15 m
80	Loud	Garbage disposal at 1 m, shouting at 1 m	Urban daytime noise
70	Loud	Vacuum cleaner at 3 m, normal speech at 1 m	Commercial area heavy traffic at 100 m
60	Moderate to quiet	Large business office	-
50	Moderate to quiet	Dishwasher next room, wind in trees	Quiet urban daytime
40	Quiet to very quiet	Small theatre, large conference room (background), library	Quiet urban night-time
30	Quiet to very quiet	Bedroom at night, concert hall (background)	Quiet rural night-time
20	Almost silent	Broadcast and recording studio	-
0 to 10	Silent	Threshold of hearing	-

Source: United States Department of the Interior (1994) and Richard Heggie Associates (1995).

The Project would achieve the following performance outcomes as identified in Part 3 of Schedule 8 of the EP Regulation:

> *2 The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.*

4.7.2 Description of Environmental Values

Acoustic Quality Objectives

Potential noise and vibration emissions generated by the Project and the applicable noise objectives/criteria are described below.

Renzo Tonin & Associates (2021) has identified a range of legislation, policy, guidelines and standards relevant to identifying values and managing potential noise and vibration impacts of the Project. These include:

- the EP Act;
- the EP Regulation;
- the Noise EPP;
- the *Guideline – Model mining conditions* (DES, 2017a);
- the *Guideline – Application requirements for activities with noise impacts* (DES, 2017c);
- *EcoAccess Guideline – Planning for Noise Control Guideline* (DEHP, 2016a);
- *EcoAccess Guideline for the Assessment of Low Frequency Noise* (Queensland Environmental Protection Agency, 2004); and
- *Interim Guideline – Operational Railway Noise and Vibration* (DTMR, 2019).

Operational Noise

Mobile equipment and fixed plant used for the Project would generate operational noise.

Acoustic quality objectives for sensitive receptors are detailed in Schedule 1 of the Noise EPP. The objectives are aimed at protecting the qualities of the acoustic environment that are conducive to human health and wellbeing for individuals to sleep, study or learn and be involved in recreation, including relaxation and conversation.

These are provided in the form of both outdoor and indoor levels for the daytime and evening, and indoor noise levels for the night-time for residences.

In addition to the acoustic quality objectives specified in Schedule 1 of the Noise EPP, section 9 of the Noise EPP states the following:

> *(2) To the extent it is reasonable to do so, noise must be dealt with in a way that ensures –*
>
> *(a) the noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and*
>
> *(b) background creep in an area or place is prevented or minimised.*

…

***Background creep**, for noise in an area or place, means a gradual increase in the total amount of background noise in the area or place as measured under the document called the 'Noise measurement manual' published on the department's website.*

DES's *Guideline – Model mining conditions* (DES, 2017a) provides a different method for determining noise criteria based on background noise levels.

Renzo Tonin & Associates (2021) notes application of the various applicable sections of the Noise EPP and DES's *Guideline – Model mining conditions* (DES, 2017a) results in differing acoustic quality objectives/noise limits for operational noise.

Renzo Tonin & Associates (2021) has therefore adopted noise limits based on the background creep noise limit determined in a recent Land Court of Queensland judgement. These noise limits are presented below and are consistent with the noise limits for the evening and night-time periods adopted for the approved Olive Downs Project, which adjoins the Project.

Sleep Disturbance

The *EcoAccess Guideline – Planning for Noise Control Guideline* (DEHP, 2016a) provides a sleep disturbance criterion for the night-time period (Appendix G).

This criterion has been converted from indoor (45 dBA maxL_p [maximum instantaneous noise level]) to outdoor, assuming partially closed windows, consistent with standard practice.

Low Frequency Noise

The *EcoAccess Guideline for the Assessment of Low Frequency Noise* (Queensland Environmental Protection Agency, 2004) provides guidance regarding the assessment of low frequency noise, including a low frequency noise criterion (Appendix G).

Road Noise

DTMR's *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* (DTMR, 2013) provides a noise limit at sensitive receptors for existing roads and road upgrades (Appendix G).

Rail Noise

The *Interim Guideline – Operational Railway Noise and Vibration* (DTMR, 2019) details operational railway noise criteria for airborne noise from railway activities (train movements) (Appendix G).

Adopted Noise Limits

The relevant external noise limits that have been adopted for the Project based on the Noise EPP, the other relevant guidelines and noise assessment outcomes for other projects described above are provided in Table 4-13. In addition, the Coordinator-General described the operational noise limits for the evening and night-time periods as stringent (Appendix G).

Table 4-13
Noise Limits Adopted for the Project

Category	Time Period	Noise Limit
Operational noise	Day	40 dBA $L_{Aeq, adj, 15min}$
	Evening	35 dBA $L_{Aeq, adj, 15min}$
	Night	35 dBA $L_{Aeq, adj, 15min}$
Sleep disturbance	Night	52 dBA maxL_p
Low frequency noise	All periods	55 dBZ
Road traffic noise	6 am to midnight	68 dBA $L_{eq, 18\ hour}$
Rail noise	All periods	65 dBA $L_{Aeq, 24\ hour}$ 87 dBA maxL_p

Source: After Appendix G.
Day (7.00 am to 6.00 pm), Evening (6.00 pm to 10.00 pm) and Night (10.00 pm to 7.00 am).
dBZ = Z-weighted decibels.

Blasting

Overpressure (or airblast) is reported in linear decibels (dBL) and is the measurable effect of a blast of air pressure, including generated energy that is below the level of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in millimetres per second (mm/s).

DES's *Guideline – Model mining conditions* (DES, 2017a) provides overpressure and vibration limits (Appendix G). These limits are presented in Table 4-14.

Blasting would generally be limited to the hours of 7.00 am to 6.00 pm and would generally not take place on public holidays.

Table 4-14
Overpressure and Vibration Limits Adopted for the Project

Blasting Emission	Blast Overpressure and Vibration Limits	
	7.00 am to 6.00 pm	6.00 pm to 7.00 am
Overpressure	115 dBL Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dBL Peak at any time	Either no blasting, or limits justified by proponent no less stringent than the limits for 7.00 am to 6.00 pm
Vibration (peak particle velocity)	5 mm/s peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/s peak particle velocity at any time	Either no blasting, or limits justified by proponent no less stringent than the limits for 7.00 am to 6.00 pm

Source: Appendix G.

Existing Noise Environment

Two unattended noise loggers were deployed in September 2019 to measure the existing background noise levels in the vicinity of the Project. Long-term unattended noise monitoring was also previously conducted in August 2017[1] at two sensitive receptors located south-east and east of the Project, for a period of nine days (Appendix G).

A summary of the representative background levels determined from the unattended noise monitoring is provided in Table 4-15. The indicative locations of the noise loggers are provided on Figure 4-17.

Further detail regarding baseline noise monitoring, including monitoring locations and ambient noise levels recorded at each of the noise monitoring sites is presented in Appendix G.

Table 4-15
Representative Background Noise Levels

Logger	L_{A90} (dBA)		
	Day	Evening	Night
L1[1]	29	27	27
L2	28	25	27
L3	30	24	19
L4	25	20	20

Source: After Appendix G.

L_{A90} = A-weighted noise exceeded by 90% for the measurement period.

[1] Access to the Olive Downs Homestead was not available for baseline data. Background noise levels were measured approximately 450 m from the homestead, closer to the Project (Figure 4-17). Renzo Tonin concluded the noise to be indicative of the acoustic environment at the dwelling.

Sensitive Receptors

There are four sensitive receptors in the vicinity of the Project[2]. These sensitive receptors are all relatively isolated rural homesteads in an existing agricultural/mining environment.

Each of the sensitive receptors are shown on Figure 4-17.

4.7.3 Potential Impacts

Operational Noise

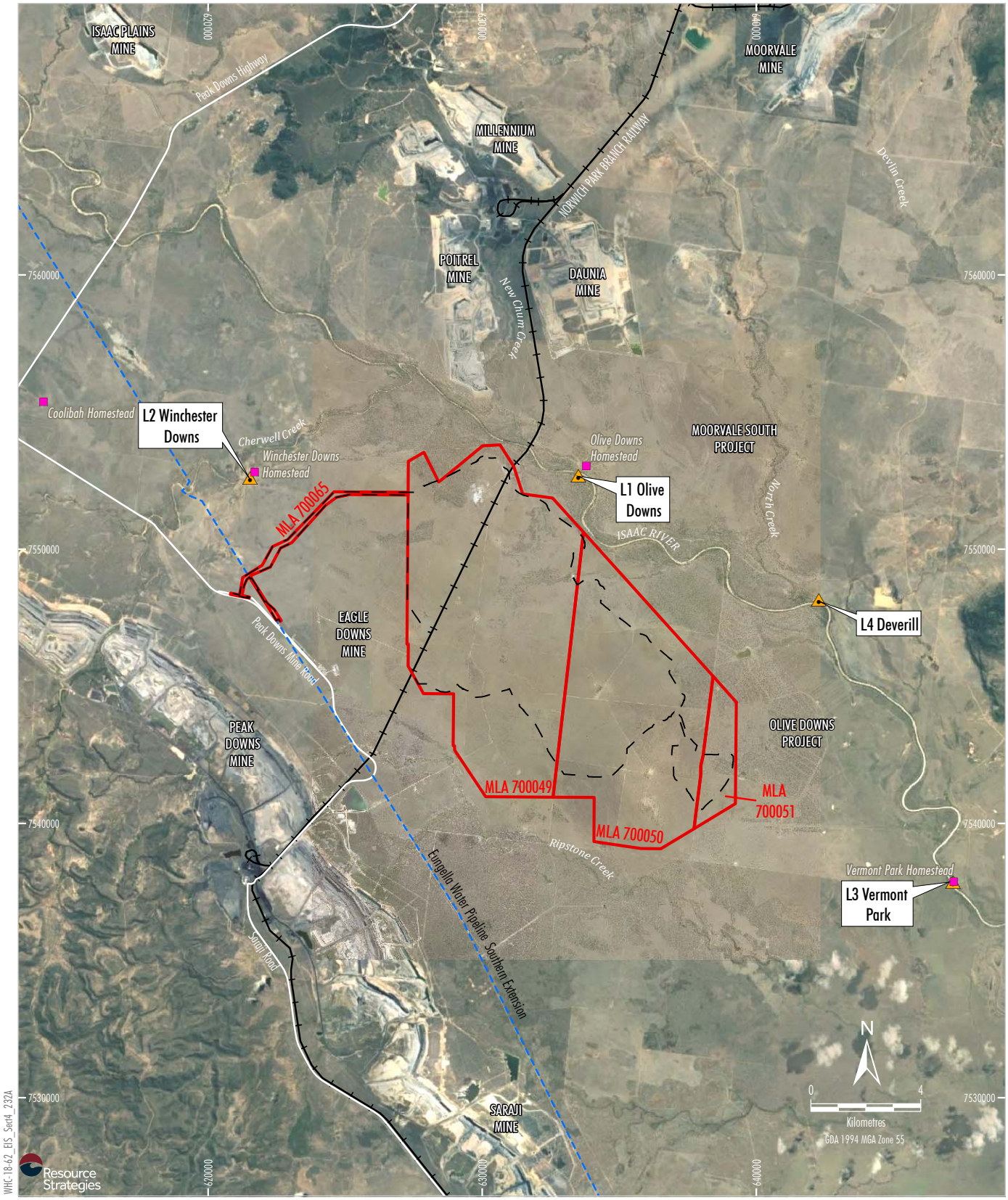
Noise Modelling

An acoustic model was developed that simulates the components of the Project using noise source information (i.e. sound levels and locations) and predicts noise levels at relevant receptor locations. The model considers meteorological effects, terrain and noise attenuation (Appendix G).

Modelled mobile equipment and fixed plant noise levels are provided in Appendix G.

[1] There has been no change in the level of activity nearby to the homesteads present at the time the monitoring was undertaken in 2017, as such it is not expected that there would be any difference in the noise levels in the monitoring were undertaken in 2019.

[2] The owner of the Deverill rural property (a neighbouring mining company) has indicated that the Deverill Homestead does not need to be considered as a sensitive receptor for the purpose of potential noise, blasting and air quality impacts associated with the Project.



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Eungella Water Pipeline Southern Extension
- Railway
- Sensitive Receptor
- Noise Monitoring Location

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2021). Orthophoto: Google Image (2019); Whitehaven (2017).

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Noise Monitoring and Sensitive Receptor Locations

Figure 4-17

Potential noise impacts were assessed for Project Years 5, 9, 19 and 27. These scenarios were selected in consideration of the scale of mining operations in each year of the Project, the number of major mobile equipment and proximity of operations to sensitive receptors and are considered to be representative of potential worst-case Project noise emissions.

It is noted that the selected scenarios exclude consideration of noise emissions generated from construction/commissioning activities (Project Years 1 to 3) and mine closure activities, as these activities would generate lower noise emissions than the selected operational scenarios (i.e. because they involve less numbers of mobile fleet than the selected operational scenarios) (Appendix G).

Given the impacts assessed would represent the "worst-case" scenarios, it is considered that any impacts associated with construction and mine closure activities would be considered as part of the assessment of the selected scenarios (Appendix G).

Assessment of Meteorological Conditions

Weather information was obtained from the Iffley Weather Station.

A review of long-term wind effects in the local area was undertaken in order to determine predominant wind directions and flows. Analysis by Renzo Tonin & Associates (2021) concluded that wind effects were not a particular feature of the area.

It has conservatively been assumed that temperature inversions are a feature of the area. Default temperature inversion parameters ('F' class inversion and 2 m/s source to receiver wind) have therefore been adopted in the modelling (including low frequency noise) to determine potential impacts under adverse meteorological conditions (Appendix G).

Assessment of Feasible and Reasonable Noise Mitigation Measures

A number of iterative steps were undertaken to develop noise mitigation measures for the Project, including the following (Appendix G):

1. Preliminary noise modelling of scenarios representative of various stages of the Project (including stages when noise levels would be expected to be greatest at sensitive receptors) to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess the relative effectiveness of each measure.
3. Review of the effectiveness of the measures and assessment of their feasibility.
4. Adoption of management and mitigation measures to appreciably reduce noise emissions associated with the Project.

Adopted management and mitigation measures are described in Section 4.7.4.

Noise Modelling Results

With the implementation of management measures described in Section 4.7.4, all sensitive receptors are predicted to comply with the relevant noise limits during the day, evening and night for all modelling cases throughout the life of the Project, except at the Olive Downs Homestead (Appendix G).

Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead regarding acoustic treatment or other suitable measures.

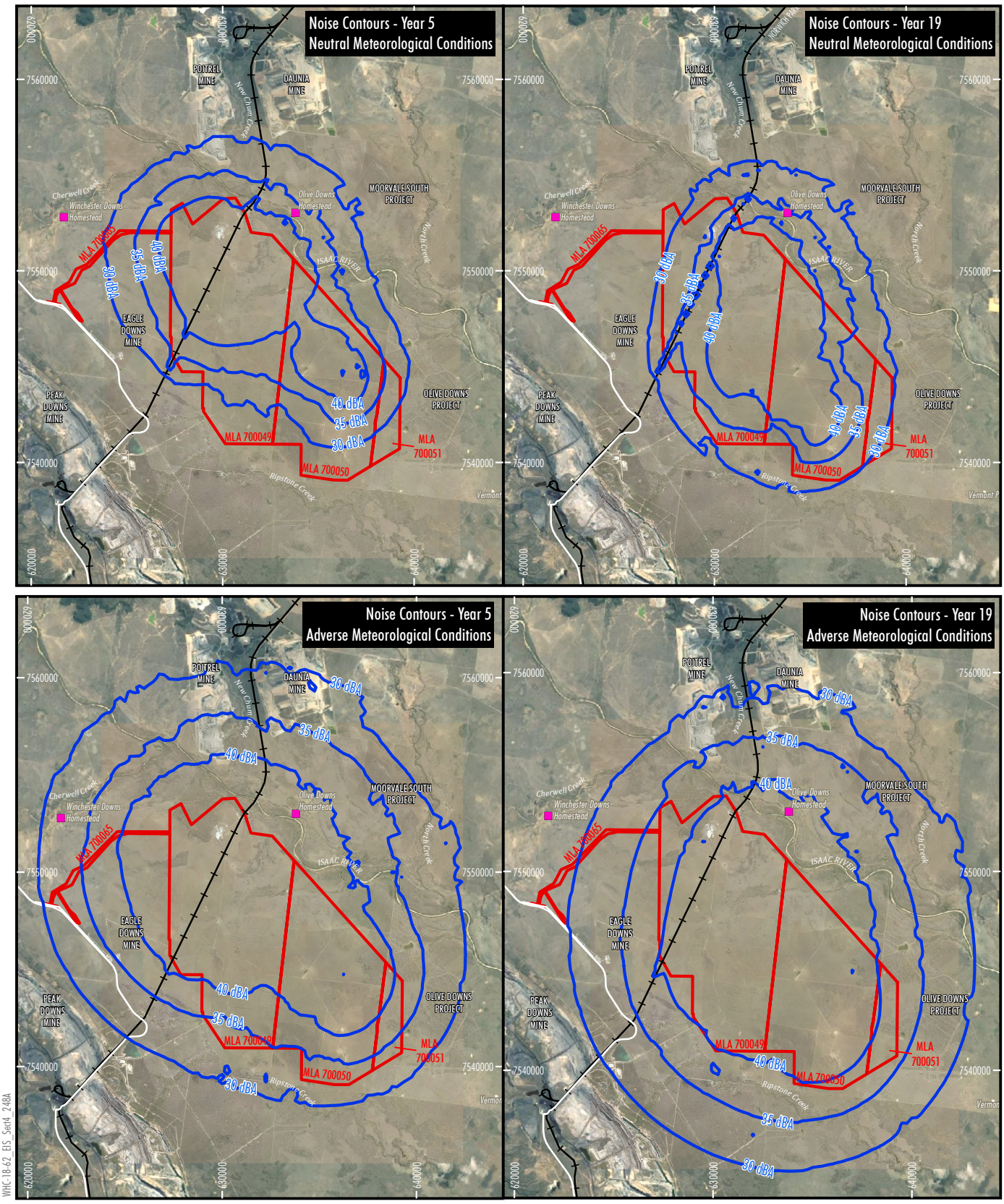
The predicted noise levels under adverse meteorological conditions are presented in Table 4-16.

Table 4-16
Predicted Operational Noise Levels ($L_{Aeq, 15min}$) During Adverse Meteorological Conditions

Receptor Name	Operational Noise Levels, $L_{Aeq, adj 15 mins}$			
	Year 5	Year 9	Year 19	Year 27
Olive Downs Homestead	47	47	46	46
Winchester Downs Homestead	32	28	27	28
Coolibah Homestead	20	19	18	18
Vermont Park Homestead	19	21	22	23

Source: Appendix G.

Predicted noise contours for Years 5 and 19 under neutral and adverse (i.e. the maximum extent of predicted impacts) meteorological conditions are shown on Figure 4-18. Noise contour diagrams for each modelled scenario under both neutral and adverse meteorological conditions are provided in Appendix G.



LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Railway
- Road

N

0 10

Kilometres

GDA 1994 MGA Zone 55

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2021). Orthophoto: Google Image (2019); Whitehaven (2017).

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Neutral and Adverse Meteorological Conditions Noise Contours - Years 5 and 19

Figure 4-18

Construction Noise

Noise generated from construction activities would generate lower noise emissions than the selected operational scenarios (Appendix G).

Consideration of Low Frequency Noise and Sleep Disturbance

Low frequency noise is expected to comply with the relevant criteria (Section 4.7.2) at all sensitive receivers, except for a marginal exceedance (up to 2 dBA under neutral and 4 dBA under adverse conditions, respectively) at the Olive Downs Homestead (Appendix G). As described above, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead regarding acoustic treatment or other suitable measures.

The Project would comply with the sleep disturbance criteria (Section 4.7.2) at all receptors except at the Olive Downs Homestead (Appendix G).

A marginal exceedance of the sleep disturbance criteria is predicted at the Olive Downs Homestead. Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead regarding acoustic treatment or other suitable measures.

Cumulative Noise Sources

Cumulative noise sources from the Winchester Quarry, the Olive Downs Project and the Daunia and Poitrel Mines were considered in the Noise and Vibration Assessment (Appendix G).

Potential noise impacts from the Winchester Quarry have been captured by the background noise monitoring undertaken for the Project. Notwithstanding, existing industrial sources were generally inaudible within the Project area (Appendix G).

Noise predictions at the Olive Downs Homestead from the Daunia and Poitrel Mines are presented in Table 4-17 (Appendix G).

Table 4-17
Daunia and Poitrel Mines Noise Predictions at the Olive Downs Homestead

Project Scenario	Predicted Daunia and Poitrel Mines Operational Noise Levels L_{eq} (dBA)	
	Neutral Conditions	Adverse Conditions
Year 5	36	41
Year 9	36	41
Year 19	0	0
Year 27	0	0

Source: Sinclair Knight Merz (2008).

Table 4-17 indicates that the operation of the Daunia and Poitrel Mines would exceed the relevant noise criteria (i.e. 35 dBA) under neutral and adverse conditions without the Project (Appendix G). Notwithstanding, the Project is predicted to result in further exceedance of the relevant noise criteria at the Olive Downs Homestead for Years 5 and 9 of the Project (Table 4-16).

Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead regarding acoustic treatment or other suitable measures.

The Moorvale South Project is an approved open cut coal mine located approximately 4 km east of the Olive Downs Homestead.

The Moorvale South Project is approved to extract up to 1 Mtpa, but has not commenced operations. As a result, potential noise impacts from the Moorvale South Project would not be included in the background noise monitoring for the Project.

An indicative worst-case noise prediction (as a result of the Moorvale South Project in isolation) at the Olive Downs Homestead calculated by Renzo Tonin (2021) would be 26 dBA and 33 dBA under neutral and adverse conditions, respectively. Accordingly, the Project would be the primary noise contributor at the Olive Downs Homestead.

Potential noise impacts from the Olive Downs Project at the Olive Downs Homestead would be less than 25 dBA under neutral and adverse meteorological conditions. Therefore, potential cumulative impacts between the Olive Downs Project and the Project would be negligible (Appendix G).

Road Noise

The increase in traffic noise due to additional traffic from the Project is predicted to be less than 1 dBA and unlikely to be perceived by the nearest noise sensitive receptors located near Eagle Downs Mine Access Road (Appendix G).

Based on the expected traffic volumes detailed in the Road Transport Assessment (Appendix I), traffic noise levels are predicted to be less than 50 dBA $L_{10,\ 18\ hours}$ at the nearest noise sensitive receptor (Appendix G).

Rail Noise

Based on a separation distance of approximately 1.6 km (from the Olive Downs Homestead to the Project rail spur) and a peak of 16 train movements per day (eight unloaded and eight loaded), noise levels from peak rail movements are predicted to comply with both the 65 dBA $L_{eq,\ 24hour}$ and Single Event Maximum 87 dBA $maxL_p$ noise limits at all sensitive receptors (Appendix G).

Blasting

Typical maximum instantaneous charge sizes (in the range of 3,000 kg to 6,000 kg) would result in blasting emissions below the vibration and airblast objectives for the Project at all sensitive receptors, including the Olive Downs Homestead located approximately 2.8 km north-east of the CHPP (Appendix G).

4.7.4 Mitigation Measures, Management and Monitoring

Noise and vibration management measures and monitoring would be documented in a Noise Management Plan and Blast Management Plan to be prepared for the Project.

Operational Noise

Noise Mitigation Measures

Identification of noise mitigation measures required to meet the noise limits at the nearest sensitive receptors was undertaken as part of the Noise and Vibration Assessment. With the adoption of reasonable attenuation for the CHPP and associated processing areas it was found that noise levels at the Olive Downs Homestead were predicted to remain above the Project noise limits (Appendix G).

With the proposed noise management measures in place, including proactive and reactive noise control measures (Appendix G), it is reasonable to expect that the noise criteria would be met during the operation of the Project, except at the Olive Downs Homestead.

Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead regarding acoustic treatment or other suitable measures.

Adaptive Measures

Project noise adaptive management measures would include:

- response to community issues or complaints including discussions with relevant landowners;
- refinement of on-site noise mitigation measures and mine operating procedures, where required and practicable;
- use of real-time noise and meteorological monitoring as a management tool; and
- if necessary (i.e. as informed by operational noise monitoring results and subject to any agreements), implementation of feasible and reasonable mitigation at relevant sensitive receptors, in accordance with the Noise EPP.

Construction Noise

Development activities for the Project would be temporary in nature, and general construction noise management measures would be implemented to minimise noise levels at the nearest sensitive receptors, where applicable.

Blasting

As described above, blasting at the Project would result in emissions below the vibration and airblast objectives at the sensitive receptors. Notwithstanding, blast design would be informed by site-specific blast monitoring (Appendix G).

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for noise and vibration. This is described further in Section 7.

4.8 AIR QUALITY

4.8.1 Methodology, Environmental Objectives and Performance Outcomes

An Air Quality and Greenhouse Gas Assessment for the Project was undertaken by Katestone (2021) and is presented as Appendix H.

A description of the proposed air quality objectives and performance outcomes is provided below. Section 4.8.3 describes the potential air quality impacts of the Project, including cumulative impacts, and Section 4.8.4 outlines proposed air quality mitigation measures, management and monitoring.

Estimated greenhouse gas emissions contributions as a result of the Project are discussed in Section 4.8.5.

The environmental objective relevant to air quality, as described in the Terms of Reference for the Project, is:

> *The environmental objective to be met under the EP Act is that the activity will be operated in a way that protects the environmental values of air.*

The Project would achieve the following performance outcomes as identified in Division 1, Part 3 of Schedule 8 of the EP Regulation:

> *1 There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity.*
>
> *2 All of the following—*
>
> *(a) fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised;*
>
> *(b) contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air;*
>
> *(c) releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.*

4.8.2 Description of Environmental Values

Air Quality Objectives

Air quality objectives are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the Project and the applicable air quality objectives/criteria.

Concentrations of Suspended Particulate Matter

Mining activities during the life of the Project have the potential to generate particulate matter (i.e. dust) emissions in the form of:

- Total Suspended Particulate (TSP) matter;
- Particulate matter with an equivalent aerodynamic diameter of 10 micrometres (µm) or less (PM_{10}) (a subset of TSP); and
- Particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) (a subset of TSP and PM_{10}).

Mining activities generate particles in all the above size categories, with the majority generally larger than 2.5 µm. Fine particles (less than 2.5 µm) are typically generated through combustion processes (Appendix H). Smaller particles can be more harmful to human health as the particles can be trapped in the nose, mouth or throat, or drawn into the lungs (Appendix H).

In Queensland, air quality is managed under the EP Act, the EP Regulation and the Air EPP.

Table 4-18 summarises the air quality objectives in the Air EPP for protection of human health and wellbeing that are relevant to the Project.

Dust Deposition

The *Application requirements for activities with impacts to air* guideline (DES, 2017d) states that a dust deposition limit of 120 milligrams per square metre per day (mg/m²/day), averaged over one month (Table 4-18) is frequently used in Queensland as a benchmark for avoiding amenity impacts due to dust. This is consistent with the guideline for dust deposition described in DES' *Guideline – Model mining conditions* (DES, 2017a).

Table 4-18
Goals for Ambient Air Quality

Pollutant	Environmental Value	Averaging Period	Air Quality Objective/Criteria (µg/m³)
$PM_{2.5}$	Health and wellbeing(1)	24-hour	25
		Annual	8
PM_{10}		24-hour	50
		Annual	25
TSP		Annual	90
Dust deposition	Amenity guideline(2)	Monthly	120 mg/m²/day

After: Appendix H.

Notes:

µg/m³ = micrograms per cubic metre. mg/m²/day = milligrams per square metre per day.

1 Air quality objective sourced from the Air EPP.

2 As per DES' *Application requirements for activities with impacts to air* and *Guideline - Model mining conditions*, not an air quality objective from the Air EPP.

Other Air Pollutants

Emissions of other air pollutants would also arise from mining operations typically associated with diesel powered equipment used on-site and on-site blasting.

Emissions from diesel powered equipment and blasting may include carbon monoxide (CO), oxides of nitrogen (NO_x) and other pollutants such as sulphur dioxide (SO_2) (Appendix H).

The emission of these and other pollutants generated from diesel consumption and blasting activities at mine sites are considered to be too small to generate any significant off-site pollutant concentrations and were therefore not assessed further in the Air Quality and Greenhouse Gas Assessment (Appendix H).

Potential blast fume impacts are discussed in Section 4.8.3.

Adopted Project Goals

The pollutants relevant to the Project and corresponding criteria as identified in the Air EPP objectives and in relevant Queensland guidelines are presented in Table 4-18.

The air quality goals typically relate to the total dust burden in the air and not just the dust generated from the Project. Background particulate matter concentrations and dust deposition levels therefore need to be considered when using these goals to assess potential cumulative impacts.

Existing Air Quality

There are a number of dust sources in the vicinity of the Project that contribute to ambient air quality, including natural sources (e.g. wind erosion of non-vegetated areas, pollen and grass seeds) and anthropogenic sources (e.g. existing mines in the region, vehicle travel on unpaved roads and agricultural activities) (Appendix H).

Air quality monitoring data from the neighbouring Olive Downs Project site was obtained for PM_{10}. The data were from a low-volume air sampler and the monitoring period covered September 2017 to May 2020, however was sporadic in nature and was therefore not considered suitable for the background levels for assessment purposes.

Katestone (2021) has estimated ambient background dust levels in the Project area using publicly available air quality monitoring information, as described below.

PM_{10} and TSP

Long-term continuous PM_{10} monitoring data is available from the DES monitoring station located in Moranbah. Katestone (2021) reviewed the data available between 2011 and 2019 and estimated the background 24-hour average PM_{10} concentration based on the 70th percentile 24-hour average and the annual average concentrations recorded during 2016 data (Appendix H).

TSP has also been calculated from 2016 PM_{10} data from Moranbah, assuming TSP is twice the PM_{10} concentration (Appendix H).

$PM_{2.5}$

DES commenced monitoring of $PM_{2.5}$ in October 2019 at its Moranbah site. There was insufficient $PM_{2.5}$ data from DES's Moranbah monitor at the time of assessment for background $PM_{2.5}$ levels.

Other publicly available information on ambient air quality monitoring in Moranbah is limited, however, a review of available data, including the *Air Quality Impact Assessment for the Moranbah South Project* (Katestone, 2015) provides information on available ambient air quality monitoring of TSP and $PM_{2.5}$.

BMA data collected in Moranbah from January 2012 to September 2012 for $PM_{2.5}$ has been used to represent background levels of $PM_{2.5}$ in the Project region as this provided the most recent and regionally relevant existing conditions at the time of conducting the assessment.

Dust Deposition

Dust deposition monitoring is not undertaken by Whitehaven WS or DES in the region. However, as detailed in the *Air Quality Impact Assessment for the Moranbah South Project* (Katestone, 2015), Anglo American previously conducted dust deposition monitoring at its Moranbah Golf Club deposition monitoring station every month from April 2009 to October 2012 (Appendix H). This data has been used to estimate ambient deposition rates in the Project area.

Background Air Quality for Assessment Purposes

Adopted background air quality levels for the Project are provided in Table 4-19. The adopted background air quality levels for the Project are generally equal to or higher than the adopted background air quality levels in similar contemporary projects.

Table 4-19
Estimated Background Air Quality Levels

Pollutant	Averaging Period	Concentration (µg/m³)
TSP	Annual	44.2
PM_{10}	24-hour	27.2
	Annual	22.1
$PM_{2.5}$	24-hour	4.3
	Annual	3.6
Dust deposition	Annual average	71 mg/m²/day

After: Appendix H.

Sensitive Receptors

There are four sensitive receptors in the vicinity of the Project[3]. The sensitive receptors are shown on Figure 4-17.

4.8.3 Potential Impacts

Assessment Methodology

Modelling Scenarios

Potential air quality impacts were assessed for Years 5, 9, 19 and 27. These scenarios were selected to represent a range of potential worst-case impacts over the life of the Project (Figures 2-3 to 2-6) with reference to the location of the operations and the potential to generate dust in each scenario. Year 19 simulates emissions at the maximum forecast ROM coal production rate (17 Mtpa) and the Project's highest dust-generating potential.

Dust emissions generated from construction (Years 1 to 3) and mine closure activities (Year 30) have not been selected in the above scenarios, as these activities would generate lower dust emissions than the chosen operational scenarios (Appendix H).

Given the impacts assessed include the worst-case scenario, it is considered that any impacts associated with construction and mine closure activities would be lower than those considered as part of the assessment of the selected scenarios (Appendix H).

[3] As described in Section 4.7.2, the owner of the Deverill rural property (a neighbouring mining company) has indicated that the Deverill Homestead does not need to be considered as a sensitive receptor for the purpose of potential noise, blasting and air quality impacts associated with the Project.

Emission Inventories

Key activities that would generate emissions include waste rock removal, ROM coal extraction, truck haulage emissions, wind erosion from exposed areas and material handling (including conveying). Air quality emission inventories were prepared for the selected years in consideration of the anticipated mining activities for each year.

Emissions of TSP, PM_{10} and $PM_{2.5}$ from mining activities were estimated using recognised and accepted methods. These include National Pollutant Inventory emissions estimation technique handbooks, ACARP emission studies and the United States Environmental Protection Agency (US EPA) AP4.2 emission handbooks (NPI, 2012; Pacific Environment Operations Pty Limited, 2015; US EPA, 1998; US EPA, 2006a; US EPA, 2006b).

The estimated dust emissions reflect the use of a range of dust mitigation measures that would be adopted for the Project. These measures are described in Appendix H and Section 4.8.4.

Local Meteorology

Local meteorological data has been generated for 2015 by the coupled TAPM/CALMET meteorological models at the location of the Project and used in the dispersion model assessment (Appendix H).

Dispersion Modelling

Dispersion modelling was conducted using the CALPUFF dispersion model. The CALPUFF dispersion model is an advanced non-steady-state dispersion modelling system (Appendix H).

A full description of the dispersion model, meteorology, emission inventories and modelling outputs is provided in Appendix H.

Suspended Particulate Matter

Assessment of the Project's potential impacts from suspended particulate matter, including model predictions, can be found in Appendix H and a summary can be found below.

Predicted 24-hour average and annual average PM_{10} isopleth diagrams for Years 5 and 19 are shown on Figure 4-19.

A range of particulate matter isopleth diagrams are presented in Appendix H including proposed Project $PM_{2.5}$, PM_{10} and TSP diagrams for all modelled scenarios and all assessed averaging periods.

Predicted Maximum 24-hour PM_{10} Concentrations

The Air EPP objective is for maximum 24-hour average PM_{10} concentrations not to exceed 50 µg/m³ from cumulative sources (Table 4-18).

With the implementation of the management measures described in Section 4.8.4, all sensitive receptors are predicted to experience 24-hour average PM_{10} levels below the Air EPP objective for the Project in isolation.

All sensitive receptors are predicted to experience 24-hour average PM_{10} levels below the Air EPP objective for the cumulative assessment, except at the Olive Downs Homestead. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead.

Predicted Annual Average PM_{10} Concentrations

All sensitive receptors are predicted to experience cumulative annual average PM_{10} concentrations below the Air EPP objective of 25 µg/m³ (Appendix H) for the Project in isolation.

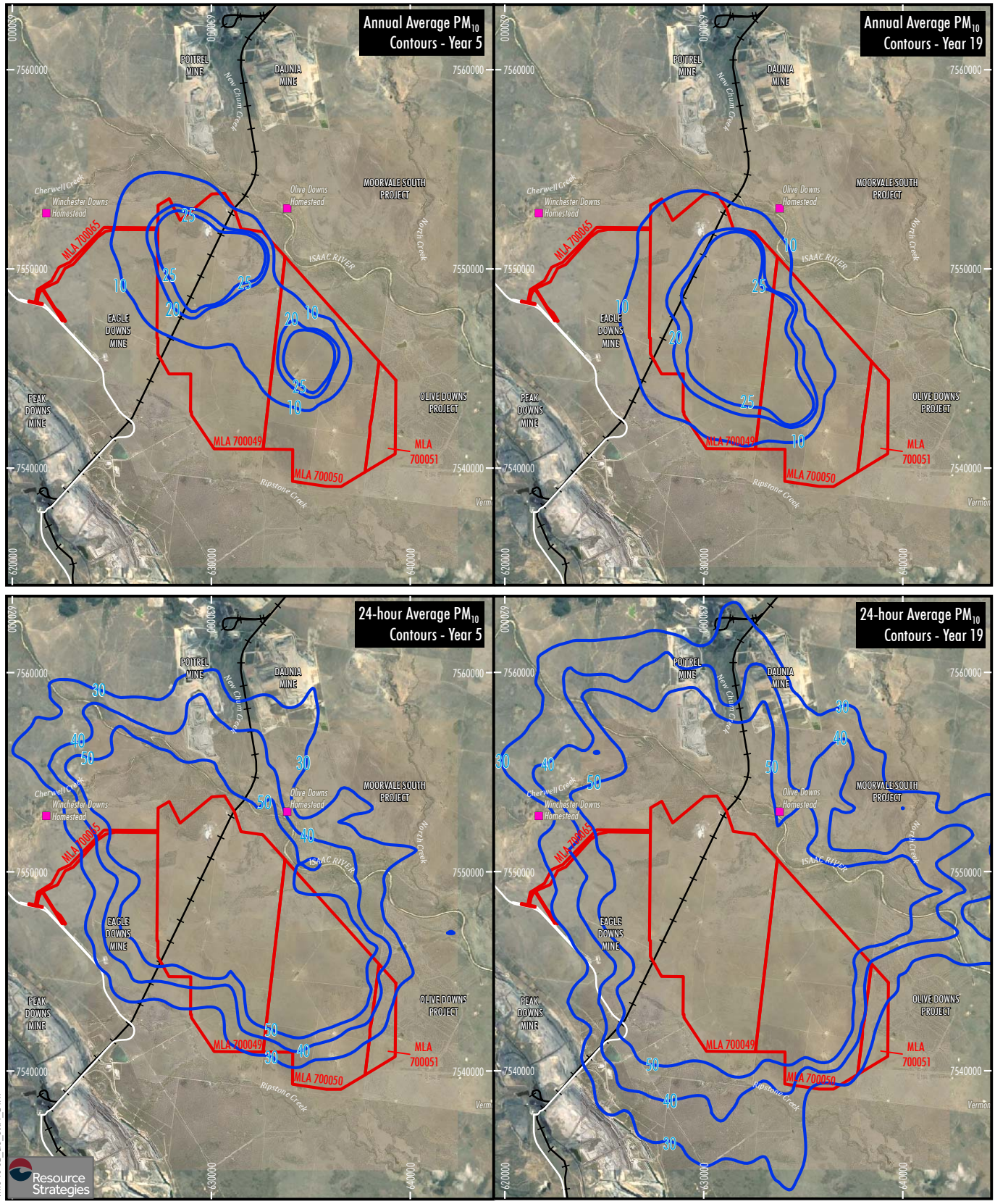
With the implementation of the mitigation measures described in Section 4.8.4, all sensitive receptors are expected to experience 24-hour average PM_{10} levels below the Air EPP objective for the Project, except at the Olive Downs Homestead. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead.

Predicted Maximum 24-hour $PM_{2.5}$ Concentrations

All sensitive receptors are predicted to experience cumulative 24-hour $PM_{2.5}$ levels below the Air EPP objective of 25 µg/m³ (Appendix H).

Predicted Annual Average $PM_{2.5}$ Concentrations

All sensitive receptors are predicted to experience cumulative annual average $PM_{2.5}$ concentrations below the Air EPP objective of 8 µg/m³ (Appendix H).



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

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Annual Average and Maximum 24-hour Average PM_{10} Contours - Years 5 and 19

Figure 4-19

Predicted Annual Average TSP Concentrations

All sensitive receptors are predicted to experience cumulative annual average TSP concentrations below the Air EPP objective of 90 µg/m³ (Appendix H).

Dust Deposition

All sensitive receptors are predicted to experience cumulative monthly average dust deposition levels below the guideline of 120 mg/m²/day (Appendix H).

A range of dust deposition level isopleth diagrams are presented in Appendix H including predicted Project monthly average dust deposition levels for all modelled scenarios.

Other Pollutants

Quantities of other air pollutants, such as NOx, CO and SO2, may also be emitted from the mining fleet and blasting within the Project site (Section 4.8.2). The emission rates of these air pollutants are low compared to the emission rates of particulate matter from mining activities (Appendix H).

It is noted that the Eagle Downs (Underground) Mine is located in close proximity to the open cut areas of the Project. Whitehaven WS would consult with South32 and Aquila regarding operational blasting procedures that may be implemented at the Project (e.g. consideration of prevailing and forecast wind direction prior to blasting in proximity to Eagle Downs' ventilation intakes) with the aim of reducing the potential risk of blast fume impacts (Appendix H).

Overall, these air pollutants are transient in nature and are likely to have negligible impact outside of the haul roads and open-cut pits within the Project site (Appendix H).

The emission of these and other pollutants generated from diesel consumption and blasting activities at mine sites are considered to be too small to generate any significant off-site pollutant concentrations and were therefore not assessed further in the Air Quality and Greenhouse Gas Assessment (Appendix H).

Odour is unlikely to be emitted from typical mining activities. Spontaneous combustion from coal stockpiles is a potential source of odour from mining activities however, the potential for this to occur is low, therefore, odour has not been assessed further in the Air Quality and Greenhouse Gas Assessment (Appendix H).

Cumulative Impacts

Mining activities and wind erosion emissions associated with the Project have been considered in the Air Quality and Greenhouse Gas Assessment (Appendix H) along with background dust contributions from non-mining sources and other mines in the region for a comprehensive cumulative assessment.

Notwithstanding, Katestone (2021) considered the potential cumulative impacts from the following approved and operating mines in the vicinity of the Project:

- Poitrel Mine;
- Daunia Mine;
- Moorvale South Project; and
- Olive Downs Project.

Poitrel and Daunia Mines

The Poitrel and Daunia Mines are existing mines located north of the Project. Dust emissions from current activities have been captured in the background concentrations to some extent (Appendix H).

Notwithstanding, the Poitrel and Daunia mines are approved to operate closer to the Project than the location of current operations (Appendix H).

There is a low potential for dust from the Poitrel and Daunia mines to affect the Olive Downs Homestead cumulatively at the same time with the Project due to the two mines being located in different directions relative to the receiver compared to the Project (Appendix H).

Moorvale South Project

The Moorvale South Project is an approved open cut coal mine located approximately 4 km east of the Olive Downs Homestead.

The Moorvale South Project would have a low potential for cumulative dust impacts at the Olive Downs Homestead at the same time because the two projects are located in different directions relative to the receiver compared to the Project (Appendix H).

In addition, the Moorvale South Project is significantly smaller than other mines in the region, and therefore it will generate less dust (Appendix H).

Olive Downs Project

The Olive Downs Project is located adjacent to the east and south-east of the Project. Air quality emissions associated with the Olive Downs Project at the Olive Downs Homestead would comply with the air quality objectives (Katestone, 2018).

In addition, there is a low potential for dust from the Olive Downs Project and the Project to cumulatively affect the Olive Downs Homestead at the same time as the two projects are located in different directions relative to the receptor (Appendix H).

Rail Transport Emissions

Appendix H also considered the potential for air quality emissions associated with the transportation of product coal via rail. Katestone (2021) reports that studies along rail corridors (transporting significantly more coal than the Project) show that emissions are very localised and, at distances of 50 to 100 m from the railway, failed to find evidence of significant dust levels.

4.8.4 Mitigation Measures, Management and Monitoring

Air quality management measures and monitoring for the Project would be documented in an Air Quality Management Plan to be prepared for the Project.

Dust Management Measures

General dust mitigation measures that would be implemented for the Project to minimise dust generation are summarised in Table 4-20.

Table 4-20
General Project Dust Control Measures

Activity	Key Dust Control Measures
Wheel-generated dust and grading	Watering of haul road surfaces.
Drilling	Dust suppression systems.
ROM unloading at CHPP	Water sprays.
Crushing	Enclosure of infrastructure.
Wind erosion of product coal stockpiles	Water sprays. Reshaping/profiling.
Train loading	Water sprays.

After: Appendix H.

In addition to the mitigation measures described in Table 4-20, Whitehaven WS would implement chemical dust suppressant on selected haul roads (or alternative technologies with equivalent effectiveness) as required. Further detail regarding the use of chemical dust suppression is provided in Appendix H.

Whitehaven WS would also implement proactive and reactive dust control measures. These measures would include the use of weather forecasting and real-time measurement of dust levels and meteorological conditions to modify mining operations as required in order to achieve compliance with applicable air quality objectives at the nearest privately-owned receivers.

Modifying mining operations could include the application of additional dust controls, an increase in the intensity of applied dust controls, reducing the intensity of particular operations or ceasing particular operations.

With the proposed dust management measures in place, including proactive and reactive dust control measures that are considered good or best practice, it is reasonable to expect that the air quality objectives would be met during the operation of the Project, except at the Olive Downs Homestead for cumulative 24-hour average and annual average PM_{10} concentrations (Appendix H).

Potential emissions associated with product coal transport (i.e. via rail) would be managed by profiling of the coal in wagons and the use of a veneering system (i.e. spray of the coal surface in the wagons).

Monitoring

Meteorological data and dust levels would be monitored on an ongoing basis at the Project for the implementation of operational dust controls.

If necessary (i.e. as informed by operational noise monitoring results and subject to any agreements), feasible and reasonable mitigation at relevant sensitive receptors would be implemented, in accordance with the Air EPP.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for air quality. This is described further in Section 7.

4.8.5 Greenhouse Gas Emissions

Emission Scenarios

The National Greenhouse Accounts (NGA) Factors document published by the DEE defines three scopes (Scope 1, 2 and 3) for different emission categories. These categories are based on whether the emissions generated are from "direct" or "indirect" sources.

Scope 1 emissions encompass the direct sources from the Project (e.g. on-site fuel use and mining activity) (DEE, 2019b).

Scope 2 emissions are indirect emissions associated with purchased electricity (e.g. Scope 2 emissions are physically produced by the burning of fuels at a power station) (DEE, 2019b).

Scope 3 emissions are other indirect emissions (e.g. attributable to the extraction, production and transport of fuels consumed) (DEE, 2019b).

Scope 1 and 2 greenhouse gas emission sources identified from the operation of the Project include the on-site combustion of diesel fuel, emissions of methane from the exposed coal seams, emissions from the use of explosives and on-site consumption of electricity (Appendix H).

Scope 3 greenhouse gas emission sources identified from the operation of the Project are the transport of coal (via rail and ship), burning of coal, electricity distribution losses and diesel extraction and processing (Appendix H).

Land clearing was also considered, however progressive rehabilitation of the open cuts and waste emplacements would offset incremental land clearance over the life of the Project. Greenhouse gas emissions from land clearance have therefore not been quantified (Appendix H).

Estimating Greenhouse Gas Emissions

Estimated quantities of materials contributing to greenhouse gas emissions for the Project are presented in Appendix H.

To quantify the amount of carbon dioxide equivalent (CO_2-e) material generated from the Project, emissions factors obtained from the NGA Factors (DEE, 2019b), *National Greenhouse and Energy Reporting (Measurement) Determination 2008* and the United Kingdom (UK) Government *GHG Conversion Factors for Company Reporting* (Department for Environment, Food and Rural Affairs [UK] [DEFRA], 2020) were used. These are presented in Appendix H.

A summary of estimated annual CO_2-e emissions due to the operations of the Project is presented in Appendix H.

Contribution of Greenhouse Gas Emissions

Estimated annual Scope 1, 2 and 3 greenhouse gas emissions from the Project are presented in Appendix H.

The estimated annual average Scope 1 and Scope 2 greenhouse gas emissions for the life of the Project is 556 kt CO_2-e, and the maximum annual is 749 kt CO_2-e. The maximum annual emissions represent a contribution of approximately 0.14% to the annual Australian greenhouse gas emissions and 0.43% of annual greenhouse gas emissions of Queensland (Appendix H).

The estimated annual average Scope 3 emissions for the life of the Project is 18,992 kt CO_2-e. As the Project would produce coal for export to overseas markets, use of coal overseas would not contribute to Australian greenhouse gas emissions or factor into Australian greenhouse gas reduction targets.

Consistent with the *Greenhouse Gas Protocol* (WBCSD and WRI, 2015), those emissions would be Scope 1 emissions in the customer country and, therefore, would be addressed by the customer country's greenhouse gas reduction initiatives.

Greenhouse Gas Mitigation and Management

Whitehaven WS would develop a plan to abate carbon dioxide emissions, which would include the following initiatives to mitigate, reduce and manage greenhouse gas emissions from the Project (Appendix H):

- regular maintenance of plant and equipment to minimise fuel consumption and associated emissions, including training staff on continuous improvement strategies regarding efficient use of plant and equipment;
- regular assessment, review and evaluation of greenhouse gas reduction opportunities;

- procurement policies that require the selection of energy efficient equipment and vehicles;
- monitor and maintain equipment in accordance with manufacturer recommendations; and
- optimise diesel consumption through logistics analysis and planning (e.g. review of the mine plan to optimise haul lengths, dump locations, and road gradients).

Whitehaven also invests in technology to reduce carbon emissions such as Low Emission Technology Australia (LETA). LETA is a $550 million fund established by the Australian black coal industry to invest in technologies that can significantly reduce emissions and support the transition to a low emission global economy in line with the Paris Agreement. The fund partners with government and industry locally and internationally to develop projects that reduce and remove carbon emissions from large-scale industrial processes, demonstrating and supporting global action to lower industrial emissions in Australia and abroad (Whitehaven, 2020).

4.9 TRANSPORT

4.9.1 Methodology and Environmental Objectives

The environmental objectives relevant to transport, as described in the Terms of Reference for the Project, are:

> *The construction and operation of the project should aim to:*
>
> *(a) maintain the safety and efficiency of all affected transport modes for the project workforce and other transport system users*
>
> *(b) avoid and mitigate impacts including those on the condition of transport infrastructure*
>
> *(c) ensure any required works are compatible with existing infrastructure and future transport corridors.*

Section 4.9.2 provides a description of the environmental values and assessment criteria, potential impacts of the Project and the proposed mitigation measures, management and monitoring with respect to road transport.

Sections 4.9.3 and 4.9.4 provide descriptions of the environmental values and assessment criteria, potential impacts of the Project and the proposed mitigation measures, management and monitoring with respect to rail and air transport, respectively.

4.9.2 Road Transport

A Road Transport Assessment for the Project was undertaken by TTPP (2021) and is presented in Appendix I. The Road Transport Assessment was prepared in accordance with the DTMR (2018) *Guide to Traffic Impact Assessment*.

As described at the start of Section 4, Whitehaven WS is investigating automation of the fleet for the Project. The Road Transport Assessment (Appendix I) assessed a non-automated case (i.e. maximum workforce case), and therefore is considered to provide for a conservative and robust assessment of potential road transport impacts should the level of automation change. Notwithstanding, a sensitivity analysis of the alternative scenario (i.e. automated case) was also undertaken.

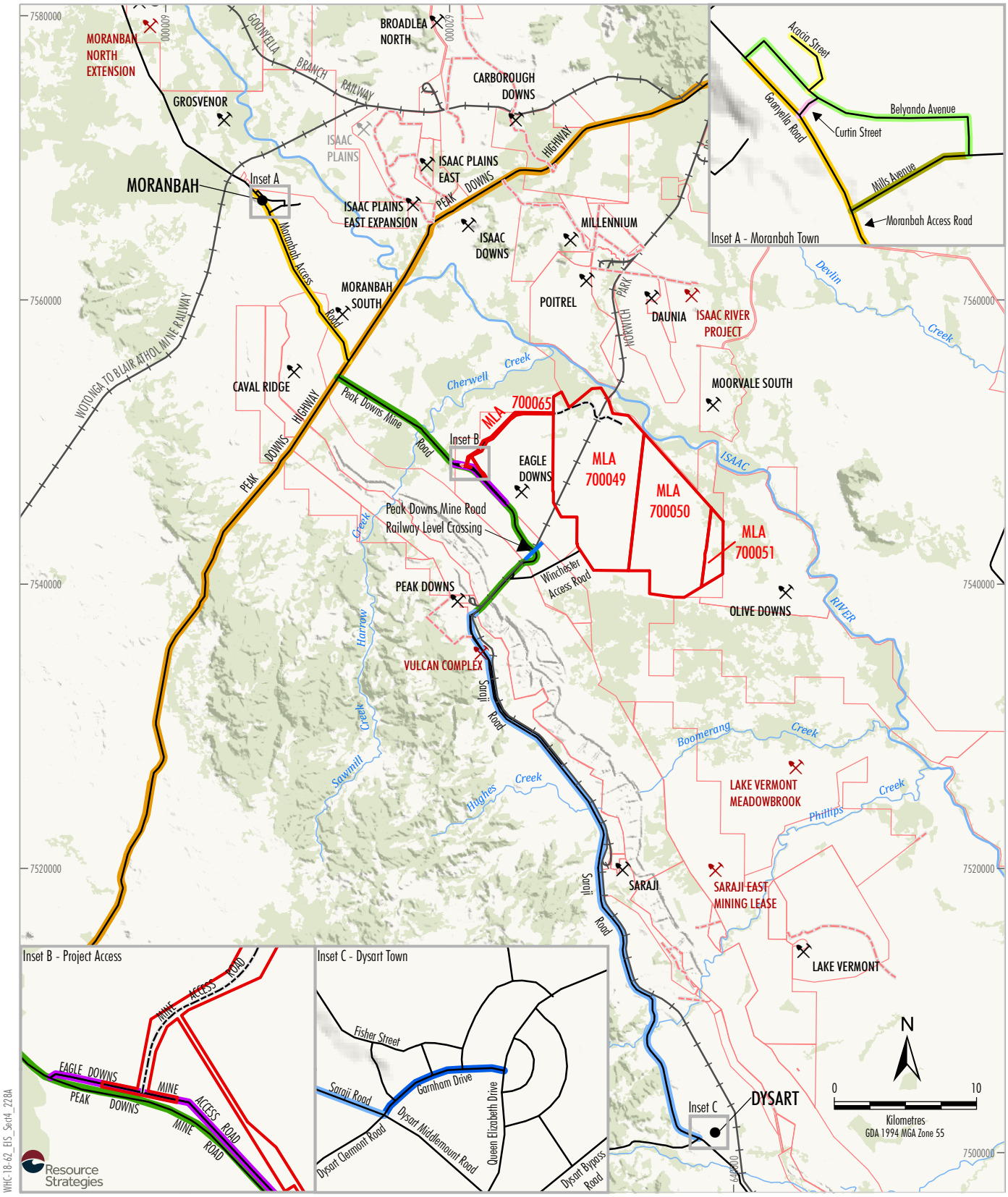
The operational workforce for the automated and non-automated cases would be approximately 500 and 750 workers, respectively.

The following subsections provide a description of the existing road transport infrastructure, and an assessment of the potential road transport impacts associated with the Project on the local and regional road network along with relevant mitigation and management measures.

Existing Environment and Transport Infrastructure

The following key roads are of relevance to the Project (Figure 4-20):

- Peak Downs Highway (a State Controlled Road [SCR]), which provides the primary link between the Whitsunday Coast and the Central West, linking the towns of Mackay and Clermont; and
- Peak Downs Mine Road/Saraji Road (a Regional Road/Council-controlled road), which provides the vehicular link between Peak Downs Mine and the town of Dysart and Moranbah.



LEGEND

- Mining Lease Application Boundary
- Mining Lease Boundary
- Mining Lease Access Road
- Railway
- Road
- Indicative Mine Access Road
- Peak Downs Mine Road Railway Level Crossing
- Approved/Operating
- Proposed
- Care and Maintenance

Regional

- Eagle Downs Mine Access Road
- Peak Downs Mine Road
- Saraji Road
- Peak Downs Highway
- Moranbah Access Road

Moranbah Local

- Curtin Street
- Belyando Avenue
- Acacia Street
- Mills Avenue

Dysart Local

- Garnham Drive

Source: The State of Queensland (2018 - 2020); TTPP (2019 - 2021). Geoscience Australia (2018).

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Existing Road Network

Figure 4-20

The key local roads that would be utilised by the traffic generated by the Project include (Figure 4-20):

- Moranbah Access Road (a Council-controlled road) (Goonyella Road north of Mills Avenue) which is a local road that provides the sole vehicular access between Peak Downs Highway and the town of Moranbah;
- Eagle Downs Mine Access Road (a private road) which would provide access to the Project via the mine access road, off Peak Downs Mine Road; and
- Winchester Access Road (a private road) which is an existing private access track, that would be used prior to the commissioning of the mine access road for the Project.

As described in Section 2.2.2, there is no public transport access or walking or cycling specific infrastructure in the region for travel to and from the Project. Some of the mines in the region operate bus services for their workforce when travelling between the mine and local towns such as Moranbah, which reduces the overall demand for vehicle travel on the road network (Appendix I).

Existing Traffic Volumes

Available Annual Average Daily Traffic data for Peak Downs Highway between Clermont and Mackay in 2018 from DTMR was reviewed as part of the Road Transport Assessment (Appendix I).

Traffic surveys at key Project locations were also undertaken, which included automatic tube counters operating over two weeks between 16 October and 22 October 2019, and between 31 October and 6 November 2019 at the following locations (Figure 4-21):

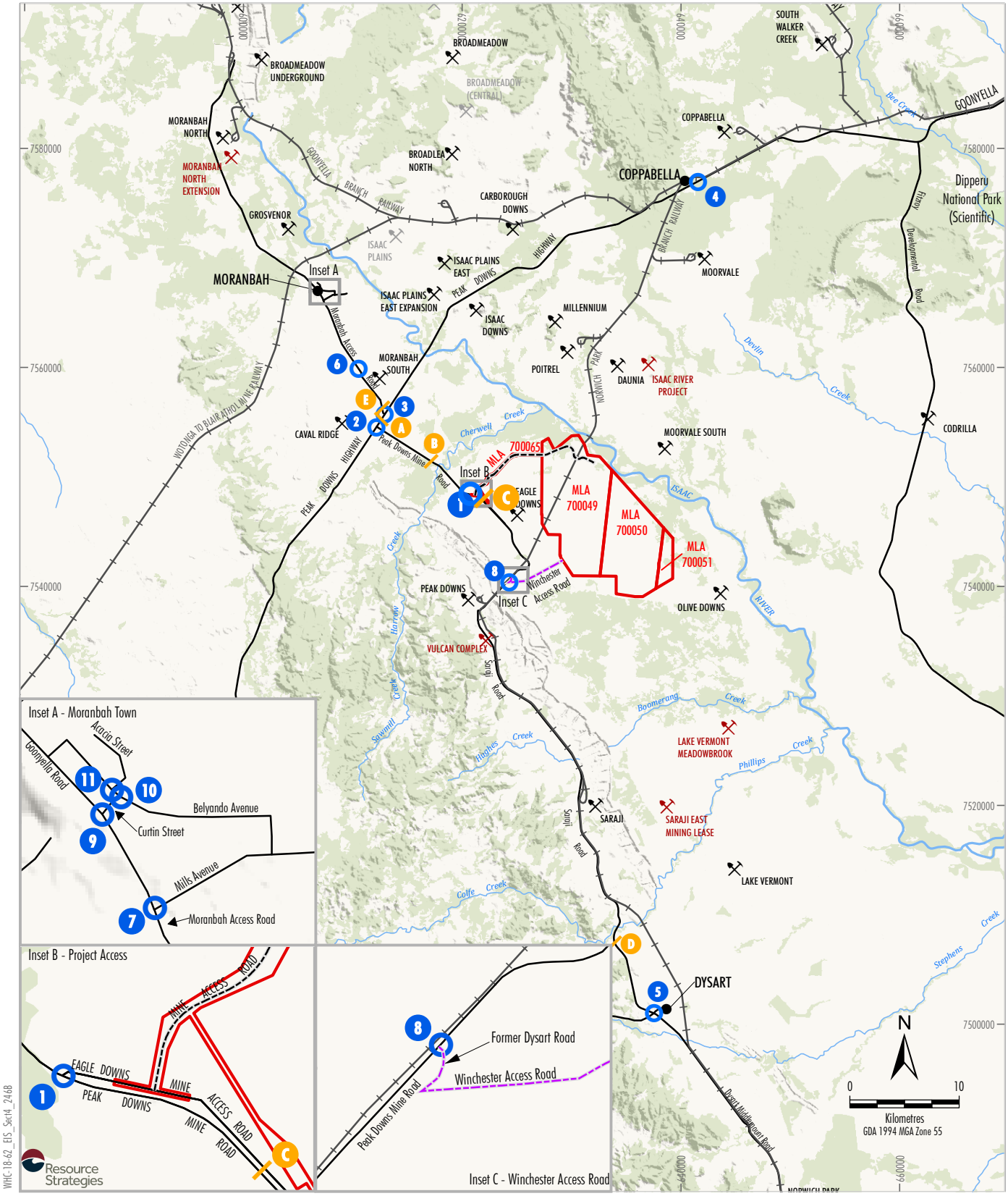
- Peak Downs Highway north-east of Peak Downs Mine Road (Location A);
- Peak Downs Mine Road north of Eagle Downs Mine Access Road (Location B);
- Peak Downs Mine Road south of Eagle Downs Mine Access Road (Location C);
- Saraji Road north of Dysart (Location D) (Week 2 only); and
- Moranbah Access Road (Location E).

The results of the surveys are presented in Table 4-21.

Table 4-21
Surveyed Traffic Volumes

Site		Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
A	Peak Downs Highway north-east of Peak Downs Mine Road	1	3,723	4,619	4,392	4,176	3,478	2,120	2,269
		2	3,749	4,584	4,644	3,949	3,436	2,122	2,218
B	Peak Downs Mine Road north of Eagle Downs Mine Access Road	1	2,263	2,822	2,704	2,613	2,155	1,261	1,355
		2	2,293	2,779	2,924	2,453	2,090	1,278	1,409
C	Peak Downs Mine Road south of Eagle Downs Mine Access Road	1	1,596	2,019	1,828	1,768	1,469	849	944
		2	1,481	1,914	2,035	1,657	1,435	806	870
D	Saraji Road north of Dysart	2	2,374	2,938	2,963	2,503	2,266	1,606	1,565
E	Moranbah Access Road north of Peak Downs Highway	1	5,501	6,268	5,811	5,918	5,180	3,133	3,448
		2	5,387	6,121	6,077	5,828	5,182	3,235	3,228

Source: Appendix I.



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LEGEND

- Mining Lease Application Boundary
- Railway
- Road
- Automated Tube Counter
- Intersection Survey
- Approved/Operating
- Proposed
- Care and Maintenance

Project Main Access Routes

- Option 1 (Mine Access Road)[1]
- Option 2 (Winchester Access Road)

Note[1]: Option 2 would be used for the first six months while the Mine Access Road is constructed.

Source: The State of Queensland (2018 - 2020); TTPP (2019 - 2021). Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Traffic Survey Locations

Figure 4-21

The survey results indicate that the traffic volumes are distinctly higher on weekdays compared to weekend days. The surveys demonstrated that the volumes varied day-to-day, with traffic volumes on the surveyed Fridays and Mondays being lower than the other weekdays, and with the highest volumes being recorded on Tuesdays (Appendix I).

Further detail on existing traffic volumes is provided in Appendix I.

Intersection Turning Movements

To examine the existing performance of key intersections of relevance to the Project, vehicle turning movements were also recorded over a 12-hour period between 6.00 am and 6.00 pm on Wednesday 16 October 2019 (Locations 1 to 8) and Thursday 27 February 2020 (Locations 9 to 11) (Figure 4-21) at the following key intersections (Appendix I):

- Peak Downs Mine Road and Eagle Downs Mine Access Road (Location 1);
- Peak Downs Mine Road and Peak Downs Highway (Location 2);
- Peak Downs Highway and Moranbah Access Road (Location 3);
- Peak Downs Highway and Maloney Street (Location 4);
- Saraji Road, Garnham Drive, Dysart Clermont Road and Dysart Middlemount Road (Location 5);
- Moranbah Access Road and Moranbah Airport Road (Location 6);
- Moranbah Access Road/Goonyella Road and Mills Avenue (Location 7);
- Peak Downs Mine Road and the former Dysart Road (for construction phase access) (Location 8);
- Goonyella Road and Curtin Street (Location 9);
- Curtin Street and Belyando Avenue (Location 10); and
- Belyando Avenue and Acacia Street (Location 11).

Supplementary intersection turning movement surveys were also completed between 4.00 am and 6.00 am on Friday 6 November 2019 at Locations 2 and 3 above.

The operating characteristics of the intersections were assessed using SIDRA INTERSECTION, an industry-standard software package.

Table 4-22 provides general descriptions of the intersection Levels of Service.

A Level of Service of D ("Near capacity") is considered to be the operational threshold for 'acceptable' performance (Appendix I).

Table 4-22
Intersection Levels of Service

Level of Service	Description
A	Good operation
B	Acceptable delays and spare capacity
C	Satisfactory
D	Near capacity
E	At capacity, requires other control mode
F	Demand exceeds capacity, with queues and delays

Source: After Appendix I.

The existing Level of Service at the other intersections in the vicinity of the Project currently ranges from A to C with the exception of the intersection of Moranbah Access Road/Goonyella Road and Mills Avenue and the intersection of Goonyella Road and Curtin Street which currently operate at Level of Service of D.

Under existing and future base conditions without the Project, the intersections that would be used by Project traffic are anticipated to operate at acceptable levels of service, with the exceptions of Moranbah Access Road/Goonyella Road with Mills Avenue and Goonyella Road with Curtin Street (Appendix I).

These intersections are the main accesses for Moranbah, and upgrading to a seagull arrangement to allow a staged right turn exit from Moranbah to the north would result in acceptable conditions in 2029 without the Project.

Further detail on intersection performance is provided in Appendix I.

Road Link Capacity

Level of Service represents road users' perceptions of the quality of service provided by a road link, and describes operational conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety (Appendix I).

Level of Service A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. Levels of Service B to D describe progressively worse traffic conditions, with Level of Service E for traffic conditions that are at or close to capacity, with virtually no freedom to select desired speeds or to manoeuvre in the traffic stream (Appendix I).

Road Safety

A review of DTMR road crash data of the key roads of relevance to the Project for the five year period from 1 January 2014 to 31 December 2018 was undertaken by TTPP as part of the Road Transport Assessment.

The DTMR road crash data indicate that the most common general crash type on the routes combined has been single vehicle crashes, particularly run-off-road crashes, which is consistent with the findings of the *Rural and remote road safety – State of the Road* (Centre for Accident Research and Road Safety – Queensland, 2017) (Appendix I).

With regard to the routes which would be used by Project-generated traffic, over the five years investigated, two fatal crashes occurred on the Moranbah Access Road/Goonyella Road south of Curtin Street, and two fatal crashes occurred on Peak Downs Highway between Peak Downs Mine Road and Coppabella (Appendix I).

Over the five years investigated, no crashes were identified at or near the level crossing on Peak Downs Mine Road and no crashes occurred involving pedestrians or bicycles (Appendix I).

Further detail on the crash characteristics along the main Project access routes is provided in Appendix I.

Potential Impacts

Potential traffic generation of the Project and its impacts on access and frontage, intersection delay, road link capacity, road safety, pavement condition, and level crossings are assessed in Appendix I and summarised below.

As described at the start of Section 4.9.2, the Road Transport Assessment (Appendix I) assessed a non-automated case (i.e. maximum workforce case, operational workforce of 750 personnel) and undertook a sensitivity analysis of the automated case (operational workforce of 500 personnel).

Project Traffic Generation

Three traffic scenarios were investigated to determine the potential impact of Project traffic flows on the local road network, having regard to the potential road transport implications of the Project and the variation in the Project and other traffic volumes throughout the life of the Project:

- during the initial construction activity in Year 1 of the Project[4];
- during the peak construction and initial coal production stage in Year 2 of the Project; and
- during the peak operational stage (i.e. peak operational workforce) in Year 8 of the Project.

The assessment scenarios were considered to conservatively represent the highest number of traffic movements expected throughout the development of the Project (Appendix I).

The level of activity (i.e. traffic movements) associated with mine closure is expected to be lower than the ongoing operational activity (Appendix I).

TTPP (2021) has also assessed two main access routes for the Project, with vehicular access for the Project via the Mine Access Road from Eagle Downs Mine Road, with access from Winchester Access Road while the Mine Access Road is constructed (Option 1), or access for the Project via Winchester Access Road (i.e. the proposed Mine Access Road is not constructed) (Option 2) (Figure 4-21).

Access via Winchester Access Road would only alter the contribution of the Project-generated traffic on the part of the road network between the proposed Mine Access Road and Winchester Access Road. Details of this assessment are provided in Appendix I and summarised in Section 4.9.2.

[4] Note during the first six months of the initial construction phase (Year 1) or until the Mine Access Road is constructed, the Project workforce would access the Project via Winchester Access Road.

Workforce

The construction and operational workforce are assumed to approach and depart the Project from and to the following locations (Appendix I):

- Moranbah (95%);
- Coppabella (3%); and
- Dysart (2%).

Table 4-23 summarises the estimated predicted Project daily vehicle movements for each scenario (weekday traffic in both directions), including workforce movements, visitors and deliveries.

Whitehaven WS would operate shuttle buses for the workforce between the Project and Moranbah. The estimated mode split for the total workforce travelling between their local residential location and the Project for all stages of the Project is (Appendix I)[5]:

- bus passenger (75%);
- car driver (18%); and
- car passenger (7%).

Deliveries and Visitors

The Project would attract visitors and require deliveries by both light and heavy vehicles throughout its construction and operational stages. Equipment and fuel deliveries would be made by a mix of rigid trucks, semitrailers and B-doubles. Light vehicles would be used by general visitors to the Project (Appendix I).

A breakdown of the anticipated Project deliveries and visitors and their origin is detailed in Table 4-24.

Cumulative Traffic Sources

There are a number of traffic sources in the vicinity of the Project that may contribute to existing and/or future traffic volumes that have been considered in the Road Transport Assessment (Appendix I), including:

- Eagle Downs Mine; and
- Olive Downs Project.

Reasonably foreseeable changes in the traffic volumes associated with the above developments have been accounted for in the baseline level for traffic (i.e. the level of traffic expected regardless of the Project).

The Road Transport Assessment applies a background growth rate of 2% per annum to all roads. This growth rate is consistent with that adopted for the assessment of the Olive Downs Project (GTA Consultants Pty Ltd, 2018), and is considered robust with regard to inferring future traffic forecasts given that mine-generated traffic makes up a significant proportion of existing traffic demands on these roads (Appendix I).

Access and Frontage

Consistent with DTMR's preference that vehicular access is to be obtained via the local road network, the Project does not have any frontage to any SCR and does not propose direct access to or from any SCR.

Table 4-23
Predicted Project Two-Way Weekday Traffic Volumes

Scenario	Project Workforce[1]		Deliveries and Visitors[1]		Total[1]	
	Light Vehicle	Heavy Vehicle	Light Vehicle	Heavy Vehicle	Light Vehicle	Heavy Vehicle
Year 1 (2022) Months 1-6[2]	72	16	84	56	156	72
Year 1 (2022) Months 7-12	144	32	300	200	444	232
Initial Operation (2023)	130	26	196	136	326	162
Peak Operation (2029)	162	18	60	60	222	78

1 A vehicle trip is a one way movement, i.e. a vehicle arriving at the Project generates one vehicle trip, and a vehicle departing the Project generates one vehicle trip. A vehicle arriving and departing generates two vehicle trips.

2 During the first six months of the initial construction stage, personnel would access the Project via the Mine Access Road off Eagle Downs Mine Access Road and Winchester Access Road.

5 Note that the mode split is an estimate only and actual shuttle bus usage may vary over the life of the Project.

Table 4-24
Project-generated Daily Deliveries and Visitors Vehicles

Scenario	Origin	Total Vehicles	
		Light Vehicles	Heavy Vehicles
Year 1 (2022) Months 1-6	Mackay	-	28
	Moranbah	42	-
Year 1 (2022) Months 7-12	Mackay	-	100
	Moranbah	150	-
Initial Operation (2023)	Mackay	-	68
	Moranbah	98	-
Peak Operation (2029)	Mackay	24	24
	Moranbah	6	6

During the construction of the mine access road, access to the Project would be via the existing Winchester Access Road from the former Dysart Road (off the Peak Downs Mine Road). The main vehicle access route to the Project is proposed via the mine access road from the Eagle Downs Mine Access Road, once constructed and commissioned (Figure 4-21).

The Project's access arrangements make use of the existing intersections of Peak Downs Mine Road with the former Dysart Road (Winchester Access Road access) (six months only) and Eagle Downs Mine Access Road, both of which are constructed with auxiliary left turn deceleration lanes and channelised right turn lanes in Peak Downs Mine Road which meet or exceed requirements based on forecast future demands (Appendix I).

The intersection of the mine access road and Eagle Downs Mine Access Road would be designed and constructed in accordance with DTMR's guidelines.

The access intersections are expected to operate at good levels of service with forecast peak demands, and sight distances meet or exceed requirements.

Intersection Delay

With the upgrading of the intersections of Moranbah Access Road/Goonyella Road with Mills Avenue and Goonyella Road with Curtis Street to seagull arrangements required to achieve acceptable operating conditions without the Project traffic, the intersections that would be used by Project traffic are anticipated to operate at acceptable Levels of Service (Appendix I).

With the Project-generated traffic and upgrades to accommodate base conditions, the resulting operation of all intersections would be acceptable in 2029 (Appendix I).

No additional infrastructure works would be required to accommodate the Project-generated traffic, beyond those required for acceptable future operations without the Project and construction of the mine access road with Eagle Downs Mine Access Road intersection (Appendix I).

Road Link Capacity

The Level of Service of road links with the Project traffic have been assessed using the *Guide to Traffic Management Part 3: Transport Studies and Analysis Methods* (Austroads, 2020). Compared with base conditions, the Project would result in changes to the Levels of Service on Moranbah Access Road in the morning and afternoon peak hours during the short-term construction stage of the Project only, and on Peak Downs Mine Road north of the Project in the afternoon peak hour in the peak operational stage of the Project (Appendix I).

The Level of Service during the peak hours is forecast to be acceptable, and additional capacity would not be required to accommodate the Project-generated traffic (Appendix I).

Road Safety

The *Guide to Traffic Impact Assessment* (DTMR, 2018) indicates that the desired outcome is for road safety at any location on the SCR network to not be significantly worsened as a result of new development, and that any pre-existing unacceptable safety risk or development-introduced safety risk is addressed. In consideration of the use of local roads for Project access, the risk assessment includes both the SCR network and the local roads that would be used by Project-generated traffic (Appendix I).

Changes to the risk profile are expected to be primarily associated with the addition of the Project-generated traffic, including heavy vehicles. However, it should be noted that the Project would involve:

- no changes to pedestrian or cyclist desire lines;
- no increases in the posted speed limit;
- no changes in visibility for movements to, from, or along, the SCR or local road network;
- no introduction of over-dimension or heavy vehicles to roads not currently used by such vehicles;
- no changes in the infrastructure network beyond the mine access road and its intersection with Eagle Downs Mine Access Road; and
- no additional traffic at intersections that would result in queues in auxiliary lanes overflowing into adjacent lanes.

In accordance with the requirements of the *Guide to Traffic Impact Assessment* (DTMR, 2018) a detailed risk assessment of the likelihood and consequence of safety risks being increased as a consequence of Project-generated traffic was conducted as part of the Road Transport Assessment (Appendix I). The road safety impact assessment has:

- identified existing safety risks relevant to the access routes for the Project;
- identified likely new or modified risks resulting from the Project; and
- recommended management or mitigation works to ensure the risk rating is not worsened as a result of the Project and that any unacceptable safety risk is addressed.

The additional traffic generated by the Project is expected to potentially increase the exposure of motorists to crashes along the access route. While the consequence of crashes is expected to remain the same, there would be an increase in likelihood due to the addition of the Project-related traffic.

The Project is however expected to result in no significant worsening of road safety at any location on the SCR network, nor on the local roads that would be used by Project-generated traffic, with the implementation of the proposed mitigation measures (Appendix I).

Pavement

The assessment of pavement impacts includes all road links where the Project standard axle repetitions (SARs) exceeds 5% of the base traffic in either direction on the road link's SARs. While the Project does not propose road haulage of product coal, the *Guide to Traffic Impact Assessment* (DTMR, 2018) indicates that the pavement impacts of both construction and operational activities should be assessed.

The assessment of base and Project-generated SARs on the Peak Downs Highway has found that the Project's impacts on pavement life, where Project SAR exceed base SAR by more than 5%, would be limited to the short-term construction stage of the Project.

Whitehaven WS is continuing consultation with the DTMR to determine appropriate contributions to support pavement reconstruction and rehabilitation works.

Railway Level Crossing

The mine access road, rail spur and rail loop for the Project would not require the development of any new level crossings.

The Project-generated traffic would only interact with the railway level crossing between Peak Downs Mine Road and the Norwich Park Branch Railway, located to the south of the Project (Figure 4-21).

During the first six months of construction, the additional Project-generated traffic through the railway level crossing would only have minor impacts of delays and queues during peak hours (Appendix I).

The Project-generated traffic would have a negligible impact on the performance of the railway level crossing during the operational phase (Appendix I).

The *Queensland Level Crossing Safety Strategy 2012-2021* (DTMR, 2012) sets out a number of key actions and performance indicators with regard to level crossing infrastructure, which support its long-term vision of zero harm at level crossings across Queensland.

With regard to those actions, the following is noted (Appendix I):

- The level crossing infrastructure and environs are observed to be designed and maintained to be in accordance with AS1742.7 and no changes are planned as a result of the Project.
- Appropriate reduced road speeds apply on both approaches to the level crossing.
- Additional heavy vehicles through the level crossing as a result of the Project would be limited to the initial six months of construction only, and during daylight hours only.
- The longer-term planning of the Project anticipates no additional heavy vehicles using the level crossing after the initial six months of construction, and only a small number of additional light vehicle movements, thus minimising any increase in the level of risk at the level crossing.
- Any continued assessment using Australian Level Crossing Assessment Method by the rail or road infrastructure owners should take into consideration the minor increases in Project-generated rail and road traffic when calculating the exposure factor at this and other level crossings. Infrastructure and consequence factors would not be impacted.

Alternative Access

As described earlier, TTPP (2021) has assessed two main access routes for the Project, with vehicular access for the Project via the Mine Access Road from Eagle Downs Mine Road, while the Mine Access Road is constructed (Option 1), or access for the Project via Winchester Access Road (i.e. the proposed Mine Access Road is not constructed) (Option 2) (Figure 4-21). Option 1 has been presented in the earlier subsections.

TTPP (2021) has assessed the impacts of the Project if Winchester Access Road is the primary access road for the life of the Project and concludes:

- The layout of and sight distance available at the existing intersection of Peak Downs Mine Road with the former Dysart Road meet or exceed requirements based on forecast demands.
- The intersections of Peak Downs Mine Road with the former Dysart Road and with Eagle Downs Mine Access Road would operate at satisfactory levels of service.
- Midblock Levels of Service during the peak hours are forecast to be acceptable on Peak Downs Mine Road between Eagle Downs Mine Access Road and the former Dysart Road.
- No additional mitigation measures are expected to those presented in the below subsection regarding road safety of the road links and intersections affected by the Project.
- The Project-generated SARs on the local roads would not be impacted by the use of Winchester Access Road for the life of the Project, however the length of Peak Downs Mine Road which would experience those SARs would be increased.
- The increase of Project-generated traffic on the actively controlled level crossing of Peak Downs Mine Road and the Norwich Park Branch Railway would have negligible impact on the delays experienced by vehicles during a closure of the level crossing.
- It is recommended that Winchester Access Road be upgraded in accordance with Austroads road design guidelines, with a minimum sealed width of 8.0 m, plus minimum 1.0 m unsealed shoulder on each side.
- The potential residual impacts of the Project can be appropriately managed or mitigated through the relevant measures outlined in the subsection below, together with the design and upgrade of Winchester Access Road consistent with DTMR and Austroads guidelines.

Mitigation and Management Measures

TTPP (2021) concluded that the potential residual impacts of the Project can be appropriately managed or mitigated through:

- continued Project travel demand management through use of, for example, shuttle bus services, car-pooling and staggering of shift times;
- design and construction of the new intersection of the mine access road with Eagle Downs Mine Access Road consistent with DTMR's guidelines;
- appropriate contributions to Isaac Regional Council's maintenance of Moranbah Access Road and Peak Downs Mine Road to address specific safety risks identified during the risk assessment; and
- appropriate contributions to DTMR and Isaac Regional Council to support pavement reconstruction and rehabilitation works.

4.9.3 Rail Transport

Existing Infrastructure and Values

Rail transportation in the region is serviced by the Norwich Park Branch Railway, which runs generally north-south, traversing the western section of the Project (Figure 1-2).

This Norwich Park Branch Railway forms part of the Goonyella railway system, which is used to transport coal from the Bowen Basin to the Port of Hay Point's DBCT (Figure 1-2).

The Norwich Park Branch Railway also links the Goonyella railway system to the Blackwater system. The Blackwater system transports coal from the southern Bowen Basin to two export terminals at the Port of RGTCT and the WICET.

Several existing mines in the region have rail spurs and loops, branching off the Norwich Park Branch Railway (Figure 1-1). The Norwich Park Branch Railway also services several railway stations within the vicinity of the Project.

Several railway stops and junctions for mining operations are located along the Norwich Park Branch Railway immediately north and south of the proposed Project rail spur including (south): Peak Downs Junction; Saraji Junction; Lake Vermont; Norwich Park; Middlemount; German Creek; and Oaky Creek, and (north): Millennium Junction; and Moorvale.

A rail spur is proposed to be developed as part of the adjacent Olive Downs Project, and is proposed to run along the north-eastern boundary of the Project area.

A rail spur and loop to the south-west of the Project was approved as part of the Eagle Downs Project in 2010. Based on the drawings in the 2009 EIS for the Eagle Downs Project, this rail spur and loop is located outside of the Project area.

The Aurizon Network performed a Capacity Assessment of the existing rail network in the vicinity of the Project and found (Aurizon, 2019):

- The Newlands System provides sufficient capacity to meet the contracted capacity, accounting for the Goonyella to Abbot Point Expansion infrastructure and full remote control signalling (RCS) installation across the entire Newlands System. The Newlands System is considered to have available track capacity ranging between 0 Mtpa to 20 Mtpa and 30 Mtpa to above 60 Mtpa along the system.
- The Goonyella System meets all contracted capacity requirements and has only limited latent capacity on the mainline track. The available track capacity of the Goonyella system ranges between 0 Mtpa to above 60 Mtpa across the system, with the available track capacity on the Norwich Park Branch Railway between 30 Mtpa to 60 Mtpa.
- The Blackwater System provides sufficient capacity to support contracted capacity. The available track capacity of the Blackwater System ranges between 5 Mtpa to greater than 60 Mtpa.

Potential Impacts

The Project rail spur and loop would be approximately 8 km in length and would connect to the Norwich Park Branch Railway, within MLA 700049. The Project rail spur would not cross any existing roads.

Product coal produced by the Project would be transported via rail to the port for export (Section 2.2.2).

Annual volumes of product coal to be transported by rail would vary over the life of the Project, with peak rate of approximately 11 Mtpa. An average of six train movements per day would be required (i.e. three arrivals and departures) with a maximum of 16 train movements per day (i.e. eight arrivals and departures). Train arrivals and departures would occur 24 hours per day.

Coal capacities of trains may vary over the life of the Project due to progressive rail capacity upgrades and changes to train configurations. Train movements may increase or decrease accordingly.

The Project would result in an increased number of trains travelling along the Norwich Park Branch Railway, with a peak of up to eight product coal trains per day (i.e. 16 train movements) being loaded for the Project. This could result in increased traffic delays at the railway level crossings located along the Norwich Park Branch Railway between the Project and the coal ports.

However, it is anticipated that the Project would not have a significant impact on these railway level crossings, since the number of coal trains associated with the Project would only be minimal in comparison to the large number of trains that travel along this network on a daily basis. It should be noted that:

- The *Network Development Plan 2019* (Aurizon, 2019) states that the coal throughput for the 2019 financial year of the Goonyella System was 124.5 Mtpa.
- The Project proposes up to 11 Mtpa of product coal to be transported along the Goonyella System.
- The Project would only represent approximately 9% of the coal throughput along the rail network.

Mitigation Measures and Management

The Project rail spur would be designed and constructed in consultation with Aurizon to minimise potential impacts on the existing environment in accordance with relevant guidelines, including the *Guide to Development in a Transport Environment: Rail* (DTMR, 2015).

Project trains would be operated and coordinated by Aurizon or another suitably qualified operator.

4.9.4 Air Transport

Existing Infrastructure and Values

The Mackay Airport is the nearest major regional airport servicing the Project region and currently accommodates for more than 800,000 passengers per year. Mackay Airport is a commercial business owned and operated by North Queensland Airports Group who is responsible for the management and operations of the airport.

Other smaller airports located near the Project include:

- Moranbah (approximately 5 km south-east of the township) which is a public airport and is approved to facilitate approximately 500,000 passenger movements per year; and
- Middlemount (approximately 1 km north of the township).

Brisbane Airport is the nearest major city airport and is operated by the Brisbane Airport Corporation and currently caters for more than 20 million passengers per year.

Potential Impacts

The construction and operational workforce for the Project would utilise the existing regional air infrastructure as required, which would increase the number of users of the Mackay, Moranbah and Brisbane Airports.

Employment opportunities expected to be generated by the Project include:

- an operational workforce of up to approximately 500 personnel;
- a construction workforce in the order of 500 personnel; and
- a decommissioning workforce of approximately 50 personnel (required towards the end of the life of the Project).

In accordance with the SSRC Act the operational workforce for the Project would not be a 100% FIFO workforce. The Project's recruitment strategy would provide equitable access to employment opportunities and prioritise recruitment of people from the Isaac Regional Council LGA in the first instance, before seeking candidates from other areas.

Mitigation and Management Measures

To minimise impacts on existing regional air infrastructure and other social impacts, the Project's recruitment strategy would provide equitable access to employment opportunities and prioritise local recruitment by applying the following order of priority for recruitment:

1. The 'local' towns of Moranbah, Dysart and Coppabella.
2. Nearby regional communities within a 125 km radius from the Project entrance (i.e. proposed intersection of mine access road and Eagle Downs Mine Access Road).
3. The Isaac region as per the Isaac Regional Council LGA.
4. The Mackay Whitsunday region.
5. The State of Queensland.
6. Outside of Queensland.

4.10 LAND

4.10.1 Methodology, Environmental Objectives and Performance Outcomes

A Soils and Land Suitability Assessment was undertaken by GTE (2021) and is presented in Appendix J.

The Soils and Land Suitability Assessment has been prepared in accordance with recognised industry standards and the requirements of the Terms of Reference.

The environmental objectives and performance outcomes relevant to land resources are described in Schedule 8 of the EP Regulation and presented in Table 4-25. The Project would achieve the following performance outcomes as identified in Schedule 8 of the EP Regulation (Table 4-25).

In accordance with *Land – EIS Information Guideline* (DES, 2020f) and *Guideline – Application requirements for activities with impacts to land* (DES, 2019a), Section 4.10.2 describes the existing environment and environmental values relating to land resources in the vicinity of the Project. Section 4.10.3 describes the potential impacts and Section 4.10.4 outlines proposed mitigation measures and management for land at the Project.

4.10.2 Description of Environmental Values

Topography and Landforms

The landscape of the Project area is generally flat to gently undulating plains with elevations in the range of approximately 185 to 235 mAHD (Geoscience Australia, 2019).

A cluster of mountains are located to the east of the Project area (Mount Coxendean, Iffley Mountain and Coxens Peak), range from elevations of 471 mAHD (Mount Coxendean) to 310 mAHD (Iffley Mountain). Possum Hill (located to the west of the Project) and Red Mountain (located to the north of Project) both reach an elevation of 330 mAHD.

Land Use

The Project is located within the Bowen Basin region of central Queensland, within the Isaac Regional Council LGA, where open cut coal mining is a key land use (Section 2.1.5). There are a number of existing and approved mining operations and projects in the vicinity of the Project, including the Moorvale South Project, Daunia, Poitrel, Isaac Downs Project, Isaac Plains East, Eagle Downs, Olive Downs Project, Peak Downs and Saraji.

Due to the high quality coal resources in the Bowen Basin, there are extensive existing mining operations in the region, serviced by well-established infrastructure. Coal mining and exploration land uses have been conducted within the vicinity of the Project for decades.

Land within the Project area and to the east and south is made up of freehold land.

The rural properties in the vicinity of the Project are shown on Figure 2-13, namely the Winchester Downs, Iffley and Wynette properties. Winchester Downs is privately-owned, Wynette is owned by Whitehaven and Iffley is owned by Pembroke (Section 2.2.1).

Grazing is the primary land use across the Project area (Appendix J) (Plate 4-6). The majority of the Project area (approximately 6,400 ha, 90%) has been historically cleared in favour of livestock grazing and agriculture. Most vegetation in the Project area exists in a non-remnant state (Section 4.5.2).

Table 4-25
Environmental Objectives and Performance Outcomes for Land Resources

Environmental Objective	Performance Outcomes
The activity is operated in a way that protects the environmental values of land, including soils, subsoils, landforms and associated flora and fauna.	*1 There is no actual or potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity.* *2 All of the following apply –* *(a) activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be manage in a way that prevents or minimises adverse effects on the environmental values of land;* *(b) areas disturbed will be rehabilitated or restores to achieve sites –* *(i) that are safe and stable; and* *(ii) where no environmental harm is being caused by anything on or in the land; and* *(iii) that are able to sustain an appropriate land use after rehabilitation or restoration;* *(c) the activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants;* *(d) the application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.*
The choice of the site, at which the activity is to be carried out, minimises environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places.	*1 Both of the following apply –* *(a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;* *(b) the activity does not have an adverse effect beyond the site.* *2 Both of the following apply –* *(a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including edge effects on the areas;* *(b) critical design requirements will prevent emissions having irreversible or widespread impact on adjacent areas.*
The location for the activity on a site protects all environmental values relevant to adjacent sensitive uses.	*1 The location for the activity means there will be no adverse effect on any environmental values.* *2 Both of the following apply –* *(a) the activity, and components of the activity, are carried out on the site in a way that prevents or minimises adverse effects on the use of surrounding land and allows for effective management of the environmental impacts of the activity;* *(b) areas used for storing environmentally hazardous materials in bulk are located taking into consideration the likelihood of flooding.*
The design of the facility permits the site at which the activity is to be carried out to operate in accordance with best practice environmental management.	*1 The activity does not involve the storage, production, treatment of release of hazardous contaminants, or involve a regulated structure.* *2 All of the following apply –* *(a) all storage provided for hazardous contaminants includes secondary containment to prevent or minimise releases to the environment from spillage or leaks;* *(b) regulated structures comply with the document called 'Manual for assessing consequence categories and hydraulic performance of structures', published by the department;* *(c) containers are provided for the storage of hazardous contaminants that are secured to prevent the removal of the containers from the site by a flood event;* *(d) the design of the facility prevents or minimises the production of hazardous contaminants and waste;* *(e) if the production of hazardous contaminants and waste is not prevented or minimised under paragraph (d) – the design of the facility contains and treats hazardous contaminants rather than releasing them.*

Plate 4-6 – Cattle Grazing at Winchester Downs

As described in Section 2.1.5, the Project is located within zones identified and mapped as Regional Landscape and Rural Production Area under the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012), and contains three areas mapped as *good quality agricultural land*.

The Project is not located within any areas of regional interest under the RPI Act. Areas of regional interest include priority agricultural areas, priority living areas, strategic cropping areas (formerly SCL) and strategic environmental areas.

Land Use Compatibility

Mackay, Isaac and Whitsunday Regional Plan

The Project is located within the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012). The Regional Plan is a State planning instrument under Chapter 2 of the Planning Act.

The *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012) establishes a vision and direction for the region to 2031, and provides strategies to inform future decision-making, which aim to:

- address regional economic, social and environmental issues;
- identify strategic infrastructure and service needs and priorities;
- support economic prosperity and employment opportunities;
- highlight and respond to climate change concerns;
- recognise environmental values;
- support consolidated growth within established regional centres and townships;
- focus public, private and community sector responses to key regional issues; and
- align efforts across agencies and all levels of government.

It is noted that development within a mining lease does not need to consider the Planning Act, associated Regulations, planning schemes and policies, including regional plans (Section 1.7). Notwithstanding, the Project is generally consistent with the strategic directions and desired regional outcomes of the Regional Plan as:

- The Project incorporates relevant ecologically sustainable development considerations (Sections 3 and 5).
- The Project incorporates a range of mitigation measures to minimise potential impacts on the environment (including potential impacts on groundwater and surface water resources, biodiversity and land suitability) (Section 4).
- The Project biodiversity offset strategy has been developed to address the potential residual impacts on biodiversity values associated with the Project (Sections 4.5 and 5.8).
- A greenhouse gas assessment for the Project has been undertaken by Katestone (2021) (Appendix H). Measures to reduce the direct (Scope 1) greenhouse gas emissions are described in Section 4.8 and Appendix H.
- The potential implications of climate change on surface water resources and flooding are considered in Appendix B. The flood modelling results show that the impact of the Project would not significantly change in consideration of climate change, in comparison to the current climate scenario (Appendix B).
- Valuation of potential impacts of Project Scope 1 and Scope 2 greenhouse gas emissions has been incorporated into the Economic Assessment (Appendix K) for the Project.
- The Project would avoid clearing any areas of riparian vegetation associated with the Isaac River (Section 4.5.4).

- The proposed PMLU for the Project would allow for future uses of the Project area following rehabilitation (grazing and agricultural uses, consistent with pre-mining land uses) (Section 6).
- The Project is located within land identified as a coal resource.
- The Project would not result in sterilisation of any coal resources that would be otherwise accessed by other mining operations.
- The Project would minimise adverse impacts on regional natural resources.
- The Project would protect the environmental values and water quality of surface water and groundwater, wetlands and their associated buffers and would minimise exposure to weeds and feral animals (Section 4).
- The Project would maximise economic opportunities and other community benefits, while minimising negative environmental and social impacts (Sections 4.4 and 4.11).

A key aim of the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012) is to manage the cumulative social impacts on the local communities that result from development. A SIA has been prepared for the Project and is presented in Appendix C, including consideration of cumulative impacts to the region, and mitigation measures to manage any potential impacts (Section 4.4 and Appendix C).

In addition, the SIA prepared as part of this EIS (Appendix C) has included genuine community engagement and consultation to inform the potential impacts the Project would have on the Isaac Regional Council and Mackay Regional Council LGAs and local communities. By targeting local employment and not relying on a FIFO workforce, the Project would improve the long-term viability of the nearby resource communities.

Whitehaven WS has also actively engaged with the Barada Barna Aboriginal Corporation through the SIA process and consultation process, including the preparation of a CHMP.

Regional Planning Interests Act 2014

The RPI Act manages development on areas of regional interest in Queensland. These include priority agricultural areas, priority living areas, strategic cropping areas and strategic environmental areas. The Project is not located within an area of regional interest. The closest areas of regional interest are:

- priority agricultural areas – located approximately 100 km south of the Project;
- priority living areas – located approximately 85 km south of the Project;
- strategic cropping areas –the closest strategic cropping area is within 10 m of the Project area (within the Norwich Park Branch Railway) (Figure 2-11); and
- strategic environmental areas – located approximately 315 km west of the Project.

As the Project would not impact any areas of regional interest, approval under the RPI Act is not required.

Local Planning Schemes

The Project is located within the Isaac Regional Council LGA. At its meeting on 24 February 2021, the Isaac Regional Council adopted a new planning scheme, the *Isaac Regional Planning Scheme 2021*, which was gazetted on 19 March 2021 and came into effect on 1 April 2021 (Section 1.7).

The *Isaac Regional Planning Scheme 2021* provides a framework for managing development in a way that advances the establishment of an efficient, effective, transparent, integrated, coordinated, and accountable system of land use planning, development assessment and related matters that facilitates the achievement of ecological sustainability.

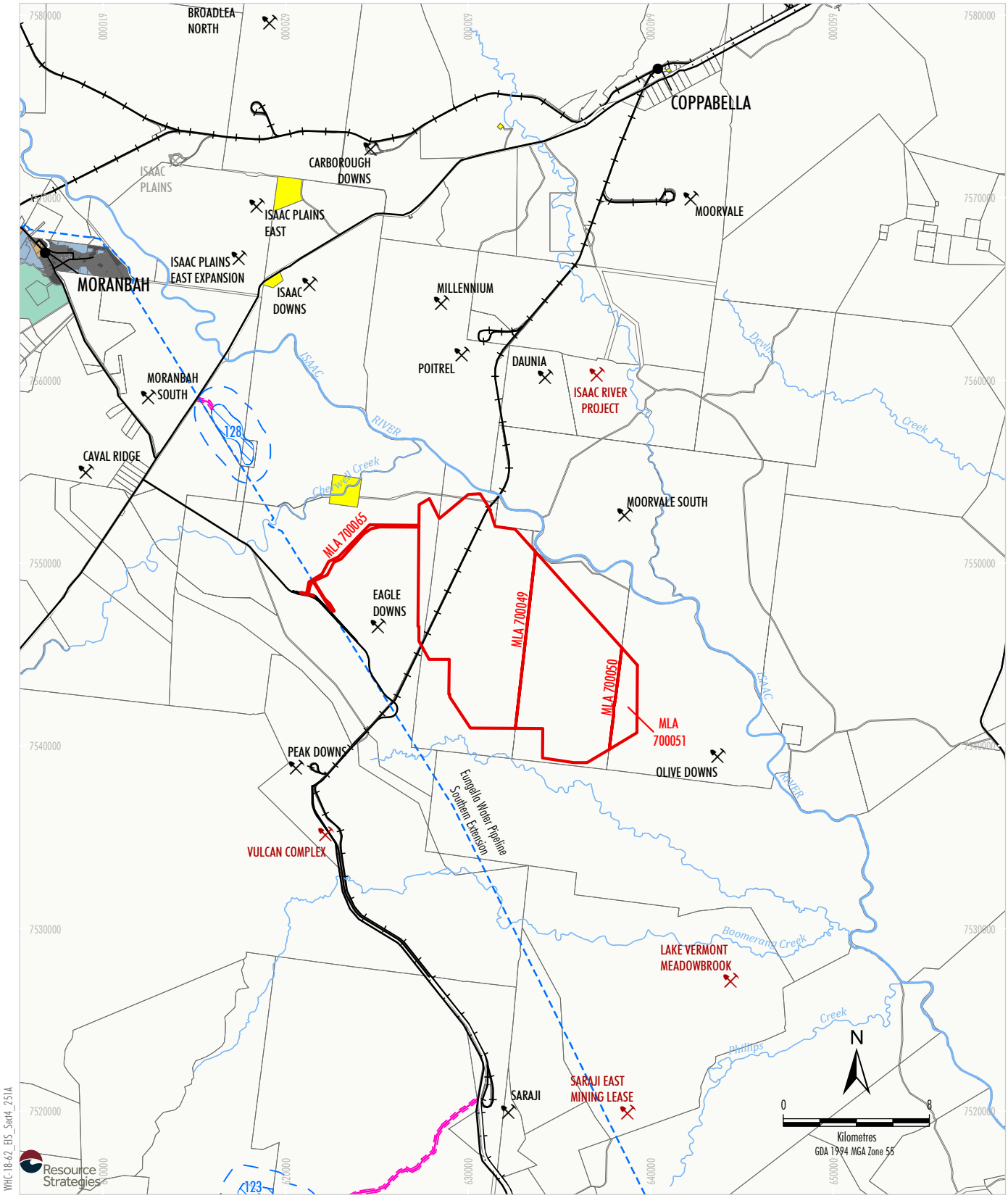
The Planning Scheme identifies strategic outcomes for example (amongst others):

- development preserves the cultural heritage values of local and State significance and does not diminish places or values of cultural significance to traditional owners;
- existing non-resident workers accommodation within the region's urban centres provide substantial accommodation for non-resident workers;

- the siting of rural industries and tourism, recreation, industry uses does not negatively impact on infrastructure networks in the area or the productivity of adjoining land;
- stock routes are protected from encroachment by sensitive land uses or other development that might prevent or constrain current or future operations;
- important agricultural areas support high value agricultural activities in the region;
- development does not significantly impact on the amenity of rural residential lots which are used primarily for residential purposes;
- Key Resource Areas and their haul routes are protected from encroachment by sensitive land uses that might prevent or constrain current or future operations;
- development avoids or mitigates impacts on Matters of National and State Environmental Significance and maintains a connected network of habitat areas, where development results in a significant residual impact on these areas, the impacts are offset;
- development ensures impacts on local biodiversity values are minimised;
- development avoids the disturbance to areas of potential acid sulfate soil or treats disturbed soils to a standard required to neutralise impacts;
- development minimises disturbances to natural topography and avoids changes to natural waterways, their bed and banks and riparian vegetation;
- development does not materially increase the extent or severity of natural hazards or their impacts;
- development within or near bushfire hazard areas incorporates appropriate siting, design and management practices to mitigate risk to an acceptable or tolerable level; and
- infrastructure corridors and sites are co-located wherever practicable to minimise impacts on landscapes, the natural environment and communities.

The Project is generally consistent with the outcomes sought to be achieved in the *Isaac Regional Planning Scheme 2021*, as:

- the Project area is within land mapped as rural, of which an appropriate land use is mining activities;
- no sites of Aboriginal or non-Indigenous cultural heritage identified within the Project area (Section 4.12);
- the CHMP for the Project includes provisions to allow the Barada Barna People access to the Project area and surrounding areas covered by the CHMP and provides management strategies to manage cultural heritage values (Section 4.12);
- there is sufficient capacity on the Norwich Park branch Railway for coal produced by the Project (Section 4.9.2);
- two stock routes are located in the vicinity of the Project, but outside the Project area (Section 2.2.1);
- the Project is not located within land mapped as important agricultural areas and the majority of the land disturbed by the Project would be moderate suitable to currently unsuitable (due to the severity of one or several limitations) land for grazing (Classes 3 and 4) (Appendix J);
- the potential cumulative impacts of the Project on the health, safety and amenity of residents and visitors would be managed (Appendices G, H and N);
- the Project is not located within a Key Resource Area, nor is it sensitive use (Figure 4-22);
- the Project would involve the development of a coal resource in a manner that would avoid, mitigate or manage potential impacts on cultural heritage, water quality, nearby landowners and natural environmental values (Section 4);
- there are no well-defined fauna movement corridors being impacted by the Project that would need to be retained (Section 6.4 and Appendix D);
- the Project would be rehabilitated in a manner that results in the establishment of fauna habitat (patches of woodland in grassland) (Section 6.4 and Appendix D);



LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Road
- Approved/Operating
- Proposed
- Care and Maintenance

Planning Scheme Key Resource Areas

- Resource Processing Area
- Separation Area
- Transport Route
- Transport Route Separation Area

Regional Plan

- Business or Centre
- Community Purposes
- Emerging Communities
- Industry
- Public Recreation and Open Space
- Residential
- Rural

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); BOM (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Regional Plan and Planning Scheme Land Zoning

Figure 4-22

- the Project has been designed to minimises impacts to MSES and MNES, including designing the infrastructure corridor to avoid creek crossings/waterways and avoiding palustrine wetlands on the boundary of MLA 700049 and MLA 700050 and establishing a 50 m buffer on two of the wetlands (Section 4.5.4);
- acid sulfate soils were not observed during the surveys and it is highly unlikely that the Project area would include actual acid sulfate soils and/or potential acid sulfate. In the unlikely event conditions of the soil during the Project's life present attributes of potential acid sulfate soils or actual acid sulfate soils, an acid sulfate soil environmental management plan would be prepared and implemented (Appendix J);
- cumulative impacts on flooding are not expected to lead to any adverse impacts on human populations, property or other environmental or social values (Section 4.3.3);
- Whitehaven WS would implement all reasonable and practicable fire prevention measures during construction and operation of the Project (Sections 2.3.5 and 4.13); and
- the ETL, raw water pipeline and mine access road are co-located within the infrastructure corridor, minimising the surface disturbance associated with the Project and the infrastructure corridor has been designed to minimise potential environmental, social and economic impacts (Section 3.6).

Good quality agricultural land as identified by the Planning Schemes is associated with the agricultural class system for the repealed *State Planning Policy 1/92: Development and the Conservation of Agricultural Land*. This has been replaced by the *State Planning Policy* (Queensland Government, 2017).

'Good quality agricultural land' was replaced by Agricultural Land Class A and Class B land and land identified as 'important agricultural areas' as a state interest topic (Queensland Government, 2017).

The Project is not located within an important agricultural area (Queensland Government, 2020). The closest important agricultural area is the Golden Mile, which is located approximately 11.6 km to the south of the Project, at its closest extent.

State Planning Policy mapping identifies Agricultural Land Class A and Class B within the Project area (DSDTI, 2020b). Mapping by GTE (2021) of the Project area ground-truthed these areas as Class A1 (approximately 1,077 ha) and Class B (approximately 21 ha) based on the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM, 2015) and *Regional Land Suitability Frameworks for Queensland* (DNRM and DSITIA, 2013).

GTE (2021) also mapped areas of Class C2 (approximately 636 ha) which is suitable for grazing native pastures and do not equate to the repealed 'good quality agricultural land' classification.

The areas of land classified and ground-truthed as Class A1 and Class B by GTE (2021) would be disturbed as a result of development of the Project. However, it is noted these areas are currently used for grazing as a land use (not cropping) and the Project area would be rehabilitated to provide a post-mining land use capable of supporting cattle grazing (consistent with its current use).

State Planning Policy

State interests are defined under the Planning Act as an interest that the Planning Minster considers:

> *(a) affects an economic or environmental interest of the State or a part of the State; or*
>
> *(b) affects the interest of ensuring this Act's purpose is achieved.*

The purpose of the Planning Act is to establish an efficient, effective transparent, integrated, coordinated and accountable system of land use planning, development assessment and related matters that facilitates the achievement of ecological sustainability.

Under the Planning Act, each local government planning sets out integrated State, regional and local planning and development assessment policies for an entire local government area.

The *State Planning Policy* (Queensland Government, 2017) supports this by setting down the state interests that apply to plan making, and that should be given effect through each local government planning scheme. Consideration of the local planning scheme relevant to the Project is provided above.

The Project is considered generally compatible with the state interests identified in the *State Planning Policy* (Queensland Government, 2017), as detailed in Table 4-26.

Existing Land Uses

The existing and approved land uses within and adjacent to the Project include mining (Eagle Downs Project, Olive Downs Project, Daunia Mine and Poitrel Mine), gas industry (Bowen Gas Project), agriculture and rural residential properties. The compatibility of the Project with each of these land uses is considered below.

Compatibility with Nearby Extractive Resources

Whitehaven WS will continue to consult and work closely with the Eagle Downs Coal Mine Joint Venture (owner of the Eagle Downs Project), Pembroke (owner of the Olive Downs Project), Peabody (owner of the Moorvale South Project) and BMA (owner of the Duania and Poitrel Mines) regarding the interactions between the mines and the Project to maximise cooperation and efficiencies. Potential interactions between the operations include:

- sharing mine water between the operations (Section 2.7);
- continued data sharing (Section 4.2.2);
- locations of the infrastructure corridor for the Project (Section 3.6); and
- the assessment and management of cumulative impacts (Section 4 and 7).

Similarly, Whitehaven WS will continue to consult and work closely with Arrow, the owner of the Bowen Gas Project, to manage interactions between this operation and the Project.

As described in Section 2.1.6, Whitehaven WS has engaged with Arrow in accordance with the requirements of the MERCP Act. Arrow confirmed that Whitehaven WS has the "right of way" and will decommission pilot wells located within land covered by the mining lease applications.

It is not expected that the Project will impact on future availability and viability of nearby extractive industries, as development of the Project would not sterilise any coal resources that would otherwise be accessed by other mining operations (Section 2.1.4) and it is predicted that the Project would have negligible impacts to water quality and resources, including the Isaac River and associated alluvium (Sections 4.1.3 and 4.2.3).

Nor would the Project impact the railway capacity of the Norwich Park Branch Railway (approximately 9% of the coal throughout along the rail network, with capacity in excess of 60 Mtpa of product coal available) (Section 4.9.3).

Based on the above and consultation to date (Attachment 4):

- there is not anticipated to be any material incompatibility between the Project and the existing and approved mining and gas extractive land uses; and
- there may be some potential benefits and efficiencies for existing and approved mining operations (e.g. sharing of water between the mining operations).

Compatibility with Agricultural Land Uses

Whitehaven WS would rehabilitate the majority of the Project to a low-intensity grazing post-mining land use, consistent with the existing land use within the Project area and approved land use outcomes for the mining operations/projects surrounding the Project.

Approximately 8% of the total disturbed land would not support an agricultural land use post-mining. This land associated with the residual voids for the Project would be fenced, with protective bunding and signage installed around the perimeter of the proposed NUMA extent to minimise the potential for risk to the public and livestock (Section 6.3.2).

It is therefore not anticipated that there would be any material incompatibility between the Project and existing agricultural land uses.

Table 4-26
Compatibility of the Project with the State Interests Identified in the State Planning Policy

State Interest	Assessment of Compatibility
Liveable Communities and Housing	
Housing supply and diversity	▪ The draft SIMP for the Project includes a Housing and Accommodation Plan which details mitigation measures to minimise impacts on housing supply (affordability and availability) as a result of the Project and increase housing diversity including (Sections 4.4.4 and 4.4.5 and Appendix C): – facilitating the construction of new houses in Moranbah dedicated for Project employees; and – providing financial contributions over the life of the Project to the Isaac Affordable Housing Trust and/or Emergency and Long-Term Accommodation Moranbah Inc. for the construction of additional affordable housing in Moranbah. ▪ The Housing and Accommodation Plan for the Project also includes enhancement measures to stimulate housing investment as a result of the Project, through maximising employment of local workers for the Project and providing support to members of the workforce seeking to reside locally (Section 4.4.5 and Appendix C).
Liveable communities	▪ The Health and Community Wellbeing Plan for the Project includes management measures to avoid and mitigate potential impacts on the local and regional community services, mitigate potential impacts on the quality of life of the local community and enhance community cohesion and resilience, such as (Section 4.4.5 and Appendix C): – Collaborating with the Isaac Regional Council to determine the most effective contribution which may be made to a childcare solution (a maximum of $200,000 within Years 1 to 5 of the Project). – Monitoring workforce demands on childcare and education services and working with the Isaac Regional Council to support solutions to cumulative demands on social services. ▪ The Level of Service of road links that would be used by the Project are anticipated to be acceptable, and additional capacity would not be required to accommodate the Project-generated traffic. Additionally, the intersection of the mine access road with Eagle Downs Mine Access Road would be designed and constructed consistent with DTMR's guidelines (Section 4.9.2 and Appendix I). ▪ The Project is expected to result in no significant worsening of road safety at any location on the SCR network, nor on the local roads that would be used by Project-generated traffic, with the implementation of the proposed mitigation measures (Appendix I).
Economic Growth	
Agriculture	▪ The Project has considered and assessed potential impacts to agricultural land and resources (Section 4.10.3 and Appendices J and K). The forgone benefits associated with the potential loss of agricultural production in the long-term (approximately 576 ha) would be immaterial (Appendix K). ▪ The Project is not located within an important agricultural area (Queensland Government, 2020). ▪ The Project would disturb areas that have been ground-truthed as Class A and Class B agricultural land (Appendix J). However, it is noted these areas are currently used for grazing as a land use (not cropping) and the majority of the Project area would be rehabilitated to provide a post-mining land use capable of supporting cattle grazing (consistent with its current use) (Section 4.10). ▪ There are two areas designated as stock routes (reserves) in the vicinity of the Project, however these would not be intersected by the Project area (Figure 2-15), and therefore would not be impacted (Section 4.10.2).
Development and construction	▪ The Project would generate approximately 500 new direct, long-term jobs with the majority of the Project workforce to be employed from the Isaac and Mackay LGAs (Section 4.11.3 and Appendix K). ▪ The Project is also predicted to result in incremental indirect employment effects, generating (on average) 285 FTE in the local area, 934 FTE in the region and 1,894 FTE in Queensland (Section 4.11.3 and Appendix K). ▪ An estimated $4.9 billion in net present value terms would accrue to suppliers in Queensland as a result of the Project (Section 4.11.3 and Appendix K). ▪ The Project is located within the Bowen Basin, which has extensive existing mining operations in the region, serviced by well established infrastructure. There is considered to be sufficient capacity provided by existing rail infrastructure for the Project and the Level of Service of road links used by the Project traffic are forecast to be acceptable during peak hours (Sections 4.9.2 and 4.9.3 and Appendix I). ▪ The Project is located within land mapped as rural by the *Isaac Regional Planning Scheme 2021*, of which an appropriate land use is mining activities.

Table 4-26 (Continued)
Compatibility of the Project with the State Interests Identified in the State Planning Policy

State Interest	Assessment of Compatibility
Economic Growth (Continued)	
Mining and extractive resources	▪ The Project is not located within a Key Resource Area (Figure 4-22). ▪ The Project is located within land identified in the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012) as a coal resource (Section 4.10.2). ▪ It is not anticipated that there would be any material incompatibility between the Project and nearby extractive resources, agricultural land uses or rural residences (Section 4.10.2).
Tourism	▪ There are no tourist destinations or recreation sites in the Project area and it is not expected that the Project-related deliveries would impact on tourism activities in the vicinity of the Project (Section 2.2.11). ▪ There are no forests or nature conservation areas, including National or State Parks, in the Project area or immediate surrounds, as such the Project would not impact on the existing natural values of the region (Section 2.2.1).
Environment and Heritage	
Biodiversity	▪ MSES and MNES relevant to the Project have been identified and assessed in accordance with the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (DEHP, 2014) and the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DotE, 2013b) (Sections 4.5 and 5 and Appendices A, B, D and E). ▪ Project elements have been located and designed to avoid or minimise potential biodiversity impacts where possible based on the outcomes of baseline survey work (Section 4.5.4 and Appendices D and E). ▪ The Project incorporates a range of mitigation measures to minimise potential impacts on the environment (including potential impacts on groundwater and surface water resources, biodiversity and land suitability) (Sections 4 and 7). ▪ The Project biodiversity offset strategy has been developed to address the potential residual impacts on biodiversity values associated with the Project (Sections 4.5 and 5.8).
Coastal environment	▪ The closest coastal management district is located approximately 120 km to the east of the Project. As such, no impacts to the coastal environment are predicted as a result of the Project.
Cultural heritage	▪ Whitehaven WS has entered into a CHMP agreement with the Barada Barna Aboriginal Corporation. The CHMP was approved by the DATSIP pursuant to section 107 of the ACH Act on 31 March 2020 (Section 1.7) and will satisfy Whitehaven WS's duty of care under the ACH Act. ▪ No items of non-Indigenous cultural heritage significance were identified within the Project area or immediate surrounds, and therefore the Project would have negligible impact to items of non-Indigenous cultural heritage (Section 4.12.3 and Appendix L).
Water quality	▪ Potential impacts of the Project on water quality have been considered and are detailed in Appendices A, B and M, and summarised in Section 4.1. ▪ Negligible impacts to water quality, including the Isaac River and associated alluvium, are predicted as a result of the Project (Section 4.1 and Appendices A, B and M).
Safety and Resilience to Hazards	
Emissions and hazardous substances	▪ An assessment of potential impacts and risks associated with emissions and hazardous activities has been undertaken for the Project (Appendix N), and is summarised in Section 4.13. ▪ Acid sulfate soils were not observed during the surveys and it is highly unlikely that the Project area would include actual acid sulfate soils and/or potential acid sulfate (Appendix J). ▪ The Project is located approximately 9 km west from the closest high pressure gas pipeline (the Arrow Bowen Pipeline) (DSDTI, 2020b).
Natural hazards, risk and resilience	▪ An assessment of potential hazards and risks associated with the Project has been undertaken (Appendix N), and is summarised in Section 4.13. ▪ Potential flooding impacts related to the Project have been considered in the Surface Water and Flooding Assessment prepared by WRM (2021) (Appendix B). The Project would not result in any significant impacts on flow velocities in the Isaac River channels and floodplain (Section 4.3.3 and Appendix B). ▪ Cumulative impacts on flooding are not expected to lead to any adverse impacts on human populations, property or other environmental or social values (Section 4.3.3 and Appendix B).

Table 4-26 (Continued)
Compatibility of the Project with the State Interests Identified in the State Planning Policy

State Interest	Assessment of Compatibility
Infrastructure	
Energy and water supply	▪ Raw water for the Project would be sourced from the Eungella pipeline network. Discussions with Sunwater indicate that availability exists within the Eungella network to satisfy the water requirement for the Project (Sections 2.2.4 and 2.4.5). ▪ Permanent electricity supply for the Project would be provided from the existing regional power network via construction of an ETL from Powerlink's Eagle Downs Substation (Section 2.2.3). The final proposed ETL alignment would result in minimal supply disturbance to other customers and surface disturbance (in close proximity to the Project) (Section 3).
Infrastructure integration	▪ The Project provides an opportunity to develop a greenfield metallurgical coal resource in an existing mining precinct. Products would include metallurgical coal for use in the steel industry and thermal coal for energy production (Section 2.1.4). ▪ The Project would utilise existing energy, water supply, road and rail infrastructure and integrate Project infrastructure (where required) with existing infrastructure (e.g. construction of a rail loop and spur from the Norwich Park branch railway) (Section 2). ▪ Development of the Project may also assist the current and future development of adjacent coal resources by improving accessibility to services and infrastructure (e.g. through the development of the Project rail spur and loop, water pipeline and ETL) (Section 2.1.4).
Transport infrastructure	▪ A Road Transport Assessment was prepared for the Project (Appendix I), which assesses potential impacts on SCRs, Regional/Council-controlled roads and local roads. TTPP (2021) concludes that the potential residual impacts of the Project can be appropriately managed or mitigated (Section 4.9.2 and Appendix I). ▪ A road safety impact assessment was undertaken in accordance with the *Guide to Traffic Impact Assessment* (DTMR, 2018) (Section 4.9.2 and Appendix I). The Project is expected to result in no significant worsening of road safety at any location on the SCR network, nor on the local roads that would be used by Project-generated traffic, with the implementation of the proposed mitigation measures (Section 4.9.2 and Appendix I). ▪ The Project would utilise existing road and rail infrastructure. Potential emissions associated with product coal transport (i.e. via rail) would be managed by profiling of the coal in wagons and the use of a veneering system (i.e. spray of the coal surface in the wagons) (Section 4.8.4 and Appendix H). ▪ Whitehaven WS is investigating automation of the fleet for the Project, to improve the safety, efficiency and cost benefits of the Project (Section 2.1.7 and Appendix K).
Strategic airports and aviation facilities	▪ No strategic airports or aviation facilities are located within the surface disturbance extent of the Project (DSDTI, 2020b). ▪ The closest strategic airport is the Moranbah Airport (DSDTI, 2020b), which is located approximately 14 km north-west of the Project. ▪ It is not expected that the Project would impact on the safety, efficiency and operational integrity of the Moranbah Airport. ▪ It is considered that the Project would complement the role of the Moranbah Airport as an economic, freight and logistics hub and enhance the economic opportunities that are available in proximity to the airport, as it is expected that the construction and operational workforces for the Project would utilise the Moranbah Airport and development of the Project would generate indirect employment opportunities, resulting in long-term flow-on social and economic benefits to local and regional communities (Sections 4.9.4 and 4.11.3 and Appendix K).
Strategic ports	▪ The Hay Point Port is the closest strategic port/priority port to the Project and is located approximately 135 km east of the Project. It is therefore not expected that the Project would adversely affect the safety, viability or efficiency of existing and future operations at the Hay Point Port. ▪ The existing port infrastructure at the DBCT, ABCT and Gladstone coal ports would be utilised by the Project for the export of product coal. Whitehaven WS understands there is sufficient capacity at these coal ports for the Project (Section 2.2.2). ▪ It is considered that the Project would complement the role of the Hay Point, Abbott Point and Gladstone strategic ports as economic, freight and logistics hubs through the supply of product coal for export.

Compatibility with Nearby Rural Residences

The Project is located in the vicinity of residences to the north-east (Olive Downs Homestead) and north-west (Winchester Downs Homestead).

As well as being proximal to the Project, these residences are located within the vicinity of other mining developments (Peak Downs Mine, Isaac Plains Mine, Daunia Mine and Poitrel Mine).

The Project is not predicted to exceed the relevant noise and air quality criteria for the Winchester Downs Homestead (Sections 4.7.3 and 4.8.3). Nor is the Project expected to adversely impact on the visual amenity of the residences as any discernible infrastructure associated with the Project would generally be consistent with the landscape that has existed in this area for decades (i.e. a rural landscape set against a mining landscape), and therefore the Project would not be remarkable in the landscape (4.10.3).

The Project is predicted to exceed the relevant noise criteria and 24-hour average PM_{10} at the Olive Downs Homestead (Sections 4.7.3 and 4.8.3). Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner of the Olive Downs Homestead.

Based on the above and consultation to date, it is not anticipated that the Project would be materially incompatible with the nearby rural residences land uses.

Existing Infrastructure

The Project is located within the Bowen Basin, which has well-established infrastructure to service the extensive existing mining operations in the region, including transport, energy and road infrastructure.

Existing infrastructure within the Project area and vicinity is described in Sections 2.2.2 and 2.2.4.

Native Title

The Barada Barna People are the native title holders for the general Project region. Investigations indicate that native title has been extinguished over all land within the area of the mining lease applications and the land does not form part of the Barada Barna People's Native Title Determination (Section 2.2.1).

Whitehaven WS has formed a CHMP with the Barada Barna Aboriginal Corporation (the prescribed body corporate for the Barada Barna People), which was approved by the DATSIP on 31 March 2020.

Details on the management measures included in the CHMP are provided in Section 4.12.3.

Geology and Geomorphology

Geological features, exploration history and the coal resource within the Project area are described in Section 2.2.7, including the JORC resources of the Project coal seams (Leichardt Seams and Vermont Seams).

A conceptual hydrogeological model of the groundwater regime was developed by SLR (2021) based on the available groundwater data, and the results of the groundwater investigation program and TEM survey (Groundwater Imaging, 2019).

The hydrogeological regime relevant to the Project comprises the following hydrogeological units (Appendix A):

- Cainozoic sediments:
  - Quaternary alluvium – unconfined aquifer localised along Isaac River; and
  - regolith – unconfined and largely unsaturated unit bordering alluvium;
- Triassic Rewan Group – aquitard;
- Permian coal measures with:
  - hydrogeologically 'tight' interburden units; and
  - coal sequences that exhibit secondary porosity through cracks and fissures.

The indicative strata (not including Cainozoic sediments) over the Project area are shown on Figures 2-18b and 2-18c and the hydrogeological units are described in Section 4.2.2.

Fluvial Systems (2020) prepared a Geomorphology Assessment for the Project, which included a desktop review and field survey to characterise geomorphological attributes of the existing environment within the Project area and surrounds. Fluvial Systems (2020) concludes that:

- the majority of the stream reaches were in a stable, close to natural or mildly disturbed geomorphic condition;
- the Isaac River was potentially impacted by factors that reduced its condition, in particular high loads of sand in the bed; and
- only two knickpoints, and no zones of major geomorphic instability, were observed over the surveyed area.

Existing Resource Tenements

Mining tenements in the vicinity of the Project includes mining lease applications, exploration permits for coal, authorities to prospect, mining leases and petroleum leases and are shown Figure 2-14 (Section 2.2.1).

The Project is located within:

- MDL 183 and parts of EPC 1951 and EPC 1949 (MLA 700049, MLA 700050 and MLA 700051); and
- ML 70389 and PL 485 (MLA 700065).

The proposed production mining lease applications for the Project within the above tenements include MLA 700049, MLA 700050 and MLA 700051 (replacing the pre-existing MDL 183) held by Whitehaven WS.

The transport mining lease application (MLA 700065), which contains the water supply pipeline, ETL and mine access road, is located within ML 70389 and PL 485 (held by South32 Eagle Downs Pty Ltd).

A petroleum tenement (ATP 1103) (held by Arrow) overlaps the Project area.

Soils

A Soils and Land Suitability Assessment prepared by GTE (2021) was undertaken for the Project and is presented in Appendix J. Soils surveys were undertaken across the Project area and surrounds to identify and assess the principal soil types and their relative distribution.

The soil and land suitability surveys and sampling were conducted in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie *et al*., 2008). Soil characteristics and soil profiles have been described in accordance with the *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009) and *Australian Soil and Land Survey: Guidelines for Conducting Surveys* (Gunn *et al.*, 1988).

GTE (2021) also surveyed the three potential infrastructure corridors in accordance with guidance provided by Forster (2011) *Draft for Discussion: Soil Survey Methodology along Linear Features* and Soil Science Australia (2015) *Guidelines for Soil Survey along Linear Features*. In addition, GTE (2021) has participated in recent discussions with DNRM (now DoR) regarding requirements for soil surveys of linear features.

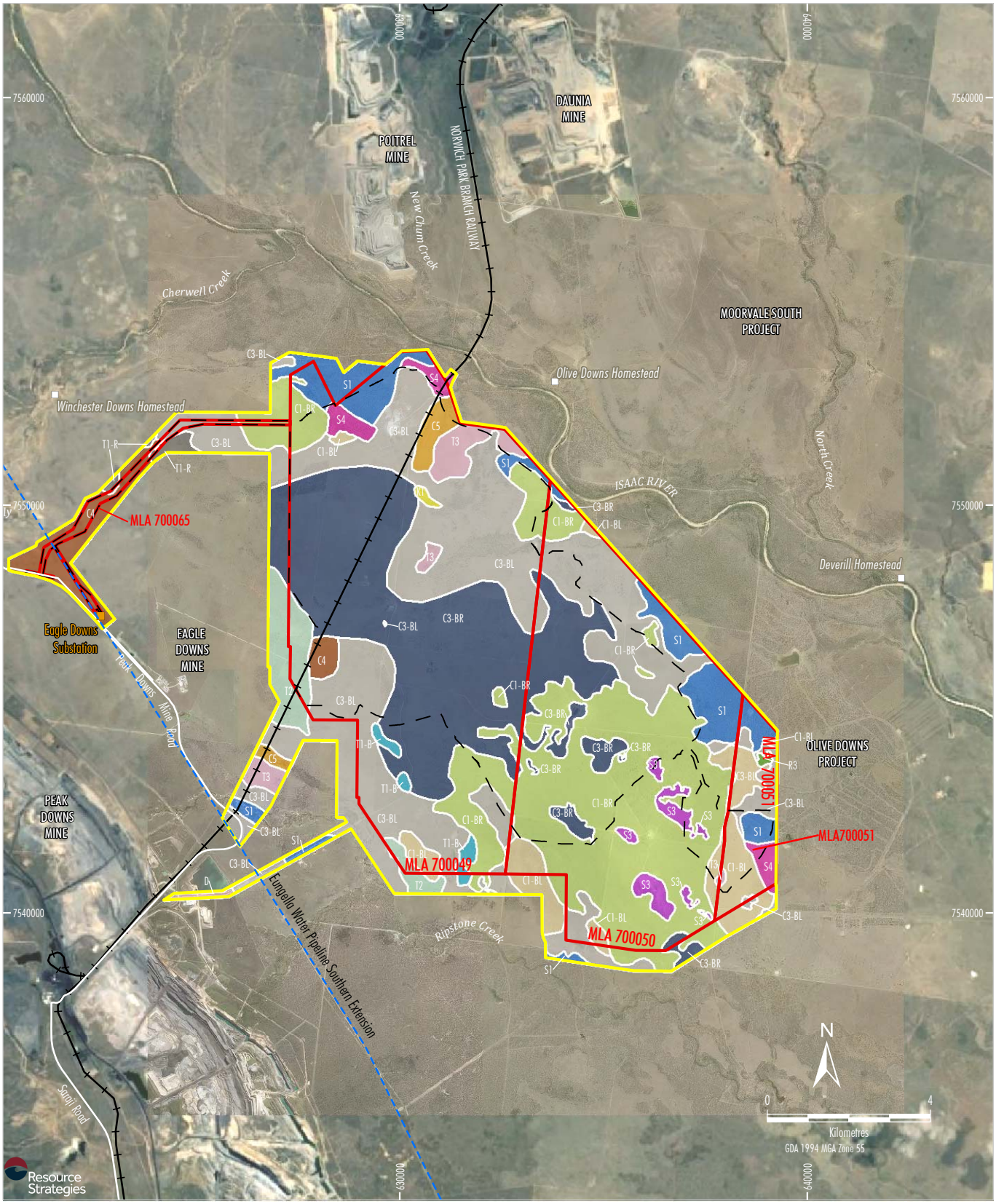
Soils have been grouped according to their parent material and position in the landscape and classified in accordance with the *Australian Soil Classification* (Isbell, 2016). Soils have also been correlated to soils identified within key regional soil assessments, the major assessment being *Lands of the Isaac-Comet Area, Queensland* (Gunn et al., 1967) (Appendix J).

Collection of soil samples for laboratory analysis was undertaken in line with the LSAT outlined in the DME guideline *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME, 1995) (Appendix J).

GTE (2021) has mapped nine different Australian Soil Classification soil types classified into fifteen SMUs across the Project area based on 99 detailed sites and 311 observation sites (Section 2.2.9). The SMUs across the Project area and surrounds are shown in Figure 4-23. Further detail for SMUs, detailed sites and observation sites is provided in Appendix J.

The Project area and surrounds include areas of flat to gently undulating plains dominated by uniform and gradational clays with microrelief (C1-BL, C1-BR and C4), uniform and gradational clays (C3-BL, C3-BR and C5), texture contrast soils on gently undulating plains (R3, S1, T1-R, T1-B1, T2 and T3), texture contrast soils on wide crests (S3), uniform sands on plains (S4) and shallow sandy earths (K1) (Appendix J).

Acid sulfate soils were not observed during the soil and land suitability surveys and actual acid sulfate soils and/or potential acid sulfate soils are highly unlikely to occur within the Project area (Appendix J).



LEGEND

- Mining Lease Application Boundary
- Indicative Surface Disturbance Extent
- Soils and Land Suitability Study Area
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Soil Mapping Units

- Moderate to Deep Black Clay Soils on Flat Plains with Melon Hole Microrelief (C1-BL)
- Moderate to Deep Brown Clay Soils on Flat Plains with Melon Hole Microrelief (C1-BR)
- Moderate to Deep Black Clay Soils on Gently Undulating Plains (C3-BL)
- Moderate to Deep Brown Clay Soils on Gently Undulating Plains (C3-BR)
- Moderate to Deep Black Clay Soils on Gently Undulating Plains with Linear Microrelief (C4)
- Moderate to Deep Black Clay Soils on Alluvial Plains (C5)
- Very Shallow Sandy Loam on Wide Crests (K1)
- Deep Brown Sandy to Loam Soils on Flat Plains (R3)
- Brown Texture Contrast Loamy Soils on Gently Undulating Plains (S1)
- Texture Contrast Loams on Clays on Flat to Gently Undulating Plains (S3)
- Deep Sandy Earths on Flat Plains (S4)
- Texture Contrast Brown Clay Soils on Gently Undulating Plains (T1-B)
- Texture Contrast Brown to Red Clay Soils on Wide Crests (T1-R)
- Texture Contrast Massive Structure Clay Soils on Gently Undulating Plains (T2)
- Gradational Alkaline Silty Clay Soils on Flat Plains (T3)

Other Mapping Units

- Disturbed Land (D)

Source: The State of Queensland (2018, 2019); GTE (2021); Whitehaven (2018). Orthophoto: Google (2019); Whitehaven (2019).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Soil Mapping Units

Figure 4-23

Soil Condition

A broad range of soil physical and chemical constraints for agricultural land use were identified within the Project, including (Appendix J):

- plant available water capacity;
- soil depth;
- soil wetness;
- pH;
- salinity;
- sodic conditions; and
- nutrient deficiencies.

Further detail on the condition of soils is provided in Appendix J.

Land Suitability

Land suitability mapping for the Project has been prepared by GTE (2021) and is presented in Appendix J.

Land suitability for the Project area was based upon classifications provided within DSITI and DNRM (2015) and DNRM and DSITIA (2013). Where guidance is not specifically provided in DSITI and DNRM (2015) and DNRM and DSITIA (2013), reference and assessment were also made in reference to the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) (Appendix J).

The *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM, 2015) and *Regional Land Suitability Frameworks for Queensland* (DNRM and DSITIA, 2013) give detailed information on appropriate land uses and associated limitations (Appendix J).

The five standard land suitability classes defined within the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM, 2015) are presented below:

- Class 1 – Suitable land with negligible limitations.
- Class 2 – Suitable land with minor limitations.
- Class 3 – Suitable land with moderate limitations.
- Class 4 – Unsuitable land with severe limitations.
- Class 5 – Unsuitable land with extreme limitations.

Land Suitability for Cropping

Land suitability assessment for cropping followed the framework and methodology prescribed in:

- the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM, 2015); and
- the *Regional Land Suitability Frameworks for Queensland* (DNRM and DSITIA, 2013).

A summary of the spatial extent of the mapped land suitability classes for cropping within the Project area is provided in Table 4-27.

Table 4-27
Land Suitability – Cropping

Land Suitability Class	Area (ha)	SMU
1	-	-
2	-	-
3	2,213	C3-BL, C4 and T2
4	122	C5, S3, T1-B and T1-R
5	4,795	C1-BL, C1-BR, C3-BR, K1, R3, S1, S4 and T3

Source: GTE (2021).

No Class 1 or Class 2 of lands suitable for cropping were identified within the Project area and surrounds. All land was assessed to be Class 3, Class 4 or Class 5 due to plant available water content, erosion hazards, surface conditions and effective rooting depth that limit cropping success (Appendix J).

Land Suitability for Grazing

Land suitability assessment for grazing within the Project area followed the framework and methodology prescribed in *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).

A summary of the spatial extent of the mapped land suitability classes for grazing within the Project area is provided in Table 4-28.

Table 4-28
Land Suitability – Grazing

Land Suitability Class	Area (ha)	SMU
1	-	-
2	-	-
3	5,085	C3-BL, C3-BR, C4, C5, S3, T1-B, T1-R and T2
4	2,045	C1-BL, C1-BR, K1, R3, S1, S4 and T3
5	-	-

Source: GTE (2021).

The suitability of the land within the Project area and surrounds for beef cattle grazing has been assessed as suitable with some limitations (Appendix J).

Limitations such as water availability, nutrients and salinity have less impact on maintaining native pastures compared with establishing cropping lands.

Observations of vegetation and the current agricultural land use display successful cattle grazing activities are already established within the Project area.

Agricultural Land Class

Agricultural Land Classes are based on a simple hierarchical scheme that is applicable across Queensland. It allows the interpreted land evaluation data to indicate the location and extent of agricultural land that can be used for a wide range of land uses with minimal land degradation (Appendix J).

Agricultural Land Classes for the Project area and surrounds are defined through various guidelines and State planning policies and is currently referenced in regional shire council planning schemes (e.g. the existing Belyando, Broadsound and Nebo Shire Planning Schemes).

Three classes of agricultural land and one class of non-agricultural land are defined in the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM, 2015):

- Class A – crop land;
  - A1 – broadacre and horticultural crops;
  - A2 – horticultural crops only;
- Class B – limited crop land, suitable for sown pastures;
- Class C – pasture land;
  - C1 – grazing of sown or native pastures;
  - C2 – grazing of native pastures;
  - C3 – light grazing of native pastures; and
- Class D – non-agricultural land.

The classes indicate the range of land use choice, the range of land use limitations and land degradation hazard. Further definition and description of Agricultural Land Class is provided in Appendix J.

The Agricultural Land Classes mapped within the Project area (and corresponding SMUs) is provided in Table 4-29 (Appendix J).

Table 4-29
Agricultural Land Class

Class	Area (ha)	SMU
A1	2,192	C3-BL and C4
A2	-	-
Total A	2,192	-
Total B	21	T2
C1	-	-
C2	4,917	C1-BL, C1-BR, C5, K1, R3, S1, S3, S4, T1-B, T1-R and T3
C3	-	-
Total C	4,917	-
Total D	-	-

Source: After Appendix J.

The Agricultural Land Class mapping generally reflects the land suitability class mapping, in that the Project area is generally suitable for cattle grazing, with limited suitability for cropping.

The land suitability assessment determined that three SMUs (C3-BL, C4, and T2) have moderate limitations for cropping land uses, while SMUs T1-R, T1-B and S3 were determined to present moderate limitations for irrigated cotton. All other SMUs identified were considered unsuitable for cropping, however these SMUs would be suitable for beef cattle grazing activities (Appendix J).

SMUs C3-BL and C4 were assessed to have an Agricultural Land Class of A1 and would be suitable for a wide range of current and potential broadacre and horticultural crops (Appendix J).

SMU T2 was assessed to have an Agricultural Land Class of B and is suitable for a narrow range of crops. The land would be suitable for sown pastures and may be suitable for a wider range of crops (Appendix J).

State Land (Stock Route Network and Reserves)

There are two areas of State land designated as stock routes (reserves) in the vicinity of the Project (Section 2.2.1), however these would not be intersected by the Project area (extent of surface disturbance) (Figure 2-15), and therefore would not be impacted.

Contaminated Land

The *Environmental Management Register* (EMR) *and Contaminated Land Register* (CLR) (DES, 2020g) were searched on 14 July 2020 for any records of contaminated or potentially contaminated lands occurring within or near the Project area. The lots within and near the Project area were not included on EMR and CLR.

4.10.3 Potential Impacts

Landscape Character and Visual Amenity

The Project would alter the topography and landforms within the Project area. Some topographic changes would be temporary (i.e. temporary bunds/levees and drains) while others would be permanent (i.e. rehabilitated landforms) (Section 6).

The out-of-pit waste rock emplacements would result in the creation of a number of elevated landforms, which would have elevations of up to 255 mAHD. The elevations of the waste rock emplacements would be similar to or lower than the existing elevated landforms in the vicinity of the Project (e.g. the mountains to the east and surrounding approved developments).

Direct views of the elevated Project landforms are not expected to be significant from nearby dwellings given the large separation distances and presence of intervening vegetation. Table 4-30 provides the distances from the nearby dwellings to the nearest potentially visible Project component (e.g. out-of-pit waste rock emplacements).

Table 4-30
Approximate Distances from Project to Nearby Dwellings

Dwelling	Approximate Nearest Distance to Potentially Visible Project Component
Olive Downs Homestead	3 km
Winchester Downs Homestead	6 km
Vermont Park Homestead	10 km
Coolibah Homestead	15 km
Seloh Nolem 1 and Seloh Nolem 2 Homesteads	16 km

Furthermore, the Project area and surrounds have been cleared for some hundred years and only the remnants of past pastoral and agricultural activities are visible in the landscape. They sit in close proximity to mining operations and mine infrastructure that have been part of the wider landscape for decades.

These remnants of past pastoral and agricultural activities identified within the Project area are typically in very poor condition and are unremarkable examples of their type. Their removal would constitute a low level of adverse cumulative impact to a mixed agropastoral-mining cultural landscape (Appendix L).

Insofar as new mine infrastructure resulting from the Project might be discernible from some locations outside of the boundary of the Project area, this would generally be consistent with the landscape that has existed in this area for decades (i.e. a rural landscape set against a mining landscape), and therefore the Project would be unremarkable in the landscape (Appendix L).

As such, it is not anticipated that there would be material visual impacts associated with the Project.

Land Use

The Project would result in the progressive disturbance (and rehabilitation) of existing agricultural lands in the short-term. The total disturbance areas for each property associated with the development of the Project is summarised in Table 4-31.

Table 4-31
Approximate Project Area within Each Property

Property	Approximate Total Area of Property (ha)	Approximate Project Disturbance within Property (ha)	Percentage of Property Disturbed
Wynette[1]	5,863	2,180	37%
Winchester Downs[2]	33,100	4,780	14%
Iffley[1]	25,600	175	<1%

[1] Property is owned by Whitehaven WS or other mining company.

[2] Property is privately-owned.

Although cattle grazing could continue to co-exist in areas adjacent to the mining operation, the land within the Project area would not sustain the existing land use during construction and operation of the Project. As shown in Tables 4-27 and 4-28, the Project area has been identified as:

- Land Suitability Class 3 (suitable land with moderate limitations) to Class 5 (unsuitable land with extreme limitations) for cropping.
- Land Suitability Class 3 (suitable land with minor limitations) to Class 4 (unsuitable land with severe limitations) for grazing.

All disturbance associated with the Project would be recorded in a PRC Plan and updated in accordance with the *Guideline – Progressive rehabilitation and closure plans* (DES, 2019b). The objective of the rehabilitation would be to return all disturbed areas to their pre-mining land suitability potential or to the land suitability described in the PRC Plan for the Project.

In the long-term, the disturbed areas of the Project area would be rehabilitated to the proposed post-mining land suitability class as detailed in Table 4-32.

The Project would also be designed to allow continued operation of the Winchester Quarry and reduce potential impacts to its operation through sequencing mining in consideration of the extent of already depleted reserves of hard rock (Section 3.2.4).

Whitehaven WS would consult with Quarrico (operator of the Winchester Quarry) with regards to its continued operation.

The Project is located within the Bowen Basin region, which has been developed through the nineteenth and twentieth centuries in response to two main social, economic and administrative imperatives; agriculture and mining (Appendix L). These two activities resulted in modification to the natural environment to create a mixed mining and farming landscape that coexist with one another over this time (Appendix L).

Cumulative Impacts

It is anticipated that the Project would have an insignificant impact on the existing land use (being grazing, predominantly) as land disturbed would be primarily rehabilitated to support a PMLU of low-intensity cattle grazing.

Approximately 8% of the total disturbed land would not support an agricultural land use post-mining. The foregone benefits from agricultural production due to the loss of potential agricultural land as a result of the Project would be immaterial (Appendix K). Furthermore, approved and operating projects in the region will be required to progressively rehabilitate any disturbed land in accordance with their respective PRC Plan and PRCP Schedule.

Therefore, it is expected that the Project would not result in material cumulative impacts on existing land uses in the region nor on the regional agricultural industry in the long-term.

It is considered that the proposed Project is compatible with the surrounding land uses (i.e. mining and agriculture).

Table 4-32
Proposed Post-mining Land Suitability Classes

Disturbance Type	Proposed Post-mining Land Suitability Class
Open cut mining, out-of-pit and in-pit waste rock emplacement areas	Class 3 to Class 4 – Grazing Class 5 – Cropping
Residual voids	**Low wall with slopes less than 18% within residual voids:** Class 5 - Cropping/Grazing **Low walls with greater than 18% slope, highwalls and water bodies within the residual voids:** N/A[1]
Infrastructure areas, including the MIA and infrastructure corridor	Same classes as pre-mining

Source: After Appendix J.

[1] No agricultural use is proposed for the slopes greater than 18% within the residual void (i.e. highwalls or low walls) or the water bodies of the residual voids, therefore no post-mining land suitability class has been assigned.

Soils

Potential impacts of the Project on soils would relate primarily to:

- disturbance of soil resources (e.g. through the development of the open cut);
- alteration of soil structure beneath infrastructure and roads (i.e. compaction);
- possible soil contamination resulting from spillage of fuels, lubricants and other chemicals;
- increased erosion and sediment movement due to exposure of soils during construction; and
- alteration of physical and chemical soil properties (e.g. structure, fertility and permeability) due to soil stripping and stockpiling operations.

The indicative extent of the Project open cut, waste rock emplacements and infrastructure areas would involve approximately 7,130 ha of the soils and land suitability study area would result in changes to the pre-mining land use and suitability. The remainder of the soils and land suitability study area (approximately 6,471 ha) would either not be disturbed or would have altered local topography from local impacts such as access roads or other minor infrastructure.

Management of soil resources is described in Section 4.10.4.

Existing Resource Tenements

The transport mining lease application (MLA 700065), which contains the water supply pipeline, ETL and mine access road, is located within ML 70389 and PL 485 (held by South32 Eagle Downs Pty Ltd).

A petroleum tenement (ATP 1103) (held by Arrow) overlaps the Project area.

Whitehaven WS has undertaken extensive consultation with South32 regarding the alignment of the infrastructure corridor. The engagement with South32, allowed the infrastructure corridor to be designed to minimise impacts on overlapping mining tenements, including consideration of the potential subsidence impacts of the Eagle Downs Mine, as well as the proposed location of the planned ventilation shafts.

Whitehaven WS would continue to consult with South32 regarding the overlapping mining tenements.

Contaminated Land

Proposed Land Use

Proposed land uses that may result in land becoming contaminated are known as “Notifiable Activities” and are listed in Schedule 3 of the EP Act. The following Notifiable Activities are relevant to the Project:

- 1 – Abrasive blasting.
- 7 – Chemical storage (other than petroleum products or oil under item 29).

- 15 – Explosives production or storage.
- 24 – Mine wastes.
- 29 – Petroleum product or oil storage.
- 37 – Waste storage, treatment or disposal.

Unsuitable storage, handling and management of chemicals, explosives and wastes could result in land at the Project becoming contaminated and listed on the EMR or CLR.

Whitehaven WS would implement appropriate mitigation measures and management (Section 4.10.4) to prevent or reduce the potential for contamination from the Project.

Unexpected Occurrences of Land Contamination

If evidence of unexpected contamination is identified, work would cease in that area and action taken to appropriately delineate the contaminated soil or fill material.

Examples of such material may include (but are not limited to):

- buried or hidden rubbish, including containers that may have held chemicals or oil;
- previously unidentified fill material, other than waste rock (i.e. ash); or
- odorous or oil-stained soil or fill material.

In accordance with the EP Act, this material would be managed or remediated and validated under supervision of a suitably qualified person.

4.10.4 Mitigation Measures, Management and Monitoring

Soil Resource Management

General soil resource management practices would include the stripping and stockpiling of soil resources for use in rehabilitation. The objectives of soil resource management for the Project would be to:

- identify and quantify potential soil resources for rehabilitation (Appendix J);
- optimise the recovery of useable soil reserves during soil stripping operations;
- manage soil reserves so as not to degrade the resource when stockpiled; and
- establish effective soil amelioration procedures to maximise the availability of soil reserves for future rehabilitation works.

Soil stripping and handling measures would be undertaken in accordance with the PRC Plan (or other management plan) to be developed for the Project.

A soil inventory would be maintained during the life of the Project and detailed in the PRC Plan (or other management plan). The soil inventory would account for the volumes and locations of soil to be progressively stripped, stockpiled and reapplied.

GTE (2021) recommended the following treatments and amelioration recommendation to assist the rehabilitation reuse of soils:

- SMUs such as C3-BL with alkaline pH and SMUs T1-R, C3-BR, T1-B, C4 and C5 with marginal alkaline levels may have reduced nitrogen availability for plant growth during revegetation. The use of nitrogen specific fertilisers during rehabilitation (as required during the targeted management of native vegetation or pasture development), will bolster nitrogen levels and would be suitable for alkaline soils. The addition of any nutrient would be managed to ensure runoff or excessive use is minimised.
- Gypsum ameliorants may be used to reduce any dispersive attributes for subsoils. This may be applied specifically for SMUs C3-BL, C3-BR, C4, S1 and T3 subsoils.
- SMUs R3, S1, S4, T1-B, T1-R, T2 and T3 have minimal limitations with the exception that topsoil consists of massive structure and/or loamy sands which may be unfavourable in sloped areas of rehabilitation due to soil structure. It is recommended that the topsoil be considered to support other suitable SMU topsoil volumes. If additional rehabilitation volumes of topsoil are required, SMUs S1 and S4 may be used separately, however, they are recommended on level plains.
- Reduce time bare soils are exposed by planting native grasses or other appropriate species and encouraging organic matter horizon, preferably during dry season.
- Contour ripping of soils during the rehabilitation process will reduce erosion and hard setting of surfaces prior to vegetation establishment.

Recommended soil stripping depths and a preliminary soil balance are detailed in Section 6.4.4.

Acid Sulfate Soils

As described in Section 4.10.7, no acid sulfate soils were observed during the surveys by GTE (2021) and it is highly unlikely that the Project area would include actual acid sulfate soils and/or potential acid sulfate soils. In the unlikely event conditions of the soil during the Project life present attributes of potential acid sulfate soils or actual acid sulfate soils, an actual acid sulfate soil environmental management plan would be prepared and implemented.

Erosion and Sediment Control

Erosion and sediment control works would be conducted in accordance with an Erosion and Sediment Control Plan developed for the Project.

During mine operations, erosion and sediment control structures would be designed and installed in accordance with the procedures outlined in the following guidelines:

- *Best Practice Erosion and Sediment Control Guideline* (IECA, 2018); and
- *Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites* (Institute of Engineers Australia, 1996).

Water management, erosion and sediment controls (e.g. sediment dams) and other land contamination controls that would be applied to the Project. In rainfall events below the design standard of the sediment dams, runoff from disturbed areas would be intercepted and treated by sediment dams (e.g. settlement of sediment). In larger events that exceed the design standards, these dams may overflow, releasing water to the receiving environment (Appendix B).

Progressive rehabilitation of disturbance areas and waste rock emplacements would minimise the potential generation of sediment-laden water on-site (Section 4.1.3).

Sediment dams would be retained until the revegetated surface of the waste rock emplacements are stable and runoff water quality reflects runoff water quality from similar undisturbed areas, at which time these controls would be removed and the areas would be free draining (Section 6.4.6).

Land Use

Agricultural land resource management at the Project would include the following key components:

- management of soil resources within the Project area for reuse during the rehabilitation; and
- inclusion of agricultural land objectives (e.g. PMLUs) in the Project rehabilitation strategy.

The Project area would be rehabilitated to achieve the land suitability classes described in Table 4-32. Further details on rehabilitation and the PMLUs for the Project are described in Section 6.

Contaminated Land

Measures used to prevent or reduce the potential for contamination of land from fuel, oils, chemical storage and wastes are described in detail in Sections 4.13 and 4.15.

Topography and Landforms

The final landform and PMLUs for the Project have been developed in consideration of the existing pre-mine topography and landforms in the Project area and surrounds.

Further detail on the final landform design and associated concepts is provided in Section 6.

Land Tenure

Whitehaven WS would continue to consult with the relevant stakeholders. Prior to any activity associated with the Project upon any relevant lands, all appropriate land tenure would be secured and all necessary approvals and/or consents from all parties holding a lawful interest in the relevant lands would be obtained.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for land. This is described further in Section 7.

4.11 ECONOMIC

4.11.1 Methodology and Environmental Objectives

An Economic Assessment for the Project was undertaken by Deloitte Access Economics (2021) and is presented in Appendix K.

The Economic Assessment was prepared in accordance with the *Economic Impact Assessment Guideline* (DSD, 2017) and the *Project Assessment Framework – Cost-benefit analysis* (Queensland Treasury, 2015).

The Economic Assessment includes a cost-benefit analysis to evaluate the potential net benefits of the Project to Queensland, as described in further detail in Appendix K and Section 8.

Further, in accordance with the *Economic Impact Assessment Guideline* (DSD, 2017), a Regional Impact Analysis was conducted at three different scales to assess the potential economic impact of the Project on the local, regional and Queensland economies. For the purpose of the Economic Assessment, 'local' refers to the Isaac LGA and 'region' refers to the Isaac and Mackay LGAs (Figure 4-8).

The Regional Impact Analysis is primarily concerned with the effect of a proposal on an economy in terms of specific indicators, such as gross value-added, employment, and economic effects of the Project on other industries, such as any spill-over or crowding-out effects. The Regional Impact Analysis for the Project used a Computable General Equilibrium model developed by Deloitte Access Economics to examine the wider economic effects of the development and operation of the Project:

- Direct impacts – economic gains associated with the 'core' Project operations, namely the extraction and processing of coal, and revenue generated by the sale of coal.
- Indirect impacts – economic gains associated with upstream or downstream industries, where the benefits relating to increased resource activity are typically the highest, including any crowding-out effects generated by the Project on other sectors of the economy.

A description of the environmental values, including a summary of the existing local, regional and Queensland economies is provided in Section 4.11.2. The potential impacts of the Project on the local, regional and Queensland economies are described in Section 4.11.3 (including the assessment scenario sensitivity analysis described at the start of Section 4), while mitigation measures are provided in Section 4.11.4.

The environmental objectives relevant to economics, as described in the Terms of Reference for the Project, are:

> *The construction and operation of the project should aim to:*
>
> *(a) avoid or mitigate adverse social and economic impacts arising from the project*
>
> *(b) capitalise on opportunities potentially available for capable local industries and communities where this does not have a significant negative impact on the project or reduce net economic benefits to the State*
>
> *(c) create a net economic benefit to the region and state*

4.11.2 Description of Environmental Values

The following description of values relevant to the local, regional and Queensland economies is a summary of the details provided in Appendix K.

The population of the Local area was 20,940 at the time of the 2016 Census, while the population of the Region was 135,909 (or 2.9% of Queensland's population) (Appendix K).

Mining is the major industry of employment within the local area (Isaac LGA) and region (Isaac and Mackay LGAs), employing approximately 60% and 22% of the employed population, respectively (Appendix K).

The agriculture, forestry and fishing industry is the second largest employer in the local area, providing employment for 5.4% of the employed population. While the healthcare and social assistance industry is the second largest employer in the region (9.2% of the employed population) (Appendix K).

Mining is the highest paying industry in the local area and region, with a median weekly wage substantially higher than the median across all industries. Within the mining industry, the vast majority of employment is in coal mining (accounting for 89% of mining industry employment in the region) (Appendix K).

At the end of March 2020, the average rate of unemployment in the local area and region was 2.1% and 5.1%, respectively. This is below neighbouring LGAs average of 7.6% and 5.8% for the Rockhampton and Whitsunday LGAs, respectively (Appendix K).

4.11.3 Potential Impacts

Net Benefit for Queensland

The Project would result in a total net benefit to the Queensland community of $756 million in NPV terms. This value is inclusive of estimated costs for environmental externalities and internalisation of environmental mitigation and management costs by Whitehaven WS (Appendix K).

The estimated net benefit of the Project for Queensland in NPV terms consists of royalties of $563 million, company income tax of $136 million and net producer surplus of $79 million (Appendix K).

Sensitivity analysis undertaken shows that the Project would generate significant net benefits to the Queensland community under a range of circumstances (including variations in coal prices) (Appendix K).

Employment and Income

One of the primary economic effects of a mining development is generating employment within the development's locality.

Direct local employment effects are the benefits associated with the Project's employment of people that reside within the local area, region and Queensland.

The Project would generate approximately 500 new direct, long-term jobs[6]. A significant proportion of the Project workforce is expected to be employed from the region during the construction phase and operations phase, respectively.

Economic benefits to workers include any wage premiums paid above the minimum wage that workers could receive elsewhere in the mining sector. It is estimated that an increase in disposable income of up to $202 million in present value terms would accrue to workers in the region, as a result of comparisons between the average wage for the mining industry relative to the average wage in the region (Appendix K).

The Project is also predicted to result in incremental indirect employment effects associated with related upstream or downstream industries, accounting for any spill-over or crowding-out effects. Over its life, the Project is estimated (on average) to generate the following additional jobs (Appendix K):

- **285 FTE in the local area;**
- **934 FTE in the region; and**
- **1,894 FTE in Queensland.**

Benefits to Suppliers and Other Flow-on Effects

In addition to employment, the other major economic effect of the Project is expenditure with local and regional contractors and suppliers, which will generate local economic activity and have broader economic impacts (Appendix K).

Whitehaven WS is committed to maximising opportunities for local businesses to provide goods and services to the Project. Whitehaven WS would seek to enhance benefits to local and regional businesses by implementing procurement policies that encourage local content and are consistent with the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation National Framework* (Appendix C).

Appendix C and Section 4.4.3 detail management and enhancement measures that Whitehaven WS would implement to maximise opportunities for local business and industry to benefit from the Project.

There would be expenditure effects on the local, regional and Queensland economies associated with capital expenditure and operating costs during the construction phase and ongoing operations of the Project (Appendix K).

[6] Note Whitehaven WS is investigating automation of the fleet for the Project. These direct employee numbers include consideration of automation and may therefore increase depending on the extent of automation (Section 2.1.7).

It is estimated that $4.9 billion in NPV terms would accrue to suppliers in Queensland as a result of the Project (Appendix K).

Whitehaven WS would seek to enhance this benefit to local and regional businesses by implementing procurement policies that encourage local content and are consistent with the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation National Framework* (Appendix C).

There would also be flow-on or 'second round' effects associated with the Project. For example, workers at the Project may spend some of their additional income at shops within the locality which, in turn, helps to support additional employment at these shops.

The primary variable used to measure the change in economic activity in the local, regional and Queensland economies, based on changes in economic output, is gross value added. At the Queensland (State) level, gross value added is known as Gross State Product; and at the regional level, Gross Regional Product.

The Project would have a positive impact on gross value added due to local and regional employment and expenditure effects, including any crowding-out effects experienced by upstream and downstream industries. Deloitte Access Economics predicted that (Appendix K):

- gross value added in the local area would increase by $2.0 billion in NPV terms;
- Gross Regional Product in the region would increase by $6.6 billion in NPV terms; and
- Gross State Product in Queensland would increase by $9.3 billion in NPV terms.

Additional Considerations

As described at the start of Section 4, the Project base case has been assumed for the Economic Assessment and is the basis for the summary presented in Section 4.11 (i.e. autonomous fleet and workforce of approximately 500 personnel for the construction and operations phases).

Notwithstanding, Deloitte Access Economics has conducted an analysis of the changes to the net economic benefits associated with the Project under a non-automated scenario. Deloitte Access Economics found that a non-automated fleet (i.e. additional workforce requirements and associated effects on capital and operational costs) would also result in a significant incremental net economic benefit to the Queensland community, albeit lower in comparison to the Project base case (Appendix K).

Specifically, changes to the economic impacts on the local, regional and Queensland economies associated with the non-automated scenario, relative to the Project base case, would include (Appendix K):

- an increase in incremental indirect employment opportunities; and
- a decline in gross value added.

Appendix K provides further detail on the changes to the economic effects expected for the Project under the non-automated scenario.

End of Project Life

The establishment and operation of the Project would stimulate demand in the local, regional and Queensland economies leading to increased employment and benefits to suppliers. Cessation of the mining operations would result in a contraction in economic activity in these economies.

The magnitude of the local, regional and Queensland economic impacts of cessation of the Project would depend on a number of interrelated factors, including the movements of workers and families, alternative development opportunities, and economic structure and trends in the broader regional economy at the time.

4.11.4 Mitigation Measures

Whitehaven WS is committed to local employment and businesses. Whitehaven WS would implement management and enhancement measures to maximise opportunities for local business and industry to benefit from the Project (Section 4.11.3 and Appendix C).

These management and enhancement measures would include implementing procurement policies that encourage local content and are consistent with the *Queensland Resources and Energy Sector Code of Practice for Local Content* and *Australian Industry Participation National Framework* (Section 4.11.3).

As described in Section 4.4.3, to minimise economic hardships for Project employees and their families following the cessation of operations, Whitehaven WS would:

- provide workers with advanced notice of the impending conclusion of operations;
- develop and implement a post-closure management plan;
- consult with employees regarding potential impacts and identify strategies which will reduce or avoid economic hardship for those affected; and
- where possible, offer to redeploy workers to other proponent-operated projects.

A SIMP has been prepared as part of the SIA (Appendix C), consistent with the DSDMIP's *Social Impact Assessment Guideline* (2018). The objectives and potential benefits/impacts of each sub-plan within the SIMP (i.e. the Workforce Management Plan, Housing and Accommodation Plan, Local Business and Industry Procurement Plan, Health and Community Wellbeing Plan and Community Stakeholder Engagement Plan) are summarised in Section 4.4.4.

As discussed in Section 4.4.4, the SIA and SIMP recognise that the social context of the Bowen Basin is fluid and can radically change due to the cyclical nature of the mining industry. The SIMP would be reviewed regularly to assess the effectiveness and relevancy of the measures and commitments within the SIMP. This would include reviewing the SIMP both during operations and prior to closure of the Project.

4.12 CULTURAL HERITAGE

4.12.1 Environmental Objectives

The environmental objective relevant to cultural heritage, as described in the Terms of Reference for the Project, is:

> *The construction and operation of the project should aim to ensure that the nature and scale of the project does not compromise the cultural heritage significance of a heritage place or heritage area.*

Section 4.12.2 describes the environmental values relating to cultural heritage in the vicinity of the Project. Section 4.12.3 describes the potential impacts and outlines proposed mitigation measures and management for cultural heritage at the Project.

4.12.2 Description of Environmental Values

The environmental values relevant to cultural heritage that are to be protected during the life of the Project include:

- recognition of cultural heritage sites and landscape features;
- respect for knowledge, culture and traditions; and
- conservation of items or areas of cultural significance.

Indigenous Cultural Heritage

Investigations indicate that native title has been extinguished over all land within the area of the mining lease applications and the land does not form part of the Barada Barna People's Native Title Determination. For the purposes of cultural heritage duty of care under the ACH Act, the Barada Barna People are the Aboriginal Party.

Whitehaven WS has formed a CHMP with the Barada Barna Aboriginal Corporation (the prescribed body corporate for the Barada Barna People).

The CHMP describes the assessment of cultural heritage values within the Project area, and the development of appropriate management strategies. The CHMP was approved by the DATSIP pursuant to section 107 of the ACH Act on 31 March 2020.

No Aboriginal cultural heritage sites within the Project area are recorded on the Aboriginal and Torres Strait Islander Cultural Heritage Register maintained by the DSDSATSIP.

Non-Indigenous Cultural Heritage

A Non-Indigenous Cultural Heritage Assessment was undertaken for the Project by Extent (2021) and is presented in Appendix L.

The assessment was prepared in accordance with the Terms of Reference and the principles and procedures established in the following:

- *Assessing Cultural Heritage Significance: Using the Cultural Heritage Criteria* (DEHP, 2013);
- *Guideline: Archaeological Investigations* (DES, 2019f);
- *Defining Boundaries: An Illustrated Guide* (Queensland Heritage Council, 2007);
- *Preparing an Environmental Impact Statement: Guidelines for Proponents* (DSDTI, 2020a);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (ICOMOS, 2013a); and
- *The Burra Charter Practice Notes: Understanding and Assessing Cultural Significance, Developing Policy and Preparing Studies and Reports: Contractual and Ethical Issues* (ICOMOS, 2013b).

Historical Overview

The following historical overview is a summary of the history detailed in Appendix L.

German explorer Ludwig Leichhardt was the first European to enter the northern Bowen Basin. Leichhardt spent two months in early 1845 camped in and exploring the region later named Peak Downs, and noted the presence of coal, although he focused on the identification of potential areas for pastoral use during his exploration (Appendix L).

Although the existence of coal had been known since Leichhardt's first explorations, the lack of reliable means for transporting coal to coastal markets, combined with the limited local demand, prevented early development of the coal resource. Consequently, gold and copper were the first minerals to be extracted from the Bowen Basin in large quantities (Appendix L).

The extension of railways into central Queensland before the end of the nineteenth century provided the 'impetus for extending coal mining' in the area (Appendix L).

The late 1960s was an era marked by the mining activities of multinational companies in the Bowen Basin, who brought necessary capital to ensure key infrastructure development and access to domestic and international markets. By 1997, two thirds of Queensland's $10 billion production of coal came from the Bowen Basin (Appendix L).

Located approximately 30 km north-west of the Project, Moranbah was purpose-built as a 'supportive town' for the Goonyella and Peak Downs mines by the Utah Development Company. Before this, the township was a pastoral station (Appendix L).

Although the town was planned with a 'community focus', Moranbah faced early difficulties. For the many early residents, the town resembled a 'construction site', with two short term caravan parks established as temporary housing. However, infrastructure and service improvements were progressively made to the town and a number of essential and recreational services were added. By the mid-1970s Moranbah had a shopping centre, a hospital, a golf course, an air charter service and an AFL club (Appendix L).

Today, Moranbah has grown into one of the hubs of the Isaac Region with an array of amenities including a major supermarket, restaurants and cafes, a public swimming pool and sporting facilities.

The Project area is positioned on one of the original pastoral runs taken up in the local Moranbah area known as 'Grosvenor Downs' (Appendix L).

The brand '2GD', incorporating the initial letters of the run, was registered to William Furlong of 'Grosvenor Downs' and was transferred to Alexander Boner McDonald on 26 May 1873. By 29 April 1885, McDonald was the registered lessee of Grosvenor Downs and amongst the earliest pioneers at the copper fields of the Peak Downs district (Appendix L).

A homestead was erected on the station under the tenure of A.B. McDonald and is said to have featured a main building with wide verandahs, a semi-detached kitchen and staff quarters, various outbuildings and a tended vegetable garden (Appendix L).

McDonald's holding began with the original Grosvenor runs, but he was able to consolidate a number of other runs into an enlarged Grosvenor Downs. By the time of McDonald's death in 1907, Grosvenor Downs included the Winchester, Teviot Bank, Broadmeadow, Roseylie, Broadlee, Hermitage Forest and Harrow holdings (Appendix L).

After McDonald's death, ownership of the Grosvenor Downs lease was transferred to J.W. and W.M. Allan and by 9 November 1910, the ownership of the run was taken over by J.H. Clark, who presented it to his younger daughter (Appendix L).

The Project area was part of the 'Winchester' holding, which was taken up by J.Y. and E.Y. Shannon who took up the Winchester pastoral lease in 1909. The holding was used for running cattle and had a permanent water source in the Isaac River. Although the holding underwent several lessee changes, this was the preferred use throughout the rest of the twentieth century (Appendix L).

In 1914, Francis Herbertson took over the Winchester holding which, after five years, he sold. In 1917, 22.5 square miles of the eastern part of the property was resumed to the Land Commissioner. However, the Shannon family maintained ownership of the rest of property until 1952 when the lessee, M.R. Shannon, passed away (Appendix L).

By the 1940s, the Winchester holding had been consolidated into three separate leases: Winchester Downs, Wynette and Iffley. Winchester was transferred to D.B. Neilsen in 1958. In 1967, the Neilsens applied for a new lease under selection tenure as a Grazing Homestead (Appendix L).

Currently, Winchester Downs is privately-owned by Beryl Neilsen and the Wynette and Iffley properties are owned by Whitehaven WS and Pembroke Olive Downs Pty Ltd, respectively.

Further discussion on the early European settlement and the pastoral history of relevance to non-Indigenous cultural heritage items in the vicinity of the Project is provided in Appendix L.

Non-Indigenous Heritage Values of Relevance to the Project

Extent (2021) (Appendix L) completed historical and archival research and review of heritage registers prior to their survey of the Project area.

No items of significance were identified on the following heritage lists within the Project area (Appendix L):

- World Heritage List;
- National Heritage List;
- Commonwealth Heritage List;
- Queensland Heritage Register;
- *Isaac Regional Planning Scheme 2020*;
- *Broadsound Shire Planning Scheme 2005*;
- *Nebo Shire Planning Scheme 2008*;
- *Belyando Shire Planning Scheme 2009*;
- the former Register of National Estate;
- the Register of the National Trust Queensland; or
- the Australian Institute of Architect's National Register of Significant Twentieth Century Architecture.

Twenty-eight potential non-Indigenous cultural heritage sites were investigated during the survey, however none of the sites or items identified are assessed to be of heritage significance (Appendix L).

4.12.3 Potential Impacts, Mitigation and Management Measures

Indigenous Cultural Heritage

Under section 87 of the ACH Act, a CHMP is required to be prepared by Whitehaven WS in accordance with the requirements of Part 7 of the ACH Act.

Whitehaven WS has formed a CHMP with the Barada Barna Aboriginal Corporation, which was approved by the DATSIP pursuant to section 107 of the ACH Act on 31 March 2020.

The CHMP provides for the engagement of the Barada Barna Aboriginal Party prior to the commencement of any ground disturbance works, which allows for an assessment of the cultural heritage values within the proposed area of disturbance, and for the development of appropriate management strategies.

The CHMP applies to all land within the Project area and includes the following provisions:

- Establishment of a Coordinating Committee comprised of representatives from Whitehaven WS and the Barada Barna Aboriginal Party for the purposes of coordination, implementation, management and future conduct of matters arising in relation to the CHMP.
- Reporting the discovery of any Aboriginal Cultural Heritage within the Project area.
- Process for obtaining approval for Project works and cultural heritage management, (through a Cultural Heritage Survey Report).
- Procedures in relation to the discovery of any human remains.
- Access to the Project area and surrounding areas covered by the CHMP.

The Project would be constructed and operated in accordance with the above provisions, to ensure compliance with the duty of care under the ACH Act.

Non-Indigenous Cultural Heritage

No items of non-Indigenous cultural heritage significance were identified within the Project area or immediate surrounds, and therefore the Project would have negligible impact to items of non-Indigenous cultural heritage (Appendix L).

Potential Impacts on Cultural Landscape

The Project would be one of several mining operations that have existed within the region over a number of decades. Currently, the Project area and its immediate surrounds are characterised by a mix of land uses and a range of activities (Appendix L).

Infrastructure associated with the Project might be discernible from some locations surrounding the Project, however this would generally be consistent with the landscape that has existed in this area for decades (i.e. a rural landscape set against a mining landscape), and therefore the Project would not be remarkable in the landscape (Appendix L).

No specific mitigation measure is required for this minor impact (Appendix L).

Potential Historical Family Grave Sites

Family grave sites are usually found a short distance from homesteads. No homesteads were identified within the Project area, nor were any homesteads identified in the immediate surrounds.

During field works, Extent (2021) remained alert to fenced off areas or 'cultural plantings' that survive as mature trees within an otherwise bare landscape. No family graves were identified within the Project area and immediate surrounds. Therefore, no known family grave sites would be impacted by the Project (Appendix L).

Furthermore, Extent (2021) assessed the potential for family grave sites to be low, based on the absence of homesteads and above-ground features that typify such locations.

Potential for Unidentified Cultural Heritage Sites

It is considered that there is low potential for further historic and archaeological places/items to exist within the Project area.

Notwithstanding, a process for managing historic cultural heritage material which may be located during further development within the Project area would be developed.

Additionally, Whitehaven WS would demonstrate diligence whilst undertaking works within the Project area, particularly during any clearing or construction associated with the Project.

All staff or contractors of Whitehaven WS would be informed of their obligations to look for and avoid impacting on any non-Indigenous cultural heritage material until it has been properly assessed.

Cumulative Impacts

The Project is not expected to impact cultural heritage values and as a result, cumulative impacts with surrounding developments would not be expected to occur.

4.13 HAZARDS AND COMMUNITY SAFETY

4.13.1 Methodology and Environmental Objectives

The PRA (Preliminary Risk Assessment) provided in Appendix N of this EIS describes the hazards and safety risks associated with the Project.

The PRA has been completed in accordance with Australian Standard/New Zealand Standard (AS/NZS) International Standards Organisation (ISO) 31000:2018 *Risk Management – Principles and Guidelines* (ISO 31000:2018).

Other risk assessment standards and handbooks considered by the PRA include:

- *Control of Risk Management Practices – Recognised Standard 02* prepared by the DNRME (2018c);
- *MDG1010 Mineral Industry Safety and Health Risk Management Guideline* (NSW Department of Trade and Investment, 2011); and
- *Handbook 203:2012 Environmental Risk Management – Principles and Process* (HB: 203:2012).

The objective of the PRA was to identify potential risks to public safety, employees and property and key environmental issues both on and off site. The PRA considers, amongst other things, natural events (e.g. flooding), wildlife hazards, hazardous materials, environmental hazards, chemical leaks and spills and other hazards which may occur away from the Project.

As defined by the Terms of Reference, relevant environmental objectives to the Project are:

> *The construction and operation of the project should aim to ensure:*
>
> *(a) the risk of, and adverse impacts from, natural and human-made hazards are avoided, minimised or managed and mitigated to protect people and property*
>
> *(b) the community's resilience to natural hazards is enhanced*
>
> *(c) developments involving the storage and handling of hazardous materials are appropriately located, designed and constructed to minimise health and safety risks to communities and individuals and adverse effects on the environment.*

4.13.2 Description of Environmental Values

Across the Project area land use is primarily for cattle grazing. The vegetation from the landscape has been mostly cleared, commensurate with its land use requirements. Patches of remnant vegetation, mainly along watercourses and drainage lines remain, with riparian vegetation well established where in close proximity to the Isaac River adjacent to the Project area to the north.

Within the vicinity of the Project, the two nearest dwellings are (Figure 2-1):

- Winchester Downs Homestead, located approximately 6 km west of the Project (approximately 2.5 km north-west of the infrastructure corridor); and
- Olive Downs Homestead, located approximately 3 km north of the Project.

4.13.3 Hazard Identification and Risk Assessment

Hazardous Substances

During the construction and operation of the Project, a number of hazardous substances would be stored, used, and disposed of, including hydrocarbons, explosives and various other types of chemicals.

Hydrocarbons and Chemicals

Hydrocarbons that may be utilised for the Project include fuels (including diesel and petroleum-based fuels), oils, grease and lubes.

Diesel and petrol fuel are classified as flammable and combustible liquids (FCLs) for which storage, handling and use are regulated under the *Work Health and Safety Regulation 2011* (WHS Regulation). The WHS Regulation classifies diesel and petrol FCLs as a Category 4 flammable liquid, aligning with AS 1940:2017 *The storage and handling of flammable and combustible liquids,* which classifies them as Class C1 combustible liquids.

Accordingly, the storage and handling of diesel and petrol fuels is a hazard that is associated with the Project. Table 2-9 in Section 2.5 describes the maximum fuel storage capacity of the Project. Generally, diesel and petrol fuels would be stored in self-bunded tanks, isolated from the surrounding environment, and located within the MIA.

Oil, lube and greases are classified as combustible liquids under the WHS Regulation (Category 4) and AS 1940:2017 (Class C2). Oils, lubes and greases would be commonly used and recovered during fleet and plant servicing. Table 2-9 in Section 2.5 describes the maximum quantity of oils, lubes and greases stored at the Project.

Licenced contractors would be utilised to recover, store and dispose of waste hydrocarbons and oil filters at the Project.

The storage of chemicals and other flammable and combustible substances at the Project would be conducted in accordance with AS 1940:2017.

Explosives

The Project would require the use of explosives, including initiating products and detonators, and ANFO explosives.

As described in Section 2.4.13, explosives magazines would generally be located near mining operations to provide ease of access, however also at an acceptable separation distance from the MIA (including the CHPP) for safety.

The explosives magazine would be fenced, signed and maintained in accordance with AS 2187.1:1998 *Explosives – Storage, Transport and Use*.

Table 2-9 in Section 2.5 describes the maximum quantity of hazardous materials stored at the Project.

Natural Events

Due to the location of the Project and its surrounding environment, natural hazard events provide possible hazardous situations within the Project area.

Natural events which may occur within or proximal to the Project area include: bushfire, flood, landslips (proximal to Isaac River) and wildlife hazards (i.e. snake bites, ticks, aggressive animals).

Bushfires

Section 2.3.5 describes that the Project area and wider surrounds are mapped as "medium potential bushfire intensity" bushfire hazard (Figure 2-20) (Queensland Government, 2020).

Whitehaven WS would implement fire prevention measures during the operation of the Project to reduce the likelihood and impact of bushfires, which would include the following:

- construction and maintenance of fire breaks;
- provision and maintenance of firefighting equipment around the Project;
- provision of firefighting equipment training for staff;
- managing vegetation within the Project mining leases to maintain safe fuel loads;
- handling and disposing any chemicals used in the Project area in accordance with the relevant Safety Data Sheet;
- implementing access tracks, to be used by Queensland Fire and Rescue Service for emergency purposes; and
- implementing an Emergency Response Procedure prepared in consultation with emergency services.

Flooding

The Project is located adjacent to the Isaac River, which receives large volumes of water following significant rainfall events. Flat to slightly undulating topography in the Project area, and lack of drainage channels, results in flooding posing a significant potential risk to the Project. Appendix B provides a detailed assessment of the potential interactions between the Project and the local flooding regime.

Temporary flood levees would be progressively constructed as required to provide flood protection to Project operations. The flood levees would be constructed to the north of the Railway Pit, and to the north-east of the Main Pit, to prevent inundation of the open cut during operations and to assist in reducing potential impacts to employees and property at the Project.

The temporary flood levees would be decommissioned and removed once they are no longer required.

Landslide

As the general topography of the Project area is flat to undulating with no significant peaks or rises in topography, landslide risk is considered to be low. Some areas adjacent to the Project area (generally confined to the banks of the Isaac River) have been eroded during high rainfall events. However, these eroded areas are not located in the Project operating area.

Wildlife Hazards

Dangerous animals were identified during surveys conducted by E2M (2021). Dangerous animals recorded within the Project area include:

- snakes;
- feral pigs;
- feral cats; and
- feral dogs.

Interaction with the Surrounding Environment

Through the development of the Project, various environmental hazards may be altered in the surrounding environment. These include:

- surface water and groundwater quality (Section 4.1 and Appendices A and B);
- flooding characteristics (Section 4.3 and Appendix B); and
- natural bushfire regime.

Sixteen risks were identified for the Project as part of the PRA (Appendix N), of which three risks were classified as "As Low As Reasonably Practical" (ALARP). The PRA further concludes that the majority of remaining risks identified carry minor or insignificant consequences (Appendix N).

4.13.4 Hazard Mitigation and Management Measures

Whitehaven WS would implement a number of mitigation and management measures through the delivery of management plans designed for the Project. Management plans suited to the Project were identified during the Project PRA (Appendix N) and include those relating to the following environmental aspects:

- air quality;
- blasting;
- terrestrial and aquatic ecology;
- surface water and groundwater;
- hazardous substances;
- biodiversity offset;
- transport; and
- social impacts.

Process and measures identified through the Project PRA would be implemented at the Project to assist in reducing the risk of impacts to health and safety of employees and the environment. The following processes and measures would be implemented:

- Development and implementation of a Risk Management System.
- Handling, storage and disposal of Hazardous Materials at the Project would be in accordance with relevant legislation, standards and guidelines.
- The management of all chemicals stored and used at the Project would be in accordance with the relevant safety data sheet for each chemical.
- Vehicle and equipment operators would be trained in processes and procedures such as safe and stable operation of machinery and emergency response.
- Licenced contractors would be used to recover, collect, store, handle and dispose of hazardous wastes and materials utilised at the Project.
- Regular inspections of hazardous material storage areas including tanks and bunds would be conducted to maintain structural integrity.

- Spill control kits would be available at all locations in which hazardous materials are stored.
- Whitehaven WS would continue to liaise with community stakeholders including the relevant community emergency services.
- The explosives magazine for the Project would be fenced, signed and maintained in accordance with AS 2187:1998 *Explosives - Storage, transport and use Storage*.
- Ongoing consultation with relevant emergency authorities over the life of the Project (e.g. the Local Disaster Management Group).

Further to the mitigation and management measures described above, Whitehaven WS would prepare an Emergency Response Procedure in consultation with emergency services (e.g. Queensland Police Service, Queensland Fire and Emergency Service, Queensland Ambulance Service). The Emergency Response Procedure would be implemented in the event of an incident to maintain the wellbeing of personnel, contractors and the public.

The Emergency Response Procedure would describe the actions that would be implemented if the following incidents were to occur:

- injury or illness;
- fire;
- unintended initiation of explosives;
- loss of containment of hazardous substances;
- natural events (e.g. flooding, bushfire, cyclone);
- vehicle accident; and
- unapproved mine-affected water discharge off-site.

The Emergency Response Procedure may include, but not be limited to:

- contact details for key stakeholders in case of any emergency;
- emergency and evacuation planning, maps and response procedures;
- a description of the proposed communication mechanisms and required infrastructure;
- treatment plans for injured workers due to chemical processes used on site, including proposed consultation;
- a description of notification requirements for planned exercises; and
- a fatigue management policy.

Whitehaven WS would perform a risk assessment specific to hazardous chemicals stored on-site during the detailed design phase of the Project, in accordance with relevant standards and codes.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for risk. This is described further in Section 7.

4.14 BIOSECURITY

4.14.1 Environmental Objectives

As defined by the Terms of Reference, environmental objectives relevant to biosecurity for the Project are:

> *The construction and operation of the project should aim to ensure:*
>
> *a) the spread of weeds, pest animals and vector agents are minimised*
>
> *b) existing weeds and pests are controlled.*

4.14.2 Description of Environmental Values

Introduced and Restricted Flora

A total of 36 introduced flora species were recorded during field surveys for the Project (Appendix D). Five of these species were identified as Category 3 Restricted Matter species under the *Biosecurity Act 2014*, including (Appendix D):

- Rubber Vine (*Cryptostegia grandiflora*);
- Common Prickly Pear (*Opuntia stricta*);
- Velvety Tree Pear (*Opuntia tomentosa*);
- Parthenium (*Parthenium hysterophorus*); and
- Harrisia Cactus (*Harrisia martinii).*

With the exception of Harrisia Cactus (*Harrisia martinii*), all of the above introduced flora species are listed as Weeds of National Significance (Appendix D).

Parthenium (*Parthenium hysterophorus*) was recorded in moderate to high densities within undulating, clay plains and alluvial areas, while scattered individuals of the four other introduced flora species were recorded throughout the Project area (Appendix D).

The distribution of Weeds of National Significance in the Project area is provided in detail within the regional ecosystem profiles attached to Appendix D.

Introduced and Restricted Fauna

A total of eight introduced fauna species were recorded within the Project area (Appendix D), four of which are listed as restricted matters of various categories under the *Biosecurity Act 2014*.

These include:

- Feral Cat (*Felis catus*) (Category 3, 4, and 6 Restricted Matter);
- European Rabbit (*Oryctolagus cuniculus*) (Category 3, 4, 5, and 6 Restricted Matter);
- Feral Pig (*Sus scrofa*) (Category 3, 4, and 6 Restricted Matter);
- Wild Dog (*Canis lupus*) (Category 3, 4, and 6 Restricted Matter);
- Cane Toad (*Rhinella marina*);
- Common Myna (*Acridotheres tristis*);
- European Hare (*Lepus europaeus*); and
- House Mouse (*Mus musculus*).

These species are not associated with a specific habitat type and are wide ranging in the Project area (Appendix D).

4.14.3 Potential Impacts

Introduced and Restricted Flora

A key threatening process under the EPBC Act is 'novel biota and their impact on biodiversity'. Introduced flora species disrupt ecosystems by outcompeting and replacing native species, resulting in altered ecosystem diversity and function (Appendix D).

Without the implementation of mitigation and management measures, there is a potential for Weeds of National Significance and/or Restricted Matters to become more prevalent, or for new weeds to be introduced to the Project area.

The following Project activities are associated with the spread or introduction of weeds (Appendix D):

- Weed seeds can be transported in contaminated fill, the mud on machinery or in the machinery itself.
- The spread of weed species is facilitated by disturbance.
- Construction activities have the potential for disturbing or introducing weeds, resulting in the establishment of weeds within and outside the Project area.

However, with the implementation of mitigation and management measures for the Project, it is unlikely that the Project would increase the weeds within the surrounding landscape (Appendix D). Mitigation and management measures are described in Section 4.14.4.

Introduced and Restricted Animals

The following threatening processes are associated with introduced fauna species under the EPBC Act:

- 'competition and land degradation by rabbits';
- 'predation by feral cats'; and
- 'predation, habitat degradation, competition and disease transmission by feral pigs'.

The presence and abundance of introduced fauna adversely impacts native fauna through increased competition of resources, predation and habitat degradation (Appendix D).

However, with the implementation of mitigation and management measures for the Project, it is unlikely that the Project would increase pest species within the surrounding landscape (Appendix D). Mitigation and management measures are described in Section 4.14.4.

4.14.4 Mitigation and Management Measures

Consistent with the general biosecurity obligations outlined in the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a), Whitehaven WS would implement mitigation and management measures to minimise the spread of weeds, pest animals and control existing weeds and pests. Whitehaven WS would:

- know the biosecurity risks associated with the Project activities;
- take all reasonable and practical steps to prevent or minimise each potential biosecurity risk; and
- prevent or minimise the adverse effects the risk could have and refrain from doing, or omit to do, something that might exacerbate the adverse effects, or potential adverse effects.

Whitehaven WS would implement various strategies and procedures to minimises potential biosecurity risks such as pests and weeds and their associated diseases or contaminants.

These include the following measures detailed below:

- vegetation clearance measures;
- progressive rehabilitation of disturbed areas;
- feral animal control strategies;
- weed management strategies; and
- implementation of an Environmental Management Plan including weed and pest management measures.

Vegetation Clearance Measures

As described in Section 4.5.4, vegetation clearance measures would be developed for the Project as part of the Environmental Management Plan.

Rehabilitation

In accordance with the *Mined Land Rehabilitation Policy* (DEHP, DNRM and Queensland Treasury, 2017), the Project would be progressively rehabilitated as land becomes available. General rehabilitation practices and measures that would be implemented for the Project are described in Section 6.4.

Feral Animal Management

Whitehaven WS would implement feral animal management measures to reduce and maintain the presence of feral animals within the Project area through an Environmental Management Plan. The plan would detail the specific measures to control pest species in accordance with the *Biosecurity Regulation 2016*.

The following threat abatement plans would be considered relevant to the feral animal control strategies outlined in the Environmental Management Plan:

- *Threat Abatement Plan for Predation by Feral Cats* (DotE, 2015a);
- *Threat Abatement Plan for Competition and Land Degradation by Rabbits* (DEE, 2016); and
- *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEE, 2017).

Control measures would be implemented at commencement of the Project and continue through to relinquishment of the Project area. The implementation of the various measures would be the responsibility of all employees and contractors as required. Section 4.5.4 describes feral management measures that would be implemented for the Project.

Whitehaven WS would ensure that all personnel tasked with feral animal management and control hold current and valid permits, including chemical licences for pesticide use.

Monitoring of feral animals would be undertaken by an appropriately qualified contractor to identify whether new or additional control measures are required.

Primary measures for the control of species identified during field surveys would include:

- baiting (European Hare and European Rabbit);
- trapping (Wild Dogs and Feral Cats); and
- shooting (Feral Pigs).

Weed Management

Weed management (i.e. prevention, monitoring and control) would be undertaken for the Project to mitigate and control the abundance of weeds, and minimise the potential for weeds to spread into adjacent areas.

Restricted matters listed under the *Biosecurity Act 2014* would be specifically targeted for control.
During the life of the Project, the following management measures would be implemented, to mitigate the abundance and species of weeds in the Project area and surrounds and minimise the potential for weeds to spread into adjacent areas:

- Bi-annual surveying of tracks, revegetation (rehabilitation) areas and soil stockpiles, etc. (or more frequently as required), to identify weeds requiring control.
- Washdown of machinery and vehicles when moving to/from weed infested areas.
- Mechanical removal of identified weeds and/or the application of approved herbicides.
- Weed control methods in accordance with those specified by the DAF and the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

Environmental Management Plan

Whitehaven WS would develop and implement an Environmental Management Plan outlining (amongst other things) vegetation clearing measures, weed management, and animal pest management. A monitoring program that includes weed monitoring and animal pest monitoring would be included in the Environmental Management Plan.

The Environmental Management Plan would be developed in accordance with the requirements of the relevant legislation and local strategic plans, including:

- the *Biosecurity Regulation 2016*;
- the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012); and
- the *Isaac Regional Biosecurity Plan 2020-2023* (Isaac Regional Council, 2020a).

The Environmental Management Plan would include the following measures related to biosecurity:

- identification of feral animal populations and weed infestations;
- strategies for preventing spread of feral animals (i.e. maintaining a clean, rubbish-free environment) and weeds (i.e. machinery wash-down, boot scrubbing facilities, appropriate disposal of weed material);
- prioritisation of treatment of weed infestations or weed species and ongoing treatment measures (as necessary);
- appropriately qualified persons would be engaged to undertake pest animal monitoring and recommended feral animal control strategies (e.g. baiting and trapping) and weed removal strategies (including those appropriate for aquatic habitats); and
- feral animal and weed monitoring protocols and follow-up control methods and protocols.

Whitehaven WS would implement pest and weed control/management measures every six months, or as required during weather conditions which are conducive to the outbreak of weeds and feral animal populations.

4.15 WASTE MANAGEMENT

4.15.1 Methodology, Environmental Objectives and Performance Outcomes

This section summarises the assessment of potential impacts associated with waste generated by the Project. The assessment has been carried out by Whitehaven WS in accordance with the *Guideline – Application Requirements for Activities with Waste Impacts* (DES, 2019c).

The Project has been designed to prevent or minimise the generation of waste and associated environmental impacts throughout the life of the Project (including construction, operations, and decommissioning), and to ensure compliance with the relevant legislation relating to waste.

The management of waste (non-mineral) at the Project would be governed by Queensland legislation, including:

- EP Act;
- EP Regulation;
- WRR Act; and
- WRR Regulation.

The EP Act defines 'waste' as anything that is:

> *(a) left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity;*
>
> *(b) or surplus to the industrial, commercial, domestic or other activity generating the waste.*

Section 42 of the EP Regulation further states that:

> *(1) **Regulated waste** is waste that—*
>
> *a) is commercial or industrial waste; and*
>
> *b) is of a type, or contains a constituent of a type, mentioned in schedule 9, part 1, column 1.*
>
> *(2) Waste prescribed under subsection (1) includes—*
>
> *(a) for an element—any chemical compound containing the element; and*
>
> *(b) anything that contains residues of the waste, including, for example, a container contaminated with the waste.*
>
> *(3) However, waste is not **regulated waste** if it is mentioned in schedule 9, part 3, division 1.*

The EP Regulation lists 78 waste items as regulated waste, including asbestos, waste from surface treatment of metals or plastics, clinical waste and waste that is contaminated with chemicals. General waste is waste that is not classified as regulated waste or recyclable waste. Recyclable waste is able to be reconditioned, reprocessed, or reused.

General, recyclable and regulated waste generated by the Project are described in Section 4.15.2.

The WRR Act waste management hierarchy (i.e. avoid, reduce, reuse, recycle, recover, treat, and dispose) would be used to manage waste at the Project. If waste must be disposed of, Whitehaven WS would do so in a way that prevents or minimises adverse effects on environmental values.

As defined by the Terms of Reference, the environmental objective of waste management for the Project is:

> *The environmental objective to be met under the EP Act is that any waste transported, generated, or received as part of carrying out the activity is managed in a way that protects all environmental values.*

Part 3 of Schedule 8 of the EP Regulation sets out the waste management performance outcomes for the Project. These include:

> *(a) waste generated, transported or received is managed in accordance with the waste and resource management hierarchy under the Waste Reduction and Recycling Act 2011;*
>
> *(b) if waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.*

The potential environmental impacts associated with waste generated by the Project are described in Section 4.15.3. Section 4.15.4 described the measures proposed by Whitehaven WS to prevent or minimise potential environmental impacts due to waste.

4.15.2 Description of Waste Material and Sources

The key waste streams generated by the Project would comprise waste rock and coal rejects (as described in Section 2.5).

General, recyclable and regulated wastes expected to be produced at the Project include:

- recyclable waste;
- refurbishable items;
- green waste;
- scrap metal;
- timber, wooden pallets and construction materials;
- personal protective equipment;
- air filters;
- waste oils, greases and lubes;
- engine oil/fuel filters;
- empty waste oil canisters;
- hydrocarbon contaminated material;
- paints;
- sewage and wastewater;
- hazardous and other chemicals;
- hazardous materials canisters/storage devices;
- batteries;
- ozone depleting substances; and
- tyres.

A summary of the waste streams expected to be produced in each phase of the Project is provided below.

Construction

Construction of the Project would span approximately three years and involve developing the Project MIA (and other on-site infrastructure) and establishing connections with external ancillary infrastructure (as described in Section 2.4 of this EIS). During this time a number of materials would be brought onto and stored on-site. Any wastes generated from the storage and use of these materials would be managed in accordance with legislation and policy requirements.

The predominant waste streams likely to be produced during construction include general waste (i.e. non-Class 1, 2 and 5 plastics, and food scraps), recyclable wastes (i.e. Class 1, 2 and 5 plastics, scrap metal, etc.), refurbishable items (i.e. pipes, fittings, etc.), waste oils/grease from machinery and vehicle maintenance, sewage from offices and workshops, and tyres from light and heavy vehicles.

The management strategies for these waste streams are outlined in Section 4.15.4.

Sewage produced during construction would be pumped by a licensed contractor and transported to a local council sewage treatment plant until the on-site treatment plant is operational.

The amount of waste produced during construction would be commensurate with the level of construction activity being undertaken.

Operations

Waste produced during operation is expected to be similar to that generated during construction, with generally increased quantities.

In addition, waste rock material and coal rejects would be produced during operations, commensurate with the level of coal production. Waste rock produced during operations would be used to progressively backfill and rehabilitate the open cuts pits (Section 6).

No tailings are currently proposed to be produced by the Project, however if they are, these would be managed in accordance with the *Guideline – Model mining conditions* (DES, 2017a) (Section 7.4.3).

The largest quantity of regulated wastes would be generated during operations (compared to construction and decommissioning). The predominant regulated wastes produced during operations include oils, empty oil containers, waste grease, wastewater and sewerage. The management strategies for these waste streams are outlined in Section 4.15.4.

Wastewater and sewage treatment would be processed on-site by a treatment plant located in the MIA (Section 2.6.6). The sewage treatment plant would be designed to meet a Class C effluent quality for irrigation. The biosolids produced would be stored on site and collected by a licensed contractor for disposal off site at a licensed facility.

Decommissioning

As described in Section 2.1.8, mining operations would ramp down over the last three years of the Project. The period of ramp-down would provide opportunity to flexibly and progressively decommission components of the Project as they become redundant, while maintaining other components as required.

The WRR Act waste management hierarchy (i.e. "avoid, reduce, reuse, recycle, recover, treat, and dispose") would be used to manage waste at the Project. As part of the progressive decommissioning of infrastructure, on-site disposal of waste (e.g. decommissioned infrastructure and associated general waste) may be required. If waste must be disposed of, Whitehaven WS would do so in a way that prevents or minimises adverse effects on environmental values.

Areas of potential contamination identified in the post-mining landform would be investigated and managed/remediated if required prior to relinquishment.

Section 6 provides a detailed rehabilitation strategy for the Project.

Waste Inventory

Table 4-33 identifies the significant waste streams expected to be produced during construction and operations of the Project. Estimated quantities listed for each waste are on an annual basis and were predicted based on Whitehaven WS' experience and the amount of waste produced at similar sized coal mine operations in Queensland.

Table 4-33 also describes the attributes of the waste stream that influence the potential for dispersal into the environment. Whitehaven WS would manage the waste streams to reduce the potential for dispersal.

Table 4-33 also provides a qualitative risk ranking associated with the relevant waste stream. A preliminary risk assessment for the Project was conducted (Appendix N) and includes preventative and mitigating measures for potentially hazardous waste streams.

4.15.3 Potential Impacts

Key risks associated with waste management for the Project include incorrect storage or disposal of waste material, which may result in the following environmental values being impacted:

- community and workforce health and wellbeing;
- water quality in the surrounding environment;
- soil classification (quality) in areas where waste is disposed, or incorrectly disposed;
- biological integrity and diversity of ecosystems and processes proximal to the Project; and
- suitability of land for the proposed post-mining use.

Potential impacts of waste which may be generated by the Project during construction, operation and decommissioning include:

- groundwater and surface water contamination caused by release or spills of solid or liquid waste either directly to receiving waters or indirectly via runoff from waste contaminated sites;
- degradation of native flora and fauna habitat as a result of inappropriate storage and management of waste;
- land contamination caused by spills or inappropriate waste disposal;
- littering due to unsuitable storage and containment of general waste;
- hygiene issues (including odour) associated with the storage, treatment and disposal of putrescibles waste;
- increased vermin and potential spread of disease due to inappropriate storage and disposal of waste;
- reduced visual amenity due to improper storage of waste;
- decreased air quality due to odours and airborne contaminants;
- increased fire hazards due to poorly managed waste storage;
- increased pressure on existing waste management infrastructure; and
- risks to human health and safety through poor management of hazardous materials.

Cumulative Impacts

As described in Section 4.15.4, Whitehaven WS would manage the waste produced at the Project in accordance with the waste and resource management hierarchy in the WRR Act (i.e. "avoid, reduce, reuse, recycle, recover, treat and dispose").

Table 4-33
Estimated Maximum Annual Waste Produced by the Project

Waste Type/Waste Category	Form	Source	Approximate Quantity (per annum)		Dispersal Characteristics	Risk of Causing Environmental Harm*	Management Strategies (Waste Management Hierarchy Level)^	Proposed Disposal Location
			Construction	Operation				
General Mineral Waste								
Excavated waste (i.e. overburden, interburden)	Solid	Mining activities	0	72 Mbcm (average)	Potential for erosion and saline runoff.	Low	Placed within the mined-out void of the open cut pit when space becomes available behind the advancing mining operations (g) or in out-of-pit waste rock emplacements (g).	Within the open cut and out-of-pit waste rock emplacement extent.
Coal rejects (i.e. coarse and fine rejects)	Solid/liquid	Mining activities	0	5 Mt (average)	Potential for erosion and saline run off. Low potential for acid formation.	Low	Coal reject material from the Project CHPP would be co-disposed within waste rock emplacement areas (g), covered by at least 10 m of inert waste rock.	Within the open cut and out-of-pit waste rock emplacement extent (co-disposed with excavated waste).
General Non-Mineral and Recyclable Waste								
General waste (i.e. food scraps, non-Class 1 [PET], 2 [HDPE] and 5 [PP plastics])	Solid	Kitchens, crib rooms, workshops, administration buildings, etc	2,000 m^3	2,500 m^3	Putrescible and attractive to fauna.	Low	Stored on-site in bins and regularly transported off-site by a licenced waste disposal contractor to a licenced landfill (g).	Licenced and approved landfill.
Recyclable waste (i.e. aluminium, steel cans, Class 2 and 5 plastics, paper towels, paper and cardboard)	Solid	Kitchens, crib rooms, workshops, administration buildings etc	500 m^3	1,400 m^3	Small in size and light in weight.	Low	Stored on-site in bins and regularly transported off-site by a licenced waste transport contractor for recycling (d).	Licenced and approved recycling facility.

Table 4-33 (Continued)
Estimated Maximum Annual Waste Produced by the Project

Waste Type/Waste Category	Form	Source	Approximate Quantity (per annum)		Dispersal Characteristics	Risk of Causing Environmental Harm*	Management Strategies (Waste Management Hierarchy Level)^	Proposed Disposal Location
			Construction	Operation				
General Non-Mineral and Recyclable Waste (Continued)								
Green waste (i.e. grass, cleared timber, weeds)	Solid	Clearing of vegetation, maintenance of accommodation grounds	240 ha~	240 ha~	Attractive to fauna.	Low	Select woody debris, logs and rocks, and habitat features (e.g. hollow bearing trees) would be salvaged for re use in rehabilitation activities (c). Other vegetation would be mulched and/or stacked for reuse in rehabilitation activities (c). Waste vegetation would be burned as required (g).	Within the open cut and out-of-pit waste rock emplacement extent.
Scrap metal (i.e. stainless steel, machine and vehicle parts, other ferrous and non-ferrous metals)	Solid	Construction activities, infrastructure maintenance and workshops	200 m^3	250 m^3	Rust formation.	Low	Smaller items would be stored on-site in skips, while larger items would be made accessible for collection as required. All items would be transported off-site by a licenced contractor to a licenced recycling facility (d).	Licenced and approved recycling facility.
General and Recyclable Waste								
Personal protective equipment (i.e. gloves, hard hats, safety glasses and face masks)	Solid	Bathhouse and contractor facilities	<1 t	<1 t	Small in size and light in weight.	Low	Suitable used equipment would be re-used (c) or otherwise disposed (g).	Licenced and approved landfill.
Air filters (i.e. from machinery)	Solid	Machinery maintenance workshops	<1 t	<1 t	NA	Low	Stored on-site in skips and regularly transported off-site by a licenced waste transport contractor for disposal (g).	Licenced and approved landfill.
Timber/wooden pallets (i.e. reusable pallets)	Solid	Workshop and administration buildings	<10 t	<10 t	NA	Low	Suitable pallets would be returned to the supplier for re-use (c) or otherwise disposed (g).	Licenced and approved landfill.

Table 4-33 (Continued)
Estimated Maximum Annual Waste Produced by the Project

Waste Type/Waste Category	Form	Source	Approximate Quantity (per annum)		Dispersal Characteristics	Risk of Causing Environmental Harm*	Management Strategies (Waste Management Hierarchy Level)^	Proposed Disposal Location
			Construction	Operation				
Regulated Waste								
Waste oils	Liquid	Machinery maintenance workshops	1,000 kg	1,000 kg	Liquid run off and breach from storages.	Medium	Temporary storage on-site and regular collection and transport off-site by licenced contractor to licenced facility for re-use (c), recycling (d) or disposal (g).	Licenced and approved recycling facility or landfill.
Empty waste oil containers	Solid	Machinery maintenance workshops	<5 t	<10 t	NA	Medium	Appropriate temporary storage on-site and regular collection and transport off-site by licenced contractor to licenced facility for recycling (d).	Licenced and approved recycling facility.
Oils rags	Solid	Machinery maintenance workshops	5,000 kg	5,000 kg	NA	Low	Stored on-site in skips and regularly transported off-site by a licenced waste transport contractor for disposal (g).	Licenced and approved landfill.
Engine oil/fuel filters	Solid/liquid	Machinery maintenance workshops	<15 t	<50 t	Liquid run off and breach from storages.	Medium	Temporary storage on-site and regular collection and transport off-site by licenced contractor to licenced facility for treatment (with solvent wash) and re-use of oil (c), and recycling (d) or disposal (g) of filters.	Licenced and approved recycling facility or landfill.
Waste grease	Liquid	Machinery maintenance workshops	<150 kL	<200 kL	Liquid run off and breach from storages.	Medium	Appropriate temporary storage on-site (e.g. sealed container in bunded area) and regular collection and transport off-site by licenced contractor to licenced facility for treatment and recycling (d) or disposal (g).	Licenced and approved recycling facility or landfill.
Sewage	Liquid	Offices, workshops, administration buildings and other locations with restroom facilities.	<100 kL	<100 kL	Liquid run off and breach from storages.	Medium	Until on-site treatment is operational, sewage collected and transported by licenced contractor to a local council sewage treatment plant (f). Once on-site treatment is operational, biosolids from on-site treatment plant collected and transported by licenced contractor to licensed facility for disposal (g).	Licenced and approved sewage treatment facility (before on-site treatment is operational) or licenced and approved landfill (when on-site treatment is operational).

Table 4-33 (Continued)
Estimated Maximum Annual Waste Produced by the Project

Waste Type/Waste Category	Form	Source	Approximate Quantity (per annum)		Dispersal Characteristics	Risk of Causing Environmental Harm*	Management Strategies (Waste Management Hierarchy Level)^	Proposed Disposal Location
			Construction	Operation				
Regulated Waste (Continued)								
Paints (i.e. general paint, air dried insulating varnish)	Liquid/gas	Machinery maintenance workshops.	5,000 L	5,000 L	Liquid/fume breach.	Medium	Appropriate temporary storage on-site (e.g. sealed container in bunded area) and regular collection and transport off-site by licenced contractor to licenced facility for treatment (f) and disposal (g).	Licenced and approved recycling facility or landfill.
Batteries (i.e. dry cell, gel cell, lead-acid)	Solid	Machinery maintenance workshops, offices, workshops, administration buildings.	<1 t	<1 t	Liquid contents breach from storages.	Medium	Appropriate temporary storage on-site and regular collection and transport off-site by licenced contractor to licenced facility for recycling (d) or disposal (g).	Licenced and approved recycling facility or landfill.
Tyres (i.e. from light vehicles and heavy machinery)	Solid	Machinery maintenance workshops.	200 units	300 units	NA	Low	Temporary storage a minimum distance of 10 m away from flammable material. Transported off-site for re-treading where practicable (c) or disposed within the mine open cut as part of backfilling (g).	Within the open cut and out-of-pit waste rock emplacement extent.

* In consideration of potential hazards, toxicity and dispersal mechanisms.

^ Waste management hierarchy as defined in section 9 of the WRR Act: (c) reuse; (d) recycling; (f) treat prior to disposal; and (g) disposal. These measures would be implemented after waste avoidance and minimisation measures have been exhausted.

~ The estimated average annual disturbance of land (i.e. green waste) assuming the life of the Project is 30 years.

Whitehaven WS would develop and implement a Waste Management Program for the Project. The program would describe the objectives and measures for protecting environmental values from potential impacts associated with waste.

The Waste Management Program would seek to achieve the highest level of waste management in accordance with the WRR Act waste management hierarchy and would include control strategies to be implemented across the Project to effectively manage wastes, including options to generate resources from waste or reuse of waste streams generated at the Project, where ongoing health, safety and reliability can be ensured, and implementing a waste recycling program for the Project to promote and encourage recycling of materials such as paper, cardboard and scrap metal.

The Isaac Regional Council operates four landfill sites (Isaac Regional Council, 2020b). The *Isaac Waste Management Strategy* (Isaac Regional Council, 2020b) describes that in 2018-19, Council received approximately 44,569 tonnes of waste across the entire waste network, 53% of which was commercial waste. The strategy further describes that the Moranbah landfill is forecast to reach capacity beyond 2045 (Isaac Regional Council, 2020b).

Impacts to the local area are therefore considered to be minor as the total volume of waste produced at the Project would be minimal in comparison to the volume of waste already being disposed of in the local area. In conjunction with existing and approved mines in the area, impacts on waste to the wider region is also considered to be negligible given the forecast capacity of the Moranbah landfill and the Isaac Council's broader waste management network (Isaac Regional Council, 2020b).

Whitehaven WS has consulted with the Isaac Regional Council in regard to waste management (Attachment 4) and would continue to consult with the Isaac Regional Council to keep the Council abreast of developments associated with the Project to ensure that the long-term needs of the Project do not affect the ability of the Isaac Regional Council to provide landfill infrastructure for the community.

4.15.4 Mitigation, Management and Monitoring Measures

Waste Management Program

Whitehaven WS would manage the waste produced at the Project in accordance with the waste and resource management hierarchy in the WRR Act (i.e. "avoid, reduce, reuse, recycle, recover, treat, and dispose"). If waste must be disposed of, Whitehaven WS would do so in a way that prevents or minimises adverse effects on environmental values.

Control strategies that would be implemented across the Project to effectively manage wastes include:

- operating procedures to define the location and size of the waste storage areas, the management for each type of waste and methods of dealing with accidents, spills, and other incidents that may impact on waste management;
- allocation of designated waste storage locations for holding of waste prior to collection for disposal;
- waste materials would be handled and relocated from the place of production to an appropriate location (e.g. green waste would be transported to the MIA);
- waste would be sorted for ease of management into general, recyclable, and hazardous waste streams;
- options to generate resources from waste would be considered under the end-of-waste framework (Chapters 8 and 8A of the WRR Act) throughout the life of the Project; and
- all waste which is to be removed from site would be done so in accordance with the relevant legislation and the *Isaac Waste Management Strategy* (Isaac Regional Council, 2020b).

Whitehaven WS would develop and implement a Waste Management Program for the Project. The program would describe the objectives and measures for protecting environmental values from potential impacts associated with waste. The Waste Management Program would seek to achieve the highest level of waste management in accordance with the WRR Act waste management hierarchy.

Waste Management Principles

The key waste management principal for the Project would be to implement the WRR Act waste management hierarchy. Consideration of relevant parts of the waste management hierarchy is provided below for the Project.

Waste Avoidance or Reduction

Whitehaven WS would seek to reduce the amount of waste produced at the Project by limiting the amount of materials transported to and stored at the Project.

Materials would be limited through control processes such as the purchasing of bulk materials in raw form, where possible, or consideration of minimalist packaging and the use of biodegradable materials. Where available, Whitehaven WS would consider the use of alternate products and materials to ensure unnecessary waste is not produced.

Waste Reuse and Recycling

Whitehaven WS would implement a waste recycling program for the Project to promote and encourage recycling of materials such as paper, cardboard and scrap metal.

Other waste streams generated at the Project would be reused wherever ongoing health, safety and reliability can be ensured.

Waste would be managed in accordance with the methods outlined in Table 4-33, and the relevant legislation (as described in Section 1.7). In particular, waste oils and metals (including drums) would be managed in accordance with the Commonwealth *Product Stewardship Arrangements for Oil Administrative Guidelines* (Commonwealth Department of Environment and Heritage, 2005).

Treatment of Waste

Wastewater and sewage treatment would be processed on-site by a treatment plant located in the MIA (Section 2.6.6). Effluent from the treatment plant would either be treated and recycled to mine water dams (provided the standards under section 58 of the *Public Health Regulation 2018* are met) or disposed via an on-site irrigation system.

The irrigation area would be located with Project mining tenements and located outside of areas potentially impacted by flooding to reduce the potential for impact on environmental values off-site. The irrigation area would be designed to maximise evapotranspiration and minimising the potential for pooling and runoff of treated effluent. Other design considerations would include, but not be limited to:

- selection of soils exhibiting low potential for erosion and increased drainage capacity;
- modelling of the irrigation area capacity and wet weather storage tank capacities using the MEDLI software;
- design and construction techniques prescribed in the relevant Queensland Government guidelines and Australian Standards; and
- irrigation scheduling to avoid pooling of effluent, e.g. when rainfall is expected, to reduce the potential for effluent runoff impacting off-site environmental values.

Disposal of Waste

Where disposal of waste is required, Whitehaven WS would seek to minimise the volume and quantity of waste product to be disposed of.

Waste products to be disposed of off-site would be transported to a suitably licenced waste disposal facility by a registered waste carrier. It is anticipated that when off-site disposal is required, Whitehaven WS would utilise Council's Moranbah Resource Recovery Centre which is understood to have capacity beyond 2045 (Isaac Regional Council, 2020b).

Whitehaven WS would engage with Isaac Regional Council in relation to off-site disposal of waste generated at the Project at its Moranbah or other preferred facility.

Where possible, waste products to be disposed of on-site would dispose in a manor such that disposal it minimises or prevents impacts to environmental values.

Collection and Storage

Designated waste collection areas would be established at the Project. With exception of waste rock material, waste produced at the Project would be transported to the MIA where:

- waste would be separated into waste streams (general, recyclable, and hazardous wastes);
- general waste would be collected into bins;
- recyclable waste would be stored as appropriate for collection;
- waste oils, chemicals, and other hazardous materials or regulated substances would be stored in bunded areas or on bunded pallets (i.e. isolated from surface runoff);
- hazardous waste would be stored in a separate storage area to ensure that all hazardous waste is managed to prevent environmental harm;
- scrap tyres would be stockpiled in accordance with the *Operational Policy – Disposal and storage of scrap tyres at mine sites* (DES, 2014). To minimise the risk of fire tyre stockpiles would be:
  - less than 3 m high and 200 square metres (m^2) in area;
  - more than 10 m from any other tyre storage area; and
  - more than 10 m in any direction from grass or vegetation.

Waste streams at the MIA would be managed through appropriate signage. Bins would be labelled to minimise risk of cross-contamination and ensure the effective separation of different waste streams. Bins would be emptied and contents transported to appropriate storage locations to assist in reducing the abundance and spread of feral animals.

The above measures would be reflected in the Waste Management Program.

Cleaner Production

Cleaner production means the continuous proactive application of an integrated preventative environmental strategy to, processes, products and services to increase efficiency and reduce risks to people and the environment.

Cleaner production practices could be implemented throughout the Project life through:

- Input substitution: utilising less polluting raw and adjunct materials and the use of process auxiliaries (i.e. lubricants and coolants) with longer service lifetimes.
- Product selection: wherever practicable, non-hazardous materials are utilised preferentially in place of hazardous materials.
- Improved operation and maintenance: selection and use of the most appropriate and practicable fixed and mobile equipment for use in efficient coal extraction, transportation and processing. Ongoing high levels of maintenance to ensure that items are operating efficiently, or decommissioned as required.
- Technology modifications: where practicable, process automation, optimisation, and equipment redesign can implement to assist in improving efficiency.
- Closed-loop recycling: where a product is recycled and used again in the same form (e.g. wooden pallets).

Whitehaven WS would contribute to cleaner production outcomes by applying the following measures for the Project:

- limiting the extent of ground to be disturbed during construction and operations (i.e. minimising the disturbance footprint of the Project);
- selecting the most efficient and practical coal extraction and processing technology to ensure the appropriate energy intensity and production efficiency;
- selecting the most efficient and productive machinery and equipment throughout the life of the Project to minimise the purchase of machinery and equipment;
- selecting the most appropriate processes during operation and maintenance, such as the reuse of runoff for dust suppression, and the recycling of effluent from the sewage treatment plant for reuse or irrigation; and
- recycling appropriate materials (i.e. glass, paper, cardboard, timber and Class, 1, 2 and 5 plastics).

End of Waste Options

Whitehaven WS would consider options to produce resources from waste generated at the Project under the Queensland end of waste framework (Chapters 8 and 8A of the WRR Act). For example, Whitehaven WS would consider supplying end of life tyres to a suitably qualified resource user in accordance with the *End of Waste Code End-Of-Life Tyres (ENEW07503018)* (DES, 2020h). Any end of waste arrangements would be detailed by Whitehaven WS in the Waste Management Program for the Project.

Waste Monitoring and Auditing

Whitehaven WS would implement monitoring and auditing of all waste streams, quantity of waste produced and management practices over the Project life.

Waste auditing would include the following activities:

- assessment of predicted versus actual waste quantities being produced;
- inspections of waste storage areas and monitoring of appropriate separation and storage practices;
- regular inspection reports detailing the status of waste management systems including storage and handling would be prepared and sent to the senior management team;
- monitoring and reporting activities outlined in the Waste Management Program;
- identification of potential improvements in waste management practices; and
- monitoring of compliance with the relevant Commonwealth and Queensland legislation.

Employees would be required to notify employers within 24 hours of becoming aware of an incident which has the potential to cause, or threaten to cause material or serious environmental harm. Whitehaven WS would notify DES either verbally or in writing in accordance with the guideline *The duty to notify of environmental harm* (DES, 2016b).

Waste Rock Management

Approximately 2,012 Mbcm of waste rock would be mined for the Project (Section 2.5.9). The annual volumes of waste rock handled during the life of the Project are provided in Table 2-7.

Waste rock produced by mining would initially be placed in out-of-pit waste rock emplacements located adjacent to the open cut mining areas (Section 2.5.9). When sufficient space is created within mined-out areas, waste rock would be used to completely or partially backfill the Project open cut pits. Waste rock emplacement areas would be progressively shaped and prepared for rehabilitation activities (i.e. final contouring, soil placement and revegetation) as soon as practicable after the area becomes available.

An assessment of the geochemical characteristics of the Project waste rock is provided in the Geochemistry Assessment prepared by Terrenus (2020) (Appendix M). The assessment concluded that the majority (> 99%) of the Project waste rock would generally be expected to have a low sulfur content and be NAF.

Waste rock material would typically generate relatively low to moderate salinity surface water runoff and seepage with relatively low soluble metal/metalloid concentrations (Appendix M).

Whitehaven WS would take reasonable measures to identify and selectively place (or alternatively manage) highly sodic and dispersive waste rock. Where this is not feasible, waste rock landforms would be constructed with short and low (shallow) slopes and progressively rehabilitated to minimise erosion.

A detailed description of the management of waste rock is provided in Section 4.1.4.

Coal Rejects Management

Approximately 148 Mt of coal rejects would be produced from the processing of ROM coal over the life of the Project (Section 2.5.10).

Coal rejects (coarse and fine) generated by the processing of ROM coal from the Project, based on Project coal samples, were assessed as part of the Geochemistry Assessment (Appendix M). The assessment concluded that the coarse component of the reject material is typically expected to generate pH neutral to alkaline, low salinity surface water runoff and seepage following initial surface exposure. A small proportion of coarse reject samples have been classified as PAF-LC (Appendix M).

Coal rejects from the CHPP would be co disposed with waste rock in locations such that any runoff or infiltration would report to the Project water management system for mine water (Section 2.7).

Reject material would be periodically sampled during the mine life to confirm geochemical characteristics and to enable the reject disposal strategy to be adjusted as necessary.

A detailed description of the management of coal rejects for the Project is provided in Section 4.1.4.

Natural Resource Use Efficiency

Water

Water would be managed at the Project to achieve the fullest separation possible of clean, sediment laden and mine-affected water, within the limitations of operational requirements.

Water would be stored at the Project and would be sourced from the following, in priority order:

- water for construction and operational purposes would be preferentially sourced from dedicated on-site water storage dams;
- water collected in water storage dams and sediment dams would be captured and retained for reuse on-site where possible (e.g. dust suppression, CHPP demand) and/or controlled release off-site to the receiving environment in accordance with *Model water conditions for coal mines the Fitzroy basin* (DES, 2013);
- surface runoff from rehabilitated waste rock emplacements during operation of the Project would be directed to dedicated sediment dams for settling and release to the receiving environment; and
- where possible, sourcing external water requirements from surrounding mining operations to reduce take from the environment or raw water supplies.

As described in Section 2.7, external water supply would be sourced when required from either an external water supplier (e.g. Sunwater) via a water supply pipeline or from water sharing with surrounding mining operations.

Water management is discussed further in Sections 4.1, 4.2, 4.3 and Appendix B.

Energy

Energy for the Project would be supplied via the existing regional power network from Powerlink's Eagle Downs Substation. Power would be relayed from the station via a 66kV ETL to a switching station located at the Project MIA.

Whitehaven WS would limit energy usage to what is needed for the Project to progress. Whitehaven WS would implement control measures such that power generation is not wasted through unnecessary activities.

As described in Section 4.8.5, Whitehaven WS would implement procurement policies that require the selection of energy efficient equipment and vehicles, and optimise diesel consumption through logistics and planning (e.g. review of the mine plan to optimise haul length, dump locations, and road gradients).

Whitehaven WS is committed to reduce operational emissions from energy use and haulage. Whitehaven WS would work with key partners to develop innovative ways to reduce energy consumption. Working with Cummins and Hitachi, updated fuel calibrations on a fleet of 17 diesel-electric trucks at the Tarrawonga Mine in NSW were rolled out. Minor changes in engine/truck control software to improve fuel efficiency resulted in a reduction of 6.6% in fuel consumption (Whitehaven, 2020).

Whitehaven WS would be subject to annual reporting obligations as detailed in Section 1.7. These include:

- GHG emissions;
- energy production;
- energy consumption; and
- any other information specified under the NGER Act.

Environmental Authority

The environmental authority for the Project would include monitoring, auditing and management measures for waste. This is described further in Section 7.