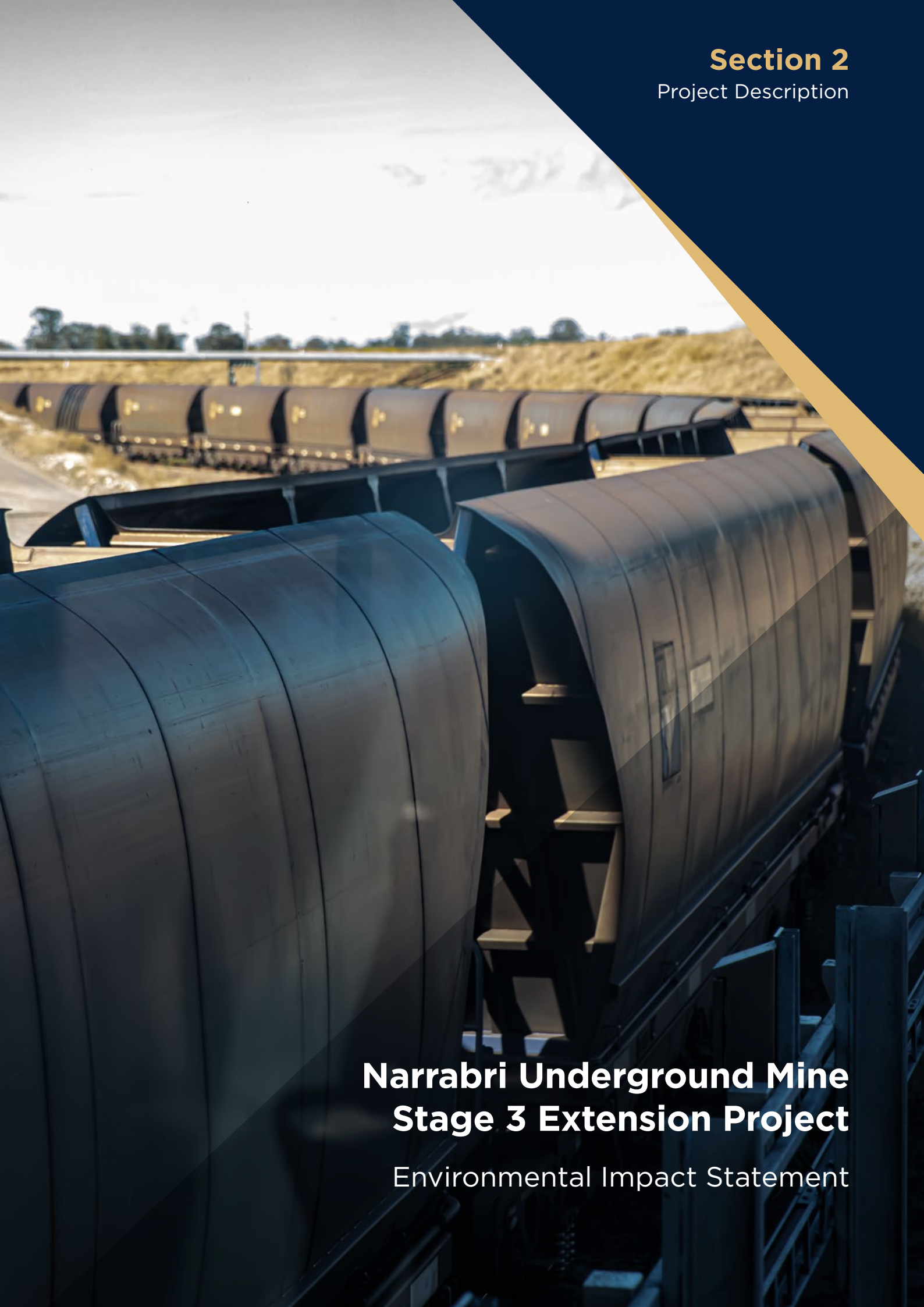

Section 2
Project Description

Narrabri Underground Mine Stage 3 Extension Project

Environmental Impact Statement

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2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF THE APPROVED NARRABRI MINE

The following subsections describe activities associated with the Narrabri Mine (Plate 2-1) that are currently approved under Project Approval 08_0144. The Development Application for the Project seeks to consolidate and replace the existing Project Approval 08_0144 (i.e. subject to approval of the Project [which includes the ongoing operation of existing approved operations], Project Approval 08_0144 would be surrendered and all relevant approved activities transferred to the Development Consent for the Project).

2.1.1 Underground Mining Operations

Development of the Narrabri Mine commenced in 2008 and production using continuous miner mining methods commenced in 2010 following the issuing of Project Approval 05_0102 (Stage 1 of the Narrabri Mine). Longwall mining operations commenced in 2012 following the issuing of Project Approval 08_0144 (Stage 2 of the Narrabri Mine).

The Narrabri Mine is approved to extract coal at a rate of up to 11 Mtpa of ROM coal until July 2031[1]. Mining operations are undertaken 24 hours per day, seven days per week.

The approved underground mining area consists of 20 longwall panels. Longwalls 101 to 106 are approximately 295 metres (m) wide and range from approximately 1.8 km to 2.9 km long. Longwalls 107 to 111 and Longwalls 201 to 209 are approximately 400 m wide and range from approximately 1.6 km to 4 km long (Figure 2-1).

Start and finish dates for longwalls extracted to date at the Narrabri Mine are provided in Table 2-1. At the time of writing, longwall mining is being undertaken in Longwall 109.

Table 2-1
Start and Finish Dates for Completed Longwalls to Date

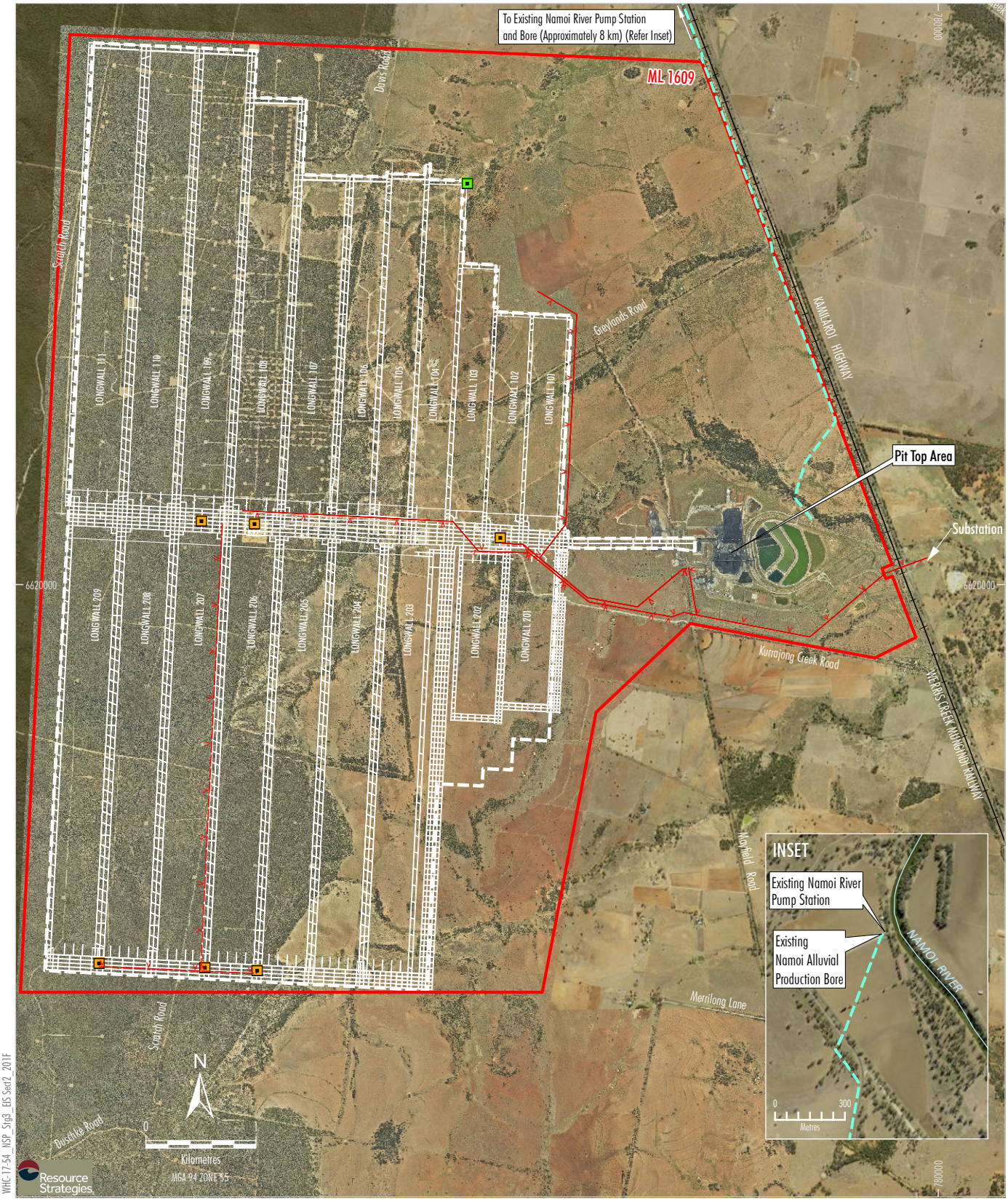
Longwall	Start Date	Finish Date
LW101	June 2012	June 2013
LW102	July 2013	January 2014
LW103	March 2014	October 2014
LW104	December 2014	July 2015
LW105	September 2015	May 2016
LW106	June 2016	March 2017
LW107	April 2017	July 2018
LW108[2]	September 2018	November 2019
LW109	January 2020	-

Source: NCOPL (2019b).

Plate 2-1 Narrabri Mine Box Cut and Drifts

[1] The Narrabri Coal Mine Stage 2 Longwall Project Environmental Assessment (R.W. Corkery & Co, 2009) described a 28-year mine life (i.e. until 2037); however, Condition 5, Schedule 2 of Project Approval 08_0144 restricts mining operations to July 2031.

[2] Longwall 108 was segregated by installing additional gate roads due to geology considerations. The panel is now known as Longwall 108a (fully extracted) and Longwall 108b (not yet extracted).



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LEGEND

- Mining Lease (ML 1609)
- Approved Narrabri Mine
- Underground Mine Footprint
- Underground Mining Layout
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Indicative Ventilation Complex
- Indicative Ventilation Complex - Decommissioned

Source: NCOPL (2019); NCOPL (2015); NSW Spatial Services (2019)

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NARRABRI STAGE 3 PROJECT

Approved Narrabri Mine
Indicative Underground Mining Layout

Figure 2-1

Underground Mine Access

Access to the underground mining area is via three drifts from the box cut, as shown on Plate 2-1. The box cut is located in the Pit Top Area (Figure 2-2). The current layout of the Pit Top Area is shown on Figure 2-3.

A conveyor to transfer ROM coal to the surface is located in one of the drifts. The other drifts allow for employee, machine and material access and services including ventilation, water and electricity.

Major Underground Equipment and Mobile Fleet

The existing major underground equipment and mobile fleet comprises (after NCOPL, 2019a):

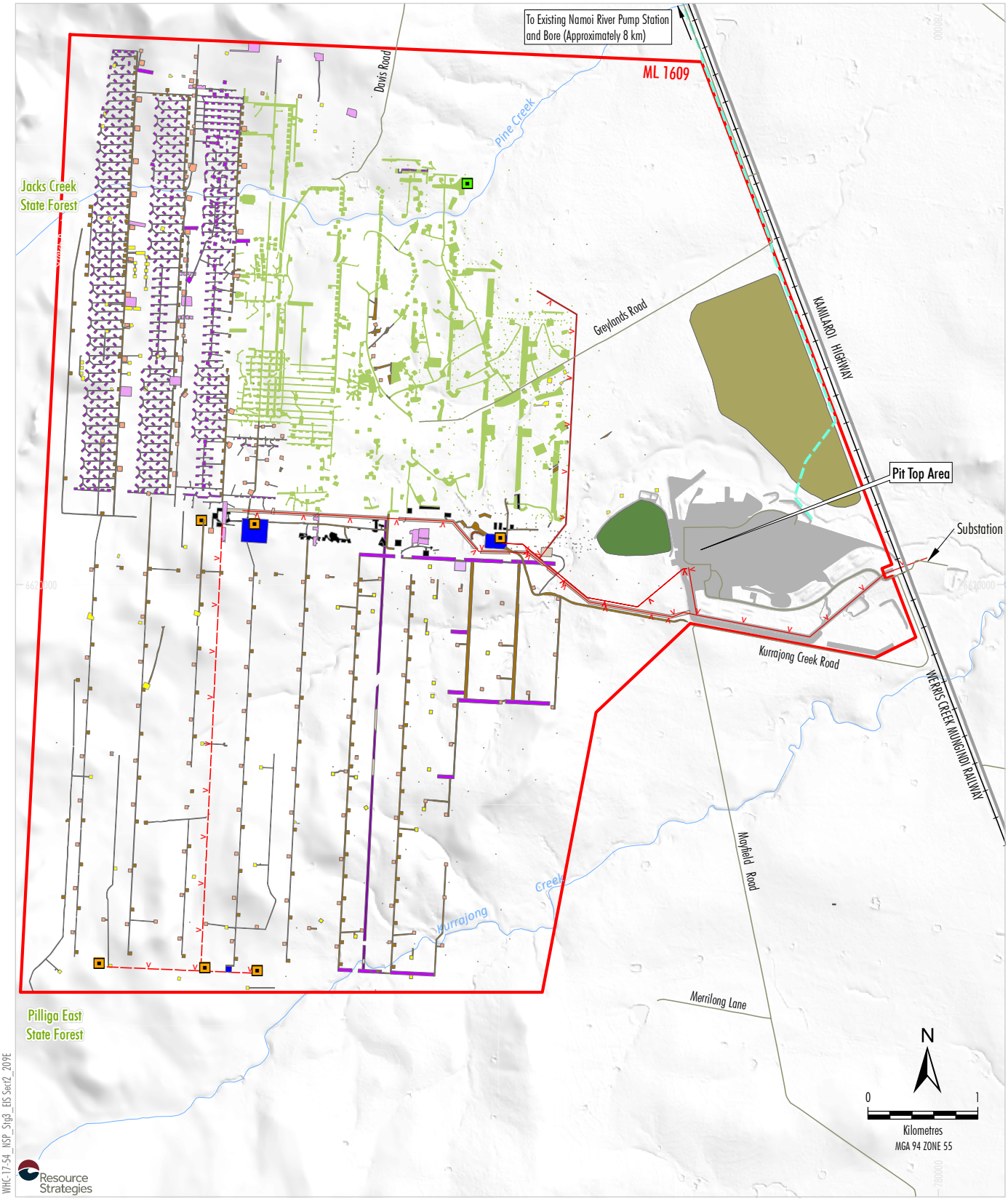
- a longwall mining unit;
- continuous miners;
- shuttle cars;
- feeder breakers;
- load/haul/dump vehicles;
- personnel transport vehicles;
- panel conveyor belts;
- underground loaders; and
- underground drill rigs.

2.1.2 Pit Top Area

The Pit Top Area is shown on Plate 2-2 and includes the following surface infrastructure (Figure 2-3):

- box cut;
- CHPP (Section 2.1.3);
- ROM coal stockpile and product coal stockpile (Plate 2-3) and associated coal handling infrastructure (Section 2.1.3);
- rail loop and product coal load-out infrastructure (Section 2.1.3);
- reject emplacement area (Section 2.1.4);
- site water management infrastructure (e.g. water storages, water treatment facilities, brine storage area, sediment dams and associated pumps, pipelines and drainage infrastructure) (Section 2.1.9);
- administration, workshop, store and bathhouse buildings;
- range of service facilities (e.g. potable water, sewage treatment facilities, electricity distribution, waste management facilities) (Section 2.1.10);
- longwall unit assembly area;
- access roads;
- car parking; and
- amenity bunds.

Plate 2-2 Existing Pit Top Area



LEGEND

- Mining Lease (ML 1609)
- Approved Narrabri Mine
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Indicative Ventilation Complex
- Indicative Ventilation Complex - Decommissioned
- Existing Rehabilitation and Subsidence Remediation Areas
- Reject Emplacement Area
- Additional Brine Storage Area
- Exploration Borehole
- Access Track and Post-drainage Corridor
- Bund
- Pre-conditioning Area
- SIS Pre-Drainage Borehole
- Service Borehole
- Services Corridor
- Pit Top Area Infrastructure
- Ventilation Complex
- Other

Source: NCOPL (2019) ; NSW Spatial Services (2019)

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NARRABRI STAGE 3 PROJECT

Approved Narrabri Mine
Indicative Surface Disturbance Footprint

Figure 2-2

Source: Orthophoto: NCOPL (2019)

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NARRABRI STAGE 3 PROJECT

Existing Pit Top Layout

Figure 2-3

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Plate 2-3 Existing Product Coal Stockpile

The existing major surface mobile fleet includes (after NCOPL, 2019a):

- dozers;
- trucks;
- water carts;
- excavators;
- graders; and
- drill rigs.

2.1.3 Coal Handling, Processing and Transport

Coal Handling and Preparation

ROM coal is transferred to the ROM coal stockpile on the surface via the drift conveyor. The ROM coal is then either fed to a rotary breaker or to a secondary bypass crusher.

The rotary breaker reduces the size of the ROM coal before it is transferred to the CHPP. Waste generated from the rotary breaker is transferred to the reject emplacement area.

The CHPP produces the following main streams:

- combined (partly washed) thermal coal;
- washed PCI coal;
- coarse coal reject material; and
- coal fines.

Product coal from the CHPP is transferred to the product coal stockpile via conveyor in conjunction with dozers.

The product coal from the secondary bypass crusher is blended with thermal coal from the CHPP on the product coal stockpile or during train loading. No waste is generated from the secondary bypass crusher except for minor amounts of tramp material.

Coarse coal reject material generated from the CHPP is disposed of in the reject emplacement area. Coal fines are either blended with thermal coal, or disposed in the reject emplacement area.

Product Coal Transport

Product coal is loaded via conveyor onto trains 24 hours per day, seven days per week using train load-out infrastructure at the Pit Top Area (Figure 2-3).

An average of four trains are loaded each day and a maximum of eight trains per day are loaded during peak periods.

Product coal is transported via the Werris Creek Mungindi Railway to the Port of Newcastle for export.

2.1.4 Reject Management

The Narrabri Mine allows for disposal of up to approximately 8 Mt of coal reject material in the reject emplacement area (Figure 2-2) over the life of the mine.

The approved reject emplacement area was originally designed with a significant excess capacity, because at the time, coal quality in the southern and western mining areas was not extensively tested (R. W. Corkery & Co., 2009).

Approximately 0.4 Mt of coal reject has been disposed in the reject emplacement area to date (NCOPL, 2019c).

The reject emplacement area has been constructed with a compacted floor with a permeability of less than $1x10^{-9}$ metres per second (m/s) and a surface water runoff management system (NCOPL, 2019c).

2.1.5 Ventilation Infrastructure

The ventilation system is progressively established to maintain a safe underground working environment.

Ventilation complexes include ventilation shafts, site access, sediment control infrastructure and other associated ancillary infrastructure. Each ventilation shaft is operated as an upcast (return to the atmosphere) or downcast (intake to the mine) ventilation shaft, and is steel or concrete-lined. In addition to the above, ventilation complexes with upcast ventilation shafts also include fans, power supply and electrical infrastructure, as well as ventilation gas management infrastructure. The majority of ventilation complexes include a single shaft and fan; however, the initial ventilation complex developed for the Narrabri Mine included one shaft and three fans. The initial ventilation complex is show on Plate 2-4.

A number of ventilation shafts in the mains and an additional four ventilation shafts at the rear of the longwall panels are approved to be constructed for the Narrabri Mine (Figure 2-1).

In addition to providing access for personnel and materials, the three drifts at the Pit Top Area also act as intake airways to the underground mine.

The requirement for each ventilation complex is subject to ongoing detailed mine planning (i.e. some ventilation infrastructure may not be required).

Ventilation fans, electrical infrastructure and other associated infrastructure are upgraded, replaced or decommissioned and removed during the life of the Narrabri Mine subject to this detailed mine planning.

Ventilation shafts may also be converted between upcast and downcast as required.

2.1.6 Gas Management Infrastructure

Pre-mining gas drainage and goaf gas drainage is required in some locations to reduce the gas content in the coal seams to levels suitable for safe underground mining operations.

Pre-mining gas drainage of the coal seam is progressively conducted ahead of longwall and underground development mining operations through a combination of surface to in-seam (SIS) boreholes and conventional underground in-seam drainage methods.

Goaf gas drainage is conducted behind the progressing longwall mining operations using goaf drainage boreholes. Goaf drainage boreholes are established along each longwall panel in consideration of gas quantity and content.

Plate 2-4 Existing Upcast Ventilation Infrastructure

The existing and indicative future locations of gas management areas for the approved Narrabri Mine are shown on Figure 2-2. The exact locations of future gas management areas may change subject to further detailed mine planning during development and operation, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts on biodiversity, heritage and surface features.

Given the low methane levels in the gas extracted from the Hoskissons Coal Seam to date, gas has been vented to the atmosphere and flaring (although approved for the Narrabri Mine) has not been required to date.

Decommissioning and rehabilitation of gas management areas occurs progressively (Section 2.1.12).

2.1.7 Exploration Drilling

Exploration drilling is conducted at the Narrabri Mine to inform coal and strata characteristics and gas quantity within ML 1609 and EL 6243.

More than 100 exploration boreholes have been drilled within EL 6243.

Rehabilitation of exploration areas occurs progressively (Section 2.1.12).

2.1.8 Mine Safety Pre-conditioning

Mine safety pre-conditioning of the strata overlying the Hoskissons Coal Seam (i.e. the Digby Conglomerate and other adjacent strata) is undertaken to ensure that the roof collapses (or 'goafs') in a regular fashion thereby limiting the risk of strata spanning behind the longwall and reducing the risk of wind blast.

Mine safety pre-conditioning is undertaken by drilling a borehole from the surface into the rock and injecting water under pressure, causing the rock to fracture and cave.

The Narrabri Mine includes development of a series of boreholes at both ends of each longwall panel to allow for mine safety pre-conditioning to occur.

More intensive pre-conditioning is generally required above longwall panels where the Digby Conglomerate thickens to greater than approximately 20 m.

The Digby Conglomerate is typically 15 to 20 m thick in ML 1609; however, the conglomerate is thickest in the north-west of ML 1609 (i.e. thicker than 20 m).

As a result, more intensive pre-conditioning has been undertaken above Longwalls 107 and 108a. More intensive pre-conditioning would be required above Longwalls 108b, 109 to 111.

The existing and indicative future locations of pre-conditioning areas for the approved Narrabri Mine are shown on Figure 2-2. The exact locations of future pre-conditioning areas may change subject to further detailed mine planning during development and operation, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts on biodiversity, heritage and surface features.

Decommissioning and rehabilitation of pre-conditioning areas is conducted progressively (Section 2.1.12).

2.1.9 Site Water Management

Site Water Management System

The site water management strategy for the Narrabri Mine is based on the containment and re-use of mine water and diversion of upstream water around the Pit Top Area.

The approved Narrabri Mine water management system includes:

- up-catchment diversion structures;
- raw water storage dams (Storage D and Containment Bund);
- mine water storage dams (Storages A1 to A3);
- Pit Top Area storages (SB1 to SB4);
- a filtered water storage dam (Storage B1);
- brine storage dams (Storages B2, C and BR1 to BR5[3]);
- sediment dams (SD1 to SD4 and SD6 to SD8[4]);

[3] Brine storages BR1 to BR5 have not been constructed. The construction of BR1 to BR5 is described in Section 2.5.10.

[4] SD7 has not been constructed.

- water treatment facilities;
- the Namoi River pump station, alluvial production bore and pipeline; and
- other water transfer infrastructure (i.e. tanks, pumps and pipelines).

Existing water management dams at the Pit Top Area are shown on Figure 2-3.

The water management system is progressively developed subject to its ongoing performance, prevailing climatic conditions and actual underground mine inflows. The water management system is managed in accordance with the Water Management Plan (NCOPL, 2017a) (or the latest approved version).

A detailed description of the Narrabri Mine site water management system is provided in Appendix C.

Water Demand and Supply

Water is required for underground mining, CHPP operations, washdown requirements, dust suppression, drilling and potable water supply.

The main water sources for the Narrabri Mine are:

- groundwater inflows into the underground workings;
- captured runoff from disturbed areas;
- raw water imported to site from the Namoi River pump station and alluvial production bore; and
- potable water trucked to site, as required.

The existing water treatment facilities treat groundwater inflows and disturbed area runoff to produce filtered water and a brine waste product. The filtered water is used in underground mining operations, or transferred to the Namoi River for controlled release. NCOPL may also investigate options for the beneficial re-use of excess water such as internal use (e.g. irrigation) or provision of water to other water users in the region.

Brine (generated from the water treatment facilities) and groundwater inflows are used for dust suppression. Brine is approved to be stored in Brine Storage Ponds at the Pit Top Area (Figure 2-2). Towards the end of mining, brine will be re-injected into the longwall goaf through the disused goaf gas drainage holes.

Disturbed area runoff and groundwater inflows are used in the CHPP.

Raw water is used to supplement underground mining and CHPP demand and to supply a separate water treatment facility used to produce potable water. If required, potable water is also transported via truck to the Narrabri Mine to supplement the potable water supply from the water treatment facility.

The water balance of the system fluctuates with water demand, the magnitude of groundwater inflows and climatic conditions over time.

Mine Dewatering

Groundwater inflows to the underground workings are pumped to a sump in the box cut before being transferred to the site water management system.

Namoi River Pump Station, Alluvial Production Bore and Pipeline

A pump station and production bore has been developed at the Namoi River to allow for supplementary water supply (Plate 2-5). A pump station and associated infrastructure has been developed to allow for the transfer of water from the Namoi River to the Narrabri Mine. The production bore has been constructed to allow groundwater extraction from the Namoi alluvium (Upper Namoi Zone 5, Namoi Valley [Gin's Leap to Narrabri] Groundwater Source).

Water is preferentially extracted from the Namoi River in accordance with Water Access Licences (WALs) held by NCOPL. When low or no flow conditions in the Namoi River prevent the extraction of water from the river (or other circumstances such as the pump station not being operational), groundwater is extracted from NCOPL's bore to provide a supplementary water supply, in accordance with WALs held by NCOPL.

The Narrabri Mine includes the development of two approved buried pipelines between the Narrabri Mine and the Namoi River (Figure 2-1). One pipeline has been constructed to date, and the second approved pipeline may be constructed in the future (Section 2.10.5).

The existing pump, bore and pipeline may be upgraded or replaced over the life of the approved Narrabri Mine as required.

Plate 2-5 Existing Namoi River Pump Station and Production Bore

Licensing requirements for extraction of water from the Namoi River and the Namoi alluvium are described in Sections 6.4 and 6.5, the Groundwater Assessment (Appendix B) and the Surface Water Assessment (Appendix C).

Controlled Releases

The Narrabri Mine has the potential to receive groundwater and surface water inflows in excess of its consumption requirements.

The Narrabri Mine allows for excess filtered water to be transferred via the approved Namoi River pipelines for controlled release to the Namoi River in accordance with Project Approval 08_0144 and Environment Protection Licence (EPL) 12789, which include the following water quality criteria:

- 50th percentile of all samples (volume-based) are below 250 milligrams per litre (mg/L) of Total Dissolved Solids (TDS);
- 100th percentile of all samples (volume-based) are below 350 mg/L of TDS; and
- pH values of all sampled water to be between 6.5 and 8.5.

To date, no water has been released to the Namoi River.

2.1.10 Other Infrastructure and Supporting Systems

Site Access, Services Corridors and Access Tracks

Access to the Pit Top Area from the Kamilaroi Highway is via Kurrajong Creek Road, which connects to an internal sealed mine access road.

For environmental monitoring, general land management, exploration activities and other ancillary activities, alternative access points to the Narrabri Mine area are also used as required.

Services corridors and access tracks are constructed across the underground mining area and Pit Top Area. Services corridors and access tracks generally include roadways, pipelines, pumps, telecommunication infrastructure, power transmission infrastructure and sediment controls.

Electricity Supply and Distribution

The Narrabri Mine receives electricity via a spur line from a 66 kilovolt (kV) supply system adjacent to the Kamilaroi Highway (Figure 2-1). Transformers in the Pit Top Area step down the 66 kV supply to 11 kV for distribution by overhead cable or underground cable, where necessary.

The 11 kV electricity transmission line will be progressively extended as ventilation complexes (Figure 2-1) and the Narrabri Mine is developed.

Dangerous Goods and Waste Management

Hydrocarbon Storages

Hydrocarbons used on-site include fuels (i.e. diesel), oils, greases, degreaser and kerosene.

Hydrocarbon storage facilities are constructed and operated in accordance with Australian Standard (AS) 1940:2017 *The Storage and Handling of Flammable and Combustible Liquids* and the NSW *Work Health and Safety Regulation 2017*.

Liquid and Non-liquid Wastes

Waste management at the Narrabri Mine is conducted in accordance with the Waste Management Plan (NCOPL, 2015a) (or the latest approved version).

Solid and hazardous waste generated by the mine is typically removed from the site and disposed of by a licensed contractor. Drilling cuttings from exploration, gas drainage and service boreholes are disposed in the reject emplacement area, or consolidated with excavated soil to backfill the sump at the exploration site.

Waste materials are collected and sorted for recycling of paper, cardboard, metals, glass, air filters and oil filters.

Sewage is treated in an on-site sewage treatment plant which is serviced by a licensed contractor.

2.1.11 Workforce

The existing operational workforce (employees and contractors) is up to approximately 520 full-time equivalent personnel.

Contractor numbers vary based on operational requirements and/or to address short-term staffing constraints.

Surface development activities at the Narrabri Mine (when required) are restricted to 7.00 am to 10.00 pm up to seven days a week.

Operations occur 24 hours per day, seven days per week. The current operational shift arrangements at the Narrabri Mine are:

- Administration personnel – 8.00 am to 5.00 pm weekdays.
- Operations day shift personnel – 6.30 am to 4.00 pm.
- Operations afternoon shift personnel – 2.30 pm to 12.00 am.
- Operations night shift personnel – 10.30 pm to 8.00 am.

Shift configurations may be amended from time to time to meet operational and industry best-practice requirements.

A description of NCOPL's approach to local employment is provided in Section 6.16. This approach includes policies and strategies to:

- prioritise recruitment of personnel from the NSC and Gunnedah Shire Council (GSC) LGAs; and
- recruit operational employees from outside the underground mining sector, supported by appropriate workforce training and development.

2.1.12 Rehabilitation and Remediation Activities

The approved Mining Operations Plan (MOP) (SLR Consulting Australia Pty Ltd [SLR], 2020a), the Rehabilitation Management Plan (RMP) (Eco Logical Australia Pty Ltd [ELA], 2017a) and the Mine Closure Plan (MCP) (SLR, 2016) describe the approved Narrabri Mine activities and progress toward rehabilitation outcomes required under ML 1609 and Project Approval 08_0144.

The Narrabri Mine final landform will generally approximate the pre-mining landscape with the exception of the reject emplacement area and surface impacts from subsidence in the underground mining area (SLR, 2020a).

The following final land uses are approved at the Narrabri Mine (SLR, 2020a):

- water management;
- pasture;
- woodland;
- State Forest; and
- biodiversity offset areas.

In addition, surface infrastructure may be retained post-mining where agreed with the relevant regulatory authorities and landholders.

Progressive rehabilitation activities have been conducted at the Narrabri Mine since 2008 and the rehabilitation of approximately 130 hectares (ha) of disturbed areas has commenced to date. Rehabilitation has been undertaken in areas that are available for rehabilitation (principally the area above Longwalls 101 to 107) (NCOPL, 2020).

NCOPL considers that the current rehabilitation performance at the Narrabri Mine indicates good progress towards achieving the relevant rehabilitation objectives and completion criteria with the continued application of adaptive rehabilitation management.

2.1.13 Environmental Monitoring and Management

The Narrabri Mine environmental management system includes various environmental management plans and programs that have been developed and implemented since operations commenced including the following (or the latest approved version):

- Environmental Management Strategy (NCOPL, 2015b).
- Noise Management Plan (NCOPL, 2018).
- Air Quality Monitoring Program (NCOPL, 2015c).
- Water Management Plan (NCOPL, 2017a) incorporating the following:
  - Site Water Balance;
  - Subsidence Monitoring Program;
  - Erosion and Sediment Control Plan;
  - Surface Water Monitoring Plan;
  - Groundwater Monitoring Program; and
  - Surface and Groundwater Response Plan.
- Aboriginal Cultural Heritage Management Plan (ACHMP) (NCOPL, 2019a).
- Energy Savings Action Plan (Advitech, 2014).
- Greenhouse Gas Minimisation Plan (SLR Consulting, 2012).
- Waste Management Plan (NCOPL, 2015a).
- Landscape Management Plan (ELA, 2017b) incorporating the following:
  - RMP (ELA, 2017a); and
  - MCP (SLR Consulting, 2016).
- Biodiversity Management Plan (ELA, 2017c).
- Biodiversity Offset Strategy (ELA, 2019a).
- Extraction Plan (NCOPL, 2017b).

The existing environmental monitoring locations at the Narrabri Mine is presented on Figure 2-4.

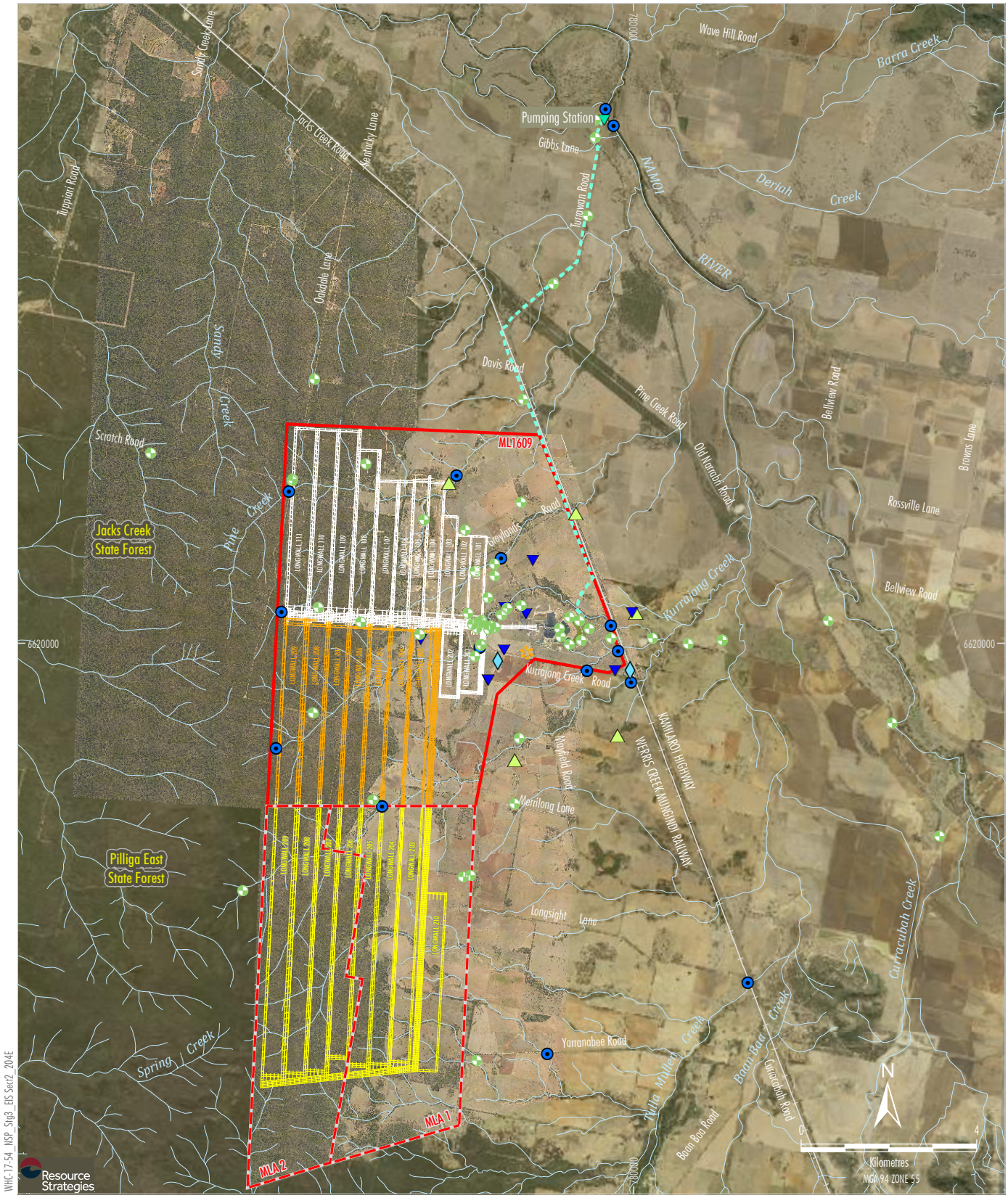
Further details of the existing content and/or revision of these plans and programs for the Project is provided under the relevant environmental aspect headings in Section 6.

2.2 PROJECT GENERAL ARRANGEMENT

The Project involves an extension to the approved underground mining area to gain access to additional coal reserves within MLAs 1 and 2 (Figure 2-5), an increase in the mine life to 2044, and development of supporting surface infrastructure (Figure 2-6). The Development Application for the Project seeks to consolidate and replace the existing Project Approval 08_0144.

The Project would include the following activities (Figures 2-5 and 2-6):

- continued longwall mining of the Hoskissons Coal Seam involving a southern extension including:
  - an extension of Longwalls 203 to 209 into MLAs 1 and 2; and
  - an additional longwall (Longwall 210) within MLA 1;
- continued development of underground roadways within the Hoskissons Coal Seam and adjacent strata to access mining areas;



LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing Namoi River Pipeline (Buried)
- Approved Underground Mining Layout
- Indicative Underground Mining Layout to be Extended for Project
- Indicative Underground Project Mining Layout
- Surface Water Monitoring Site*
- Groundwater Monitoring Site
- Noise Monitoring Site
- Deposited Dust Monitoring Site
- PM_{10} Monitoring Site
- Meteorological Station
- Pumping Station

* Does not include on-site water storage monitoring locations.

Source: NCOPL (2019); NSW Spatial Services (2019)

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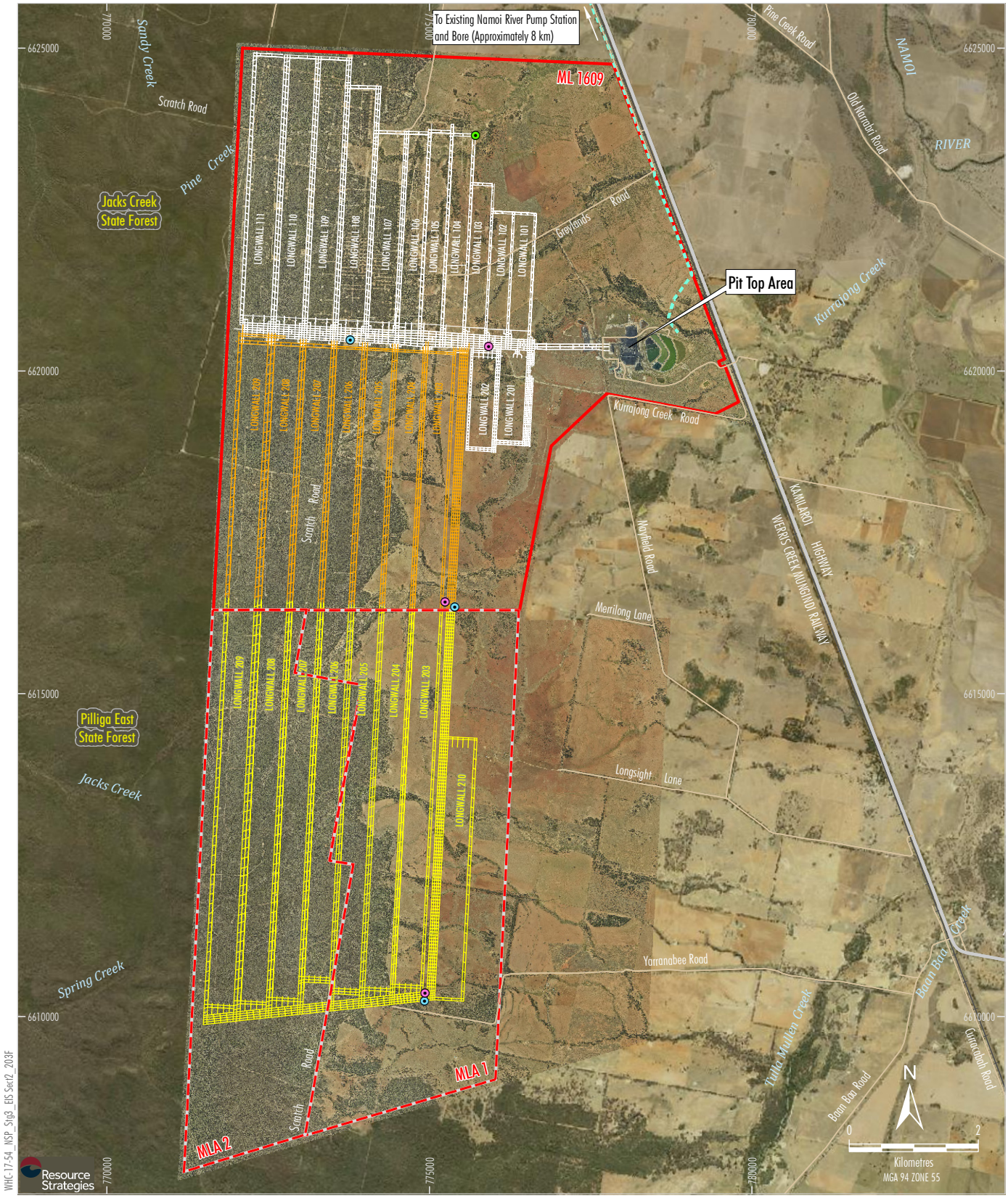
NARRABRI STAGE 3 PROJECT

Current Environmental Monitoring Locations

Figure 2-4



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LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing Namoi River Pipeline (Buried)
- Approved Underground Mining Layout
- Indicative Underground Mining Layout to be Extended for Project
- Indicative Underground Project Mining Layout
- Indicative Ventilation Complex (Downcast)
- Indicative Ventilation Complex (Upcast)
- Indicative Ventilation Complex (Upcast - Decommissioned)

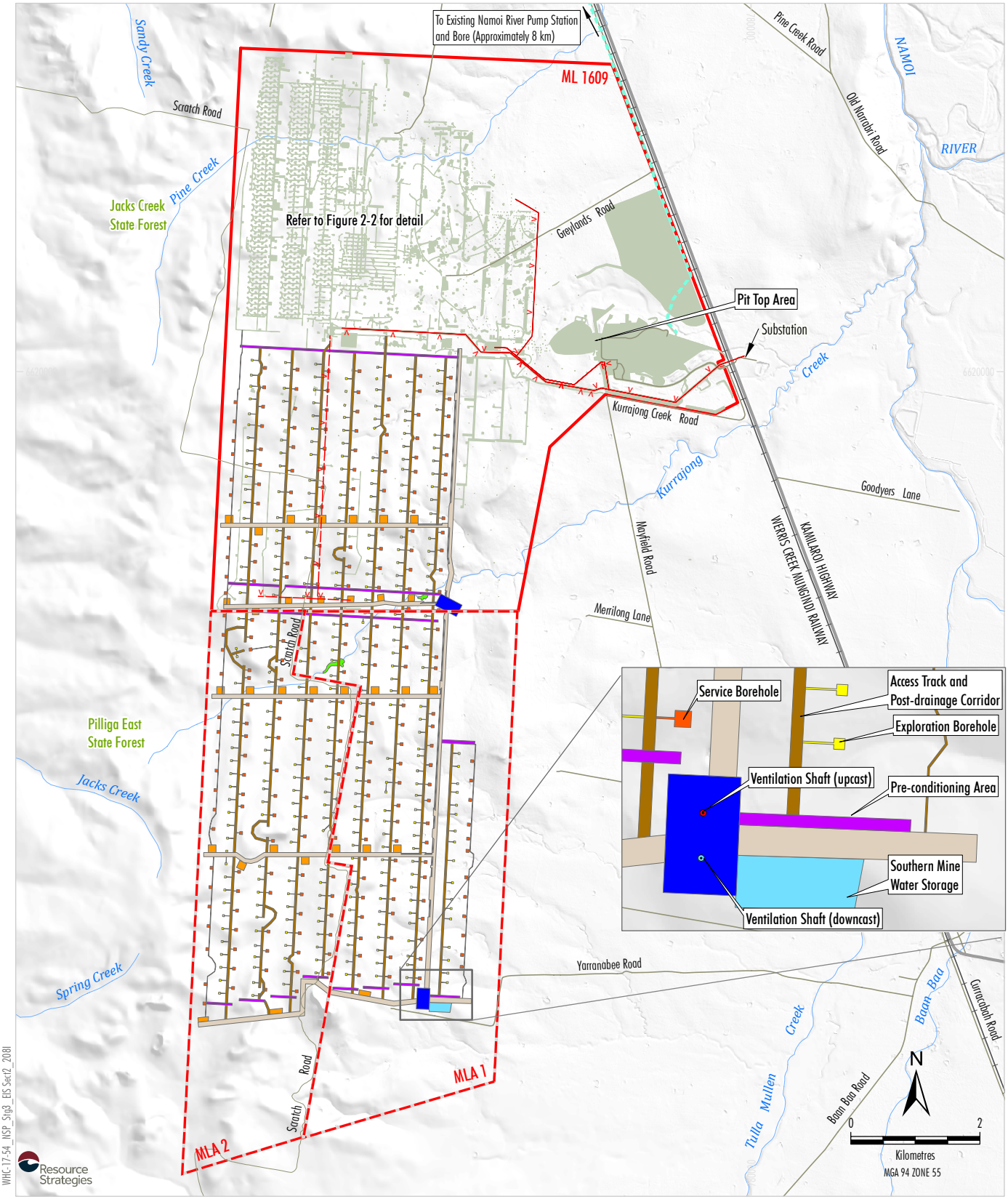
Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Project General Arrangement - Indicative Underground Mining Layout

Figure 2-5



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LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Existing/Approved Surface Development*
- Services Corridor
- Service Borehole
- Exploration Borehole
- Access Track and Post-drainage Corridor
- Pre-conditioning Area
- Service Borehole and Power Reticulation
- Southern Mine Water Storage
- Ventilation Complex
- Farm Dam Decommissioning Works

*Excludes the Impact Reduction Area (Refer to Figure 2-12)

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Project General Arrangement - Indicative Surface Development Footprint

Figure 2-6

- continued use of existing underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities;
- continued production of up to 11 Mtpa of ROM coal (i.e. no change compared to the approved Narrabri Mine);
- continued use of the existing surface facilities (with minor upgrades and extension) and development of additional surface infrastructure associated with roadways, mine ventilation, gas management, exploration, services, water management areas and other ancillary infrastructure above the extended underground mining area;
- continued development of mine safety pre-conditioning areas;
- continued use of the existing coal reject emplacement area;
- disposal of drilling waste products within the reject emplacement area, including receipt and disposal of similar drilling waste products from off-site;
- continued transport of product coal from site by rail;
- continued use and progressive development of the sumps, pumps, pipelines, water storages and other water management infrastructure and development of additional water management infrastructure associated with the extended underground mining areas;
- continued use of the Namoi River pump station, alluvial production bore and pipeline (including potential development of a second approved pipeline);
- continued employment of up to approximately 520 full-time equivalent personnel and additional contractors;
- continued monitoring, rehabilitation and remediation of subsidence effects and surface disturbance areas; and
- other associated minor infrastructure, plant, equipment and activities.

Table 2-2 provides a tabulated summary of the key characteristics of the Project and a comparison to the approved Narrabri Mine.

Table 2-2
Summary Comparison of the Existing/Approved Narrabri Mine and the Project

Project Component	Existing/Approved Narrabri Mine	The Project
Mining Method and Resource	▪ Longwall mining of the Hoskissons Coal Seam.	▪ Unchanged.
Underground Mine Geometry	▪ Twenty longwall panels (Longwalls 101 to 111 and Longwalls 201 to 209). ▪ 295 m wide longwall panels for Longwalls 101 to 106. ▪ 400 m wide longwall panels for Longwalls 107 to 111 and Longwalls 201 to 209.	▪ Twenty-one longwall panels (Longwalls 101 to 111 and 201 to 209 and Longwall 210). ▪ No change to Longwalls 101 to 111 and 201 and 202. ▪ Extension of Longwalls 203 to 209 into MLAs 1 and 2. ▪ Additional longwall panel within MLA 1 (Longwall 210), which is approximately 410 m wide.
Tenements	▪ Mining operations conducted within ML 1609.	▪ Continued mining operations conducted within ML 1609. ▪ Mining operations conducted within MLAs 1 and 2.
Mine Life	▪ Mining operations approved until July 2031.	▪ Extension of mining operations to 2044.
ROM Coal Production	▪ Approved total ROM coal production of approximately 170 Mt*.	▪ Total ROM coal production increased to approximately 252 Mt.
ROM Coal Production Rate	▪ ROM coal production of up to 11 Mtpa.	▪ Unchanged.
Underground Mine Surface Infrastructure	▪ Ventilation shafts, pre-drainage and post-drainage sites, mine safety pre-conditioning sites, access roads and electricity transmission lines.	▪ Augmentation of the existing gas drainage, mine safety pre-conditioning, mine ventilation system, services corridors and boreholes, access tracks and electricity transmission lines within MLAs 1 and 2.

Table 2-2 (Continued)
Summary Comparison of the Existing/Approved Narrabri Mine and the Project

Project Component	Existing/Approved Narrabri Mine	The Project
Underground Mine Access	▪ Via three drifts at the box cut.	▪ Unchanged.
Coal Washing	▪ CHPP and secondary crusher/screen.	▪ Continued use of existing facilities, with replacement or upgrades of components as required.
Coal Handling and Stockpiling	▪ ROM coal stockpile capacity of approximately 700,000 t. ▪ Product coal stockpile capacity of approximately 500,000 t.	▪ Unchanged.
Reject Management	▪ CHPP rejects placed in reject emplacement area.	▪ Continued disposal of coal reject waste in the reject emplacement area. ▪ Disposal of exploration drilling waste in the reject emplacement area, including potential receipt and disposal of exploration drilling waste products from off-site.
Product Coal Transport	▪ Product coal transported from site by rail. ▪ Average of four trains per day. ▪ Peak of eight trains per day.	▪ Unchanged.
Water Management	▪ Conducted in accordance with the Water Management Plan (including discharge under the conditions of EPL 12789 and Project Approval 08_0144).	▪ Water management strategy generally unchanged. ▪ Development of Southern Mine Water Storage within MLA 1.
Water Supply	▪ Make-up water demand to be met from mine dewatering, runoff recovered from operational areas, and licensed extraction from Namoi River and Namoi Alluvium.	▪ Unchanged.
Power	▪ Permanent mains power supplied via a spur line from a 66 kV powerline located to the east of Kamilaroi Highway. ▪ Power converted from 66 kV to 11 kV on-site and reticulated, using progressively developed 11 kV powerlines.	▪ No change to key power supply infrastructure; however, demand for mains power would increase. ▪ Continued progressive development of electricity transmission lines to service the extended underground mining area and associated surface infrastructure.
Hours of Operation	▪ 24 hours per day, seven days per week.	▪ Unchanged.
Employment	▪ Operational workforce (employees and contractors) of approximately 520 full-time equivalent personnel.	▪ Continued employment of up to approximately 520 full-time equivalent personnel. ▪ Possible short-term increases in employment for development activities and potential additional development requirements.
Site Access	▪ Primary access via a sealed mine access road connected to the Pit Top Area.	▪ Unchanged.
Surface Development Footprint	▪ Approximately 210.5 ha of woodland/forest native vegetation clearance.	▪ Approximately 640 ha of additional surface development footprint to support underground mining.
Rehabilitation Strategy	▪ Conducted in accordance with the MOP.	▪ Unchanged.
Capital Investment Value	▪ Not applicable.	▪ $404 million.

* Based on current mine planning, the approved Narrabri Mine is expected to produce a total of approximately 145 Mt of ROM coal (i.e. approximately 25 Mt less than the approved limit of 170 Mt).

2.3 COAL RESOURCE AND GEOLOGICAL FEATURES

The Narrabri Mine currently extracts coal from the Hoskissons Coal Seam (Figures 2-7a and 2-7b).

More than 100 exploration boreholes have been drilled within EL 6243 (Section 2.1.7). Further mineable areas of the Hoskissons Coal Seam have been identified within MLAs 1 and 2 (Figures 2-7a and 2-7b). These areas would be targeted for extraction for the Project.

The lower portion of the Hoskissons Coal Seam contains low-ash coal suitable for thermal applications, whilst the upper section contains high-ash coal and tuffaceous claystone that will remain in the roof where the seam thickness exceeds 4.3 m (the target mining height).

The Project would continue to produce a combination of thermal and PCI product coal, consistent with the approved Narrabri Mine.

2.3.1 Stratigraphy and Seam Characteristics

The Narrabri Mine is located near the northern and western boundaries of the Gunnedah Basin and the eastern margin of the Surat Basin.

The stratigraphy of the Narrabri Mine is characterised by two main geological basins:

- Surat Basin Units of Jurassic age which include Pilliga Sandstone, Purlawaugh Formation and Garrawilla Volcanics; and
- Gunnedah Basin Units, comprising:
  - Napperby and Digby Formations of Triassic age; and
  - Permian coal measures within the Black Jack Group which include Hoskissons Coal Seam, Melvilles Seam, and Arkarula and Pamboola Formations. Locally, these coal measures are characterised by an east (shallowest) to west (deepest) gradient (or dip).

Typical depths of cover from the surface to the Hoskissons Coal Seam range from approximately 180 to 420 m within MLAs 1 and 2 (Appendix A).

2.3.2 Geological Features

Geological features identified in the target underground mining area and surrounds include the Digby Formation Conglomerate, a dolerite sill intruding into the Napperby Formation and the Boggabri Ridge.

The Digby Conglomerate is typically approximately 15 to 20 m thick within ML 1609. Sandstone palaeochannels present in the north-west of ML 1609 thicken the Digby Conglomerate to greater than approximately 20 m.

The Digby Conglomerate is generally less than 20 m thick within MLAs 1 and 2.

The Boggabri Ridge, comprising Early Permian volcanic rocks, forms the basement of the Gunnedah Basin and divides the Basin into two parts, the Maules Creek Sub-basin to the east, and the Mullaley Sub-basin to the west.

The alluvium associated with the floodplains of the Namoi River is located approximately 5 km east of the Project underground mining area (Figures 2-7a and 2-7b).

Geological features in the Project area are described and considered further as part of the Subsidence Assessment (Appendix A) and the Groundwater Assessment (Appendix B).

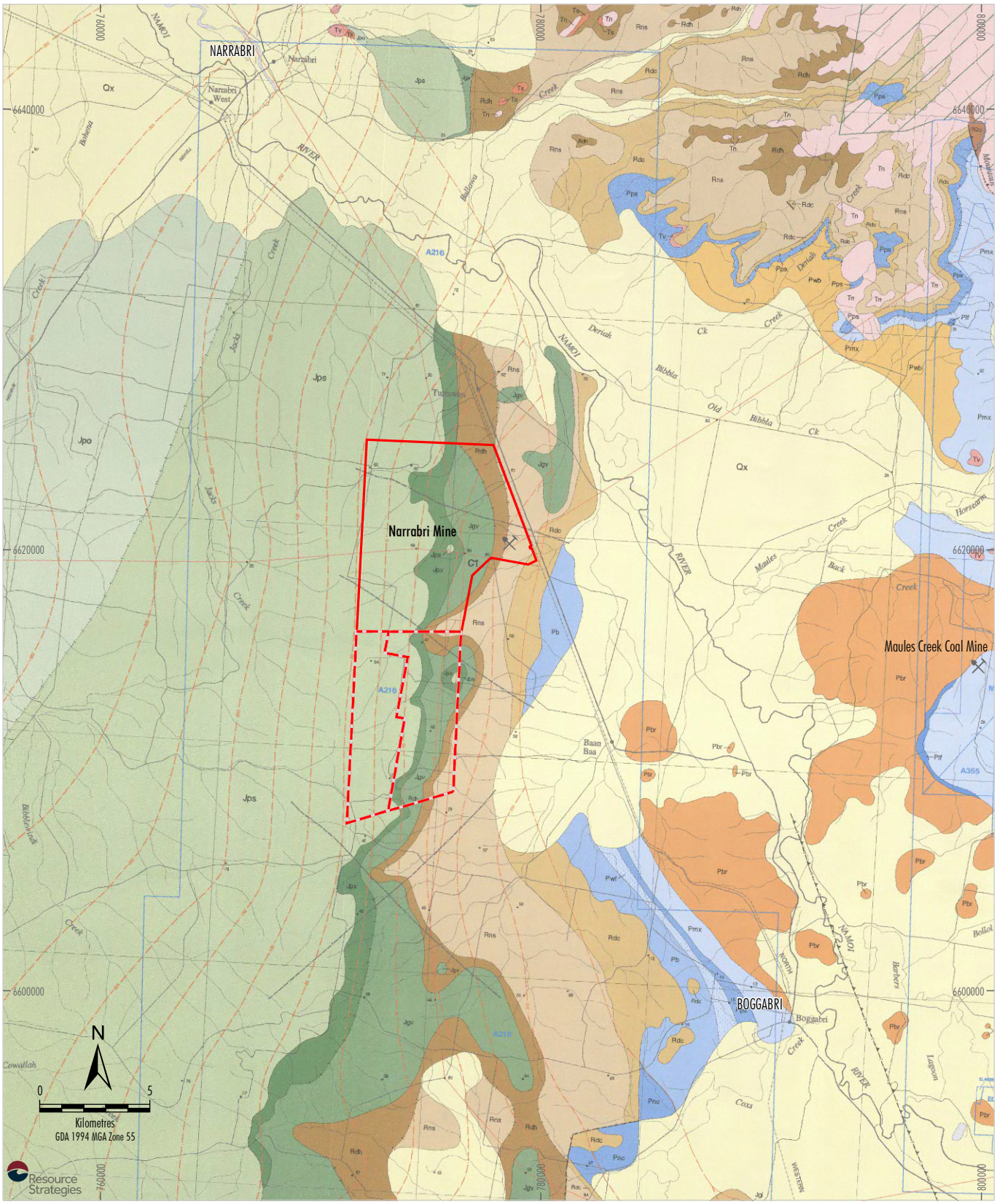
2.3.3 Coal Resource and Resource Recovery

The Project would involve the extraction of approximately 252 Mt of ROM coal over the life of the Project (inclusive of historical and approved mining operations).

The Hoskissons Coal Seam strikes generally north-south and dips gently to the west.

The southern extent of the Hoskissons Coal Seam is constrained by a split in the Hoskissons Coal Seam south of Longwalls 203 to 209.

The Hoskissons Coal Seam has a maximum working section thickness of up to approximately 4.5 m (Appendix A).



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LEGEND

- Mine Site
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area

Source: NSW Resources & Geoscience (2017)

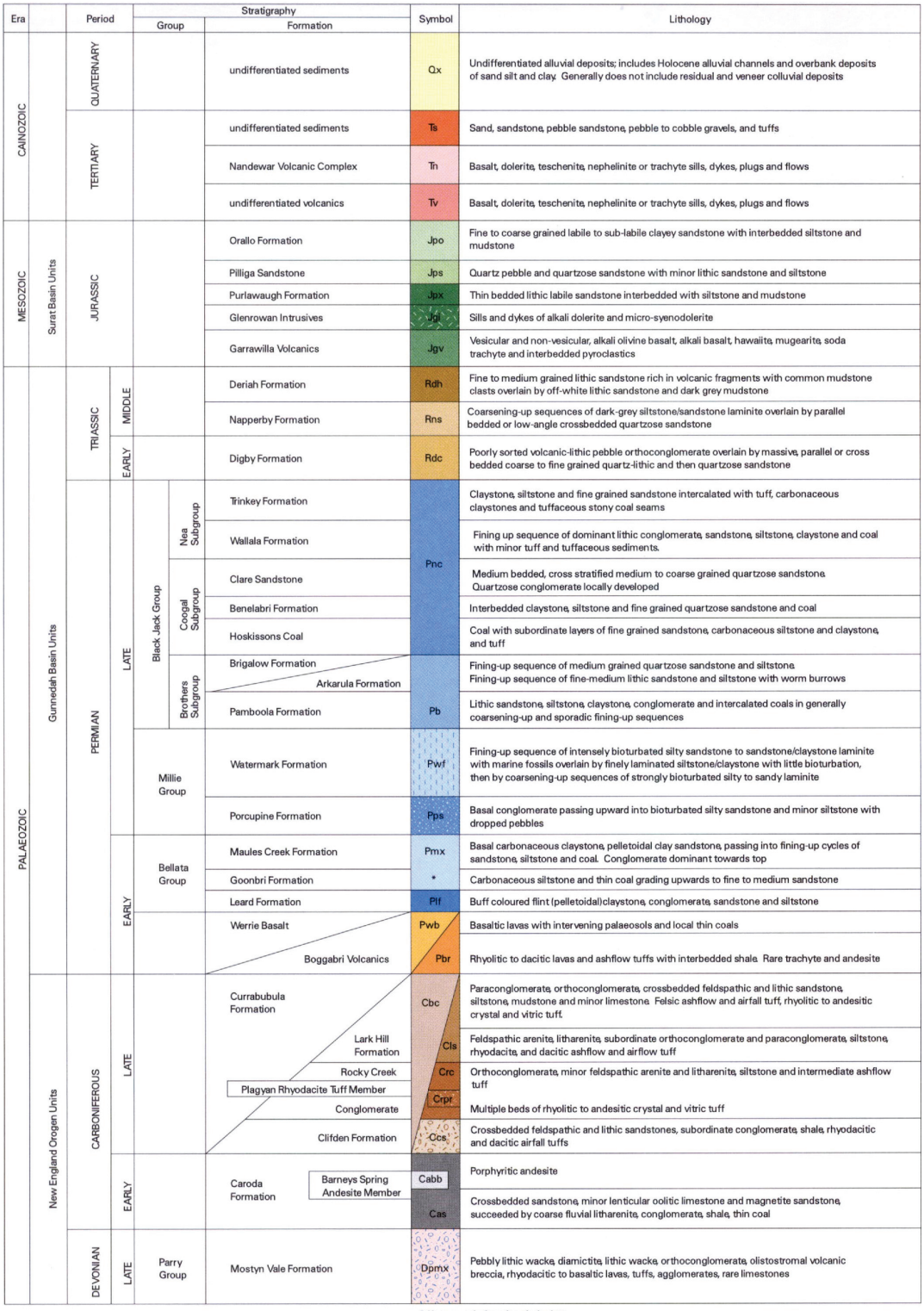
Note: Refer Figure 2-7b for Regional Geology Legend

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Regional Geology

Figure 2-7a



Era		Period	Stratigraphy: Group	Stratigraphy: Formation	Symbol	Lithology
CAINOZOIC		QUATERNARY		undifferentiated sediments	Qx	Undifferentiated alluvial deposits; includes Holocene alluvial channels and overbank deposits of sand silt and clay. Generally does not include residual and veneer colluvial deposits
CAINOZOIC		TERTIARY		undifferentiated sediments	Ts	Sand, sandstone, pebble sandstone, pebble to cobble gravels, and tuffs
CAINOZOIC		TERTIARY		Nandewar Volcanic Complex	Tn	Basalt, dolerite, teschenite, nephelinite or trachyte sills, dykes, plugs and flows
CAINOZOIC		TERTIARY		undifferentiated volcanics	Tv	Basalt, dolerite, teschenite, nephelinite or trachyte sills, dykes, plugs and flows
MESOZOIC	Surat Basin Units	JURASSIC		Orallo Formation	Jpo	Fine to coarse grained labile to sub-labile clayey sandstone with interbedded siltstone and mudstone
MESOZOIC	Surat Basin Units	JURASSIC		Pilliga Sandstone	Jps	Quartz pebble and quartzose sandstone with minor lithic sandstone and siltstone
MESOZOIC	Surat Basin Units	JURASSIC		Purlawaugh Formation	Jpx	Thin bedded lithic labile sandstone interbedded with siltstone and mudstone
MESOZOIC	Surat Basin Units	JURASSIC		Glenrowan Intrusives	Jgi	Sills and dykes of alkali dolerite and micro-syenodolerite
MESOZOIC	Surat Basin Units	JURASSIC		Garrawilla Volcanics	Jgv	Vesicular and non-vesicular, alkali olivine basalt, alkali basalt, hawaiite, mugearite, soda trachyte and interbedded pyroclastics
PALAEOZOIC	Gunnedah Basin Units	TRIASSIC – MIDDLE		Deriah Formation	Rdh	Fine to medium grained lithic sandstone rich in volcanic fragments with common mudstone clasts overlain by off-white lithic sandstone and dark grey mudstone
PALAEOZOIC	Gunnedah Basin Units	TRIASSIC – MIDDLE		Napperby Formation	Rns	Coarsening-up sequences of dark-grey siltstone/sandstone laminite overlain by parallel bedded or low-angle crossbedded quartzose sandstone
PALAEOZOIC	Gunnedah Basin Units	TRIASSIC – EARLY		Digby Formation	Rdc	Poorly sorted volcanic-lithic pebble orthoconglomerate overlain by massive, parallel or cross bedded coarse to fine grained quartz-lithic and then quartzose sandstone
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Nea Subgroup	Trinkey Formation	Pnc	Claystone, siltstone and fine grained sandstone intercalated with tuff, carbonaceous claystones and tuffaceous stony coal seams
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Nea Subgroup	Wallala Formation	Pnc	Fining up sequence of dominant lithic conglomerate, sandstone, siltstone, claystone and coal with minor tuff and tuffaceous sediments.
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Coogal Subgroup	Clare Sandstone	Pnc	Medium bedded, cross stratified medium to coarse grained quartzose sandstone. Quartzose conglomerate locally developed
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Coogal Subgroup	Benelabri Formation	Pnc	Interbedded claystone, siltstone and fine grained quartzose sandstone and coal
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Coogal Subgroup	Hoskissons Coal	Pnc	Coal with subordinate layers of fine grained sandstone, carbonaceous siltstone and claystone, and tuff
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Brothers Subgroup	Brigalow Formation / Arkarula Formation	Pnc / Pb	Fining-up sequence of medium grained quartzose sandstone and siltstone. Fining-up sequence of fine-medium lithic sandstone and siltstone with worm burrows
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Black Jack Group – Brothers Subgroup	Pamboola Formation	Pb	Lithic sandstone, siltstone, claystone, conglomerate and intercalated coals in generally coarsening-up and sporadic fining-up sequences
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Millie Group	Watermark Formation	Pwf	Fining-up sequence of intensely bioturbated silty sandstone to sandstone/claystone laminite with marine fossils overlain by finely laminated siltstone/claystone with little bioturbation, then by coarsening-up sequences of strongly bioturbated silty to sandy laminite
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – LATE	Millie Group	Porcupine Formation	Pps	Basal conglomerate passing upward into bioturbated silty sandstone and minor siltstone with dropped pebbles
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – EARLY	Bellata Group	Maules Creek Formation	Pmx	Basal carbonaceous claystone, pelletoidal clay sandstone, passing into fining-up cycles of sandstone, siltstone and coal. Conglomerate dominant towards top
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – EARLY	Bellata Group	Goonbri Formation	*	Carbonaceous siltstone and thin coal grading upwards to fine to medium sandstone
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – EARLY	Bellata Group	Leard Formation	Plf	Buff coloured flint (pelletoidal) claystone, conglomerate, sandstone and siltstone
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – EARLY		Werrie Basalt	Pwb	Basaltic lavas with intervening palaeosols and local thin coals
PALAEOZOIC	Gunnedah Basin Units	PERMIAN – EARLY		Boggabri Volcanics	Pbr	Rhyolitic to dacitic lavas and ashflow tuffs with interbedded shale. Rare trachyte and andesite
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Currabubula Formation	Cbc	Paraconglomerate, orthoconglomerate, crossbedded feldspathic and lithic sandstone, siltstone, mudstone and minor limestone. Felsic ashflow and airfall tuff, rhyolitic to andesitic crystal and vitric tuff.
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Lark Hill Formation	Cls	Feldspathic arenite, litharenite, subordinate orthoconglomerate and paraconglomerate, siltstone, rhyodacite, and dacitic ashflow and airflow tuff
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Rocky Creek	Crc	Orthoconglomerate, minor feldspathic arenite and litharenite, siltstone and intermediate ashflow tuff
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Plagyan Rhyodacite Tuff Member	Crpr	Multiple beds of rhyolitic to andesitic crystal and vitric tuff
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Conglomerate	Ccs	Crossbedded feldspathic and lithic sandstones, subordinate conglomerate, shale, rhyodacitic and dacitic airfall tuffs
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – LATE		Clifden Formation	Ccs	
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – EARLY		Caroda Formation – Barneys Spring Andesite Member	Cabb	Porphyritic andesite
PALAEOZOIC	New England Orogen Units	CARBONIFEROUS – EARLY		Caroda Formation	Cas	Crossbedded sandstone, minor lenticular oolitic limestone and magnetite sandstone, succeeded by coarse fluvial litharenite, conglomerate, shale, thin coal
PALAEOZOIC	New England Orogen Units	DEVONIAN – LATE	Parry Group	Mostyn Vale Formation	Dpmx	Pebbly lithic wacke, diamictite, lithic wacke, orthoconglomerate, olistostromal volcanic breccia, rhyodacitic to basaltic lavas, tuffs, agglomerates, rare limestones

* Known only from borehole data

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Resource Strategies

Source: NSW Resources & Geoscience (2017)

Note: Refer Figure 2-7a for Regional Geology Mapping.

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Regional Geology - Legend

Figure 2-7b

Thickness and quality characteristics of the coal seams present in MLAs 1 and 2 are such that only the Hoskissons Coal Seam is currently considered to contain coal resources with mining potential.

NCOPL would seek to maximise resource recovery within geological, environmental and infrastructure constraints via continued use of the existing longwall mining method. At this stage, the Project would not be expected to have a significant impact on future extraction or recovery of other coal resources (e.g. beneath the Hoskissons Coal Seam).

Further exploration (Section 2.5.7) or technical assessment may result in changes to the recoverable coal resource. NCOPL also recognises that mining technology will advance over the life of the Project, influencing the ultimate coal reserves.

2.3.4 Spontaneous Combustion Potential

The Hoskissons Coal Seam has a high intrinsic spontaneous combustion propensity (Beamish, 2006).

The Narrabri Mine would continue to implement the following spontaneous combustion management measures to the physical layout and design of the Project:

- ventilation shaft design to reduce a pressure differential across goaves and, therefore, reduce potential for spontaneous combustion;
- pre-mining and goaf gas drainage systems would be implemented for gas management purposes, minimising ventilation pressures that would result if the ventilation system were only used to maintain gas concentration to acceptable levels;
- installation of high standard ventilation control devices such as stopping, regulators and overcasts;
- installation, operation and maintenance of a dual ventilation monitoring system (telemetric and tube bundle);
- on-site gas chromatograph; and
- on-site inertisation capability including:
  - pipework and valves fitted to goaf seals to allow the injection of inert gas;
  - potential utilisation of in-seam drainage ranges; and
  - a nitrogen generating plant is located on-site and reticulated underground via a dedicated pipeline.

Spontaneous combustion at the Narrabri Mine is further managed during operations in accordance with the Spontaneous Combustion Management Plan (NCPL, 2007) (or the latest approved version).

Other management measures to minimise the potential for spontaneous combustion for coal stockpiles are described in Section 6.18.3.

Coarse reject comprises predominately broken rock (sandstone/siltstone material), which is not carbonaceous; therefore, the propensity of reject for spontaneous combustion is considered very low (NCOPL, 2019a).

2.4 PROJECT SCHEDULE

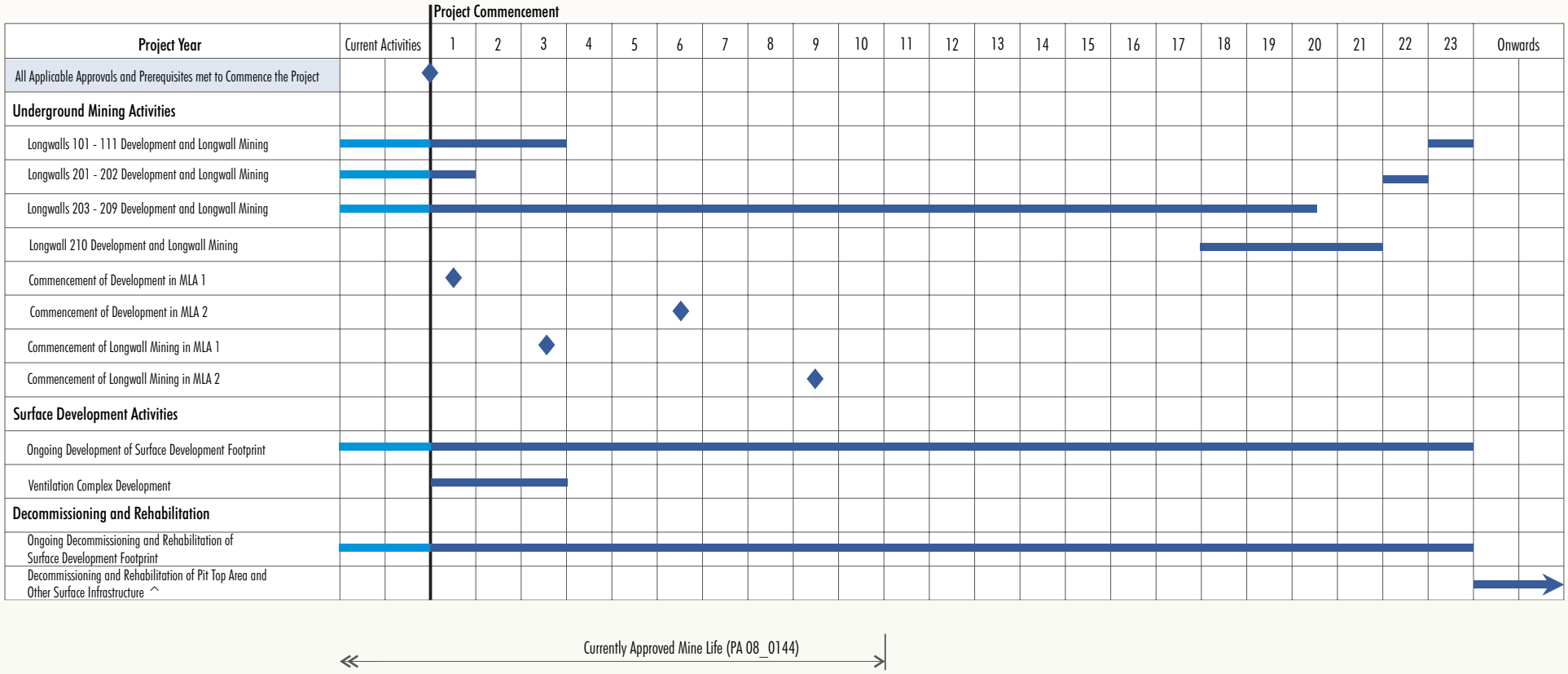
An indicative Project schedule is shown on Figure 2-8. The Project is assumed to commence in 2022.

2.5 PROJECT DEVELOPMENT ACTIVITIES

The Project would use the existing and approved Pit Top Area and supporting infrastructure described in Section 2.1.

Additional infrastructure and upgrades to existing infrastructure that are required to support the Project would be progressively developed in parallel with ongoing mining operations, including:

- development of underground roadways, coal clearance infrastructure and other ancillary infrastructure required to access and support Project underground mining areas (Section 2.5.2);
- underground mining machinery replacement and upgrades (Section 2.5.3);
- development of services corridors and access tracks to surface infrastructure (Section 2.5.4);
- development of mine ventilation infrastructure (Section 2.5.5);
- development of gas management infrastructure (Section 2.5.6);
- development of exploration boreholes (Section 2.5.7);



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Resource Strategies

LEGEND

Approved Narrabri Mine Activities *

Project Activities

* Approved Narrabri Mine activities would occur within ML 1609 only and under Development Consent PA 08_0144.

^ Subject to consultation with relevant stakeholders.

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Indicative Project Schedule

Figure 2-8

- development of service boreholes (Section 2.5.8);
- development of pre-conditioning areas (Section 2.5.9);
- water management system upgrades (Section 2.5.10);
- CHPP upgrades (Section 2.5.11); and
- minor augmentations and upgrades of other surface facilities.

Surface construction and development would generally occur 7.00 am to 6.00 pm, seven days per week. Activities undertaken outside of these hours would include:

- excavation of ventilation shafts, and other drilling activities, which may be conducted 24 hours per day, seven days per week;
- activities that cause equivalent continuous noise level over a sample period of 15 minutes ($L_{Aeq(15\ minute)}$) of no more than 35 decibels (dB) at any privately-owned residence, or at a higher level that has been agreed with the resident;
- the delivery of construction materials of which delivery is required, by the NSW Police or the NSW Roads and Maritime Services (RMS), to be undertaken for safety reasons outside the normal construction hours; and
- emergency work to avoid the loss of life, damage to property or to prevent environmental harm.

The existing mobile equipment including drill rigs, mobile cranes, excavators, loaders and delivery trucks, would generally be required for ongoing development activities. During periods of more intense development, additional mobile equipment may be required.

The number and type of equipment would vary, depending on the development activity being undertaken.

Additional infrastructure required for the Project would be developed within the indicative Surface Development Footprint shown on Figure 2-6 and described below.

2.5.1 Indicative Surface Development Footprint

The indicative Surface Development Footprint is the area of land proposed to be directly impacted by the Project based on the current mine design (Figure 2-6). Some flexibility in the indicative Surface Development Footprint is needed over the life of the Project to allow for further detailed mine planning during development and operations, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts.

Any such changes are expected to be minor and, therefore, would not have an increased impact on the biodiversity values identified in the EIS. Throughout the life of the Project, NCOPL would track actual native vegetation/habitat clearance against the indicative Surface Development Footprint and the allowance included in the calculation of biodiversity credits (Section 6.7.6). Any proposed native vegetation/habitat clearance outside of the indicative Surface Development Footprint or beyond the allowance, should it be required, would trigger a review of the proposed activities, the relevant Project approval documentation and MOP and the impact on biodiversity values.

To facilitate this review, Vegetation Zones (Plant Community Types in broad condition states) and habitat for species credit species (i.e. those species which a species polygon is required to be determined by the area of habitat) have been mapped in and surrounding the indicative Surface Development Footprint. This mapping is provided in the BDAR (Appendix D).

There is a single species credit species recorded, namely Coolabah Bertya, for which the credit requirement is required by the DPIE to be determined by a count of the number of individual plants within the indicative Surface Development Footprint. For this species, the credit requirement was based on a conservative estimate of the density of Coolabah Bertya individuals for each Vegetation Zone (which exceeded the count of the number of individual plants). NCOPL would track the clearance of the number of Coolabah Bertya plants by applying the density to the area of habitat to be cleared.

The development of key surface infrastructure components required for the Project (and for the approved Narrabri Mine) that form the indicative Surface Development Footprint are discussed in the subsections below. The locations of surface infrastructure components have been selected in consideration of avoiding or minimising impacts to surface features (e.g. infrastructure would avoid significant features such as rock outcrops to minimise impacts, where practicable). Furthermore, Palaris (2020a) has reviewed the indicative disturbance footprints of individual key surface infrastructure components for the Project against other comparable underground coal mines in NSW and Queensland. Palaris (2020a) concludes the disturbance footprints of individual infrastructure components proposed for the Project are below the industry averages.

Impacts during clearing would be minimised through the implementation of a vegetation clearance protocol (Section 6.7.4).

Areas of approved surface disturbance that are no longer proposed for the Project are described in Section 2.15.

2.5.2 Development of Access and Supporting Infrastructure for Underground Mining Areas

Underground roadways would continue to be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).

Coal clearance infrastructure and other ancillary infrastructure would be developed for the Project underground mining areas. The existing coal clearance infrastructure would also be upgraded and augmented progressively throughout the life of the Project through replacement or upgrades of conveyors, sizers, drives, winders and supporting systems.

Other ancillary infrastructure required to support the Project underground mining areas includes infrastructure for electricity distribution, communication systems, water management, services and service delivery (e.g. boreholes to the surface).

2.5.3 Mining Machinery Replacement and Upgrades

Over the life of the Project, it is anticipated that a range of the current underground mining equipment (Section 2.1.1) and surface mobile fleet (Section 2.1.2) would be replaced or upgraded as a component of general maintenance, or to increase efficiency.

2.5.4 Services Corridors and Access Tracks

Services corridors and access tracks would continue to be progressively developed for the Project to provide access from the Pit Top Area to surface infrastructure components.

The indicative locations of services corridors and access tracks for the Project are shown on Figure 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

Project services corridors would generally include roadways, pipelines, pumps, telecommunication infrastructure, power transmission infrastructure, sediment controls and other ancillary infrastructure.

Project access tracks would generally include roadways, pipelines, pumps, sediment controls, goaf gas drainage infrastructure (Section 2.5.6) and other ancillary infrastructure. Narrower access tracks would also be developed where goaf gas drainage is not required.

Small borrow areas may be developed within the corridors and access tracks to provide material for development activities (e.g. roadbase).

Services corridors, access tracks and other infrastructure would utilise fords or culverts to traverse drainage lines in accordance with the Fisheries NSW *Policy and Guidelines for Fish Habitat Conservation and Management* (Department of Primary Industries [DPI], 2013a).

2.5.5 Mine Ventilation Infrastructure

The Project would involve the continued use of existing upcast (return) and downcast (intake) ventilation shafts.

The Project would also continue to use the existing drifts as intake airways.

In addition, the Project would involve the progressive establishment of two additional ventilation complexes.

The indicative locations of the ventilation complexes potentially required for the Project are shown on Figure 2-5. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The requirement for each ventilation complex is subject to detailed mine planning (i.e. some ventilation infrastructure may not be required).

The development area for each ventilation complex would generally include:

- drilling areas;
- laydown and parking areas;
- soil and spoil stockpile areas;
- sediment dam and sump areas;
- construction offices and amenities;
- generators, compressors, lighting and fuel storage area;
- nitrogen plant areas; and
- areas for other associated infrastructure and works.

Development of each ventilation complex would generally include:

- development of two concrete-lined or steel-lined shafts, typically approximately 6 m in diameter;
- installation of ventilation fans and associated power supply (for the upcast ventilation shaft);
- development of other boreholes as required (e.g. dewatering, gas monitoring, power reticulation, concrete and ballast boreholes);
- installation of a power supply and transmission and associated electrical switchroom, transformer and ancillary infrastructure for the ventilation fans (for the upcast ventilation shaft);
- installation of Personal Emergency Device (PED) cables to facilitate emergency transportation to/from underground mining operations;
- installation of erosion and sediment control infrastructure;
- construction of temporary in-ground or above-ground sumps for the containment of drilling process water;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated infrastructure and works.

Cut-throughs (development between two underground roadways) may be required during the development to facilitate enhanced ventilation.

It is expected that the ventilation shafts would be constructed using either the “blind bore” or conventional shafts sinking methods (from the surface down to the underground) or a “raise bore” (from the underground up to the surface) or using other construction methods identified through the detailed design process. Using the blind bore method, the shaft development would take place in advance of development workings, with material from the excavation being removed from the top of the shaft. The raise bore method involves using a pilot hole for guidance to develop the bore from the underground working to the surface.

It may be necessary to initiate small blasts within the shafts, particularly when harder volcanic units are encountered. Such blasts are routine for shaft development and cause few effects because of their small size and depth below the surface.

The mined rock from the development of ventilation shafts would be used as fill material for the development of Southern Mine Water Storage, sediment dams and/or other infrastructure construction activities. Any excess material would be stockpiled at the ventilation complex, temporarily revegetated and used for future rehabilitation of the shaft sites upon decommissioning.

Excavation of the shafts would occur 24 hours per day, seven days per week.

Ventilation fans, electrical infrastructure and other infrastructure may be upgraded, converted between upcast and downcast, replaced or decommissioned and removed during the life of the Project subject to detailed mine planning.

Development of ventilation shafts would be documented in the MOP and relevant Annual Reviews.
The operation and decommissioning of ventilation infrastructure is described in Section 2.6.6.

2.5.6 Gas Management Infrastructure

Pre-mining gas drainage and goaf gas drainage would continue to be progressively developed for the Project to reduce the gas content in the coal seam to levels suitable for safe underground mining operations.

The indicative locations of gas management infrastructure areas are shown on Figures 2-2 and 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

Gas management operations are described in Section 2.6.7.

Underground In-Seam Pre-drainage

Conventional underground in-seam pre-drainage would continue to be undertaken by drilling into the coal seam from gate roads, with gas collected and then pumped to the surface for venting at service boreholes using mobile extraction units (Section 2.5.8).

Underground in-seam pre-drainage does not involve surface disturbance (except for infrastructure on the surface where gas is transferred to).

Surface to In-Seam Pre-drainage

SIS pre-drainage would continue to be progressively undertaken where conventional underground in-seam drainage is not feasible (e.g. where gas or water content is too high, or pre-drainage is required prior to establishment of the underground gate roads).

The existing and indicative future locations of SIS pre-drainage borehole areas for the Project are shown on Figure 2-2. The exact locations of future SIS pre-drainage borehole areas may change, subject to further detailed mine planning during construction and operation, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The development area for each SIS borehole would generally include:

- drilling areas;
- laydown and parking areas;
- soil and spoil stockpile areas;
- sediment management measures; and
- areas for other minor associated infrastructure and works.

SIS pre-drainage borehole development activities would generally include:

- development of a small-diameter borehole;
- construction of in-ground or above-ground sumps for the containment of drilling process water;
- installation of erosion and sediment control infrastructure;
- installation of gas management infrastructure (including flaring infrastructure, if required);
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

It is expected that the SIS pre-drainage boreholes would be constructed from the surface down to the underground (i.e. conventional drilling methods) with casing being installed where required, but may be constructed using other methods subject to further detailed mine planning.

The operation and decommissioning of SIS pre-drainage boreholes is described in Section 2.6.7.

Goaf Gas Drainage

Goaf gas boreholes would continue to be developed for the Project to drain gas from the goaf. Goaf gas drainage boreholes would generally be developed within the access track corridors or, in the case of approved (but not constructed) goaf gas boreholes, on discrete pads.

The indicative locations of goaf gas boreholes areas for the Project are shown on Figures 2-2 and 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The development area of each goaf gas drainage borehole would generally include:

- drilling area;
- laydown and parking areas;
- soil and spoil stockpile areas;
- sediment management measures; and
- areas for other associated infrastructure and works.

Goaf gas borehole development activities would generally include:

- drilling of small-diameter hole(s);
- development of in-ground or above-ground sumps for the containment of drilling process water;
- installation of erosion and sediment control infrastructure;
- installation of gas management infrastructure;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

It is expected that the goaf gas boreholes would be constructed from the surface down to the underground, with casing being installed where required, but may be developed using other methods subject to further detailed mine planning.

The operation of goaf gas drainage sites is described in Section 2.6.7.

2.5.7 Exploration Boreholes

Exploration boreholes would continue to be developed for the Project to inform coal, strata characteristics and gas quantity for ongoing mine planning.

The indicative locations of exploration borehole areas for the Project are shown on Figures 2-2 and 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The development area for each exploration borehole would generally include:

- drilling area;
- laydown and parking areas;
- soil and spoil stockpile area;
- sediment management measures; and
- areas for other associated infrastructure and works.

Exploration borehole development activities would generally include:

- development of small-diameter hole(s);
- development of in-ground or above-ground sumps for the containment of drilling process water;
- installation of erosion and sediment control infrastructure;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

It is expected that the exploration boreholes would be constructed from the surface down to the underground, with casing being installed where required, but may be developed using other methods subject to further detailed mine planning.

2.5.8 Service Boreholes

Service boreholes would continue to be developed for the Project to provide water, gas and electricity to the underground mining area.

The indicative locations of service borehole areas for the Project are shown on Figures 2-2 and 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The development area for most service boreholes would generally include:

- drilling area;
- laydown and parking areas;

- soil and spoil stockpile areas;
- sediment dam and sump areas;
- construction offices and amenities; and
- areas for other associated infrastructure and works.

Some service boreholes would provide power reticulation along with the other services to the underground mining areas. These sites require a larger area for transformers, generators, compressors, gas extractors, lighting and fuel storage.

Service borehole development activities would generally include:

- development of a large-diameter hole;
- installation of a power supply and transmission and associated electrical switchroom, transformer and ancillary infrastructure (where power reticulation is required);
- installation of erosion and sediment control infrastructure;
- construction of in-ground or above-ground sumps for the containment of drilling process water;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

It is expected that the service boreholes would be constructed from the surface down to the underground, with casing being installed where required (to control the borehole), but may be constructed using other methods subject to further detailed mine planning.

The operation and decommissioning of service boreholes is described in Section 2.11.4.

2.5.9 Mine Safety Pre-conditioning

The Project would include the progressive development of mine safety pre-conditioning of the Digby Conglomerate or other large strata units at both ends of each longwall and in the middle of some longwalls to mitigate the potential for wind blast events occurring underground (Figure 2-6).

As described in Section 2.1.8, more intensive pre-conditioning (i.e. along the entire longwall panel length) is typically required along the longwall panels where the Digby Conglomerate thickens to greater than approximately 20 m.

Based on available geological data, intensive mine safety pre-conditioning would be required for the Project consistent with the approved Narrabri Mine (i.e. above the approved Longwalls 108b, and 109 to 111 [Section 2.1.8]).

Based on available geological data, the Digby Conglomerate thickness within MLAs 1 and 2 generally ranges between 12 and 19 m, and therefore intensive mine safety pre-conditioning is not expected to be required for Longwalls 201 to 210. However, the need for intensive mine safety pre-conditioning would continue to be evaluated.

Notwithstanding, pre-conditioning would be required at both ends of Longwalls 203 to 210, and two additional rows in the middle of Longwalls 203 to 209.

The indicative locations of pre-conditioning areas for the Project are shown on Figures 2-2 and 2-6. The exact locations may change subject to further detailed mine planning, operational/mine safety requirements and for specific siting of infrastructure to minimise impacts (Section 2.5.1).

The development area for each pre-conditioning area would generally include:

- drilling area;
- hydraulic pump areas;
- laydown and parking areas;
- soil and spoil stockpile areas;
- sediment management measures; and
- areas for other associated infrastructure and works.

Development within pre-conditioning areas would generally include:

- development of several small-diameter hole(s) at variable intervals across the pre-conditioning area;
- development of in-ground or above-ground sumps for the containment of drilling process water;

- installation of erosion and sediment control infrastructure;
- installation of hydraulic pumps, clean water dams and gas testing equipment;
- installation of appropriate security (i.e. fencing) to prevent unauthorised access;
- development of access; and
- other minor associated works.

The operation of pre-conditioning areas is described in Section 2.6.8.

2.5.10 Water Management System

Southern Mine Water Storage

Additional water management infrastructure would be required directly south of Longwall 210 to store water from mine dewatering activities.

Development of the additional water management infrastructure area would generally include:

- installation of a lined Mine Water Storage (herein referred to as the Southern Mine Water Storage) (Figure 2-6);
- installation of electric pumps, clean water dams or tanks and gas-testing equipment;
- installation of erosion and sediment control infrastructure;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

The Southern Mine Water Storage would utilise mined rock from the development of ventilation shafts as fill material.

Pipelines between the Southern Mine Water Storage area and the Pit Top Area would be installed to facilitate transfer of clean water and mine water. The pipelines would be installed within services corridors and other cleared areas.

Brine Storage Ponds

NCOPL would progressively construct Brine Storage Ponds (BR1 to BR5) within the approved Brine Storage Area, as required. This would comprise:

- progressive installation of lined ponds within the approved Brine Storage Area;
- installation of erosion and sediment control infrastructure;
- installation of appropriate security (i.e. fencing) and development or improvement of access where required (Section 2.5.4); and
- other minor associated works.

The Brine Storage Pond walls would be constructed with a slope of no greater than 1:3 (vertical [V]:horizontal [H]) or other slopes delivering the same factors of safety. A sequential process of topsoil removal would be adopted, with subsoil recovered from the floor of each Brine Storage Pond used to construct the perimeter walls.

The topsoil would be used to stabilise the outer slopes of the cell walls (which form the perimeter of the Brine Storage Area).

Surplus topsoil would be stored in dedicated stockpiles around the perimeter of the Brine Storage Area.

The Brine Storage Ponds would be lined with a low permeability high-density polyethylene (HDPE) with a permeability of less than $1x10^{-14}$ m/s to minimise the potential for seepage.

Water Management for Underground Mining Area Surface Infrastructure

Sediment dams would typically be constructed within ventilation complex and service borehole pads.

These sediment dams would typically be lined with a low-permeability HDPE. Each ventilation complex and gas management infrastructure pad would be designed and constructed such that any overflow from sediment dam would be retained on the pad itself (i.e. no runoff would be discharged to local drainage or impact on undisturbed vegetation).

2.5.11 Coal Handling and Preparation Facility

Over the life of the Project, a range of equipment within the CHPP and its associated infrastructure would be replaced or upgraded as a result of general maintenance or to increase efficiency.

2.6 UNDERGROUND MINING OPERATIONS

The Project involves the continuation of longwall mining operations within ML 1609 and extension into MLAs 1 and 2 to extract coal from the Hoskissons Coal Seam. The Project (including the approved Narrabri Mine) would involve extraction of approximately 252 Mt of ROM coal.

Based on current mine planning, the approved Narrabri Mine is expected to produce a total of approximately 145 Mt of ROM coal (i.e. approximately 25 Mt less than the approved limit). Therefore, the Project would result in an additional ROM coal production of 107 Mt compared to the currently approved Narrabri Mine, or 82 Mt relative to the approved limit.

Consistent with the approved Narrabri Mine, underground mining operations would be conducted on a continuous basis, 24 hours per day, seven days per week.

2.6.1 Mining Method

Longwall mining methods and equipment would continue to be employed for the Project.

Longwall mining involves the extraction of rectangular panels of coal defined by underground roadways constructed around each longwall. The longwall shearer travels back and forth across the width of the coal face, progressively removing coal in slices from the panel. Once each slice of coal is removed from the longwall face, the hydraulic roof supports are moved forward, allowing the roof and a section of the overlying strata to collapse behind the longwall machine (referred to as forming a 'goaf') (Figure 2-9).

Subsidence-related monitoring and remediation activities for the Project are discussed in Section 2.14.1 and described in detail in Attachment 4.

2.6.2 Longwall Mining Layout

The approved Narrabri Mine allows for extraction of 20 longwall panels (101 to 111, and 201 to 209).

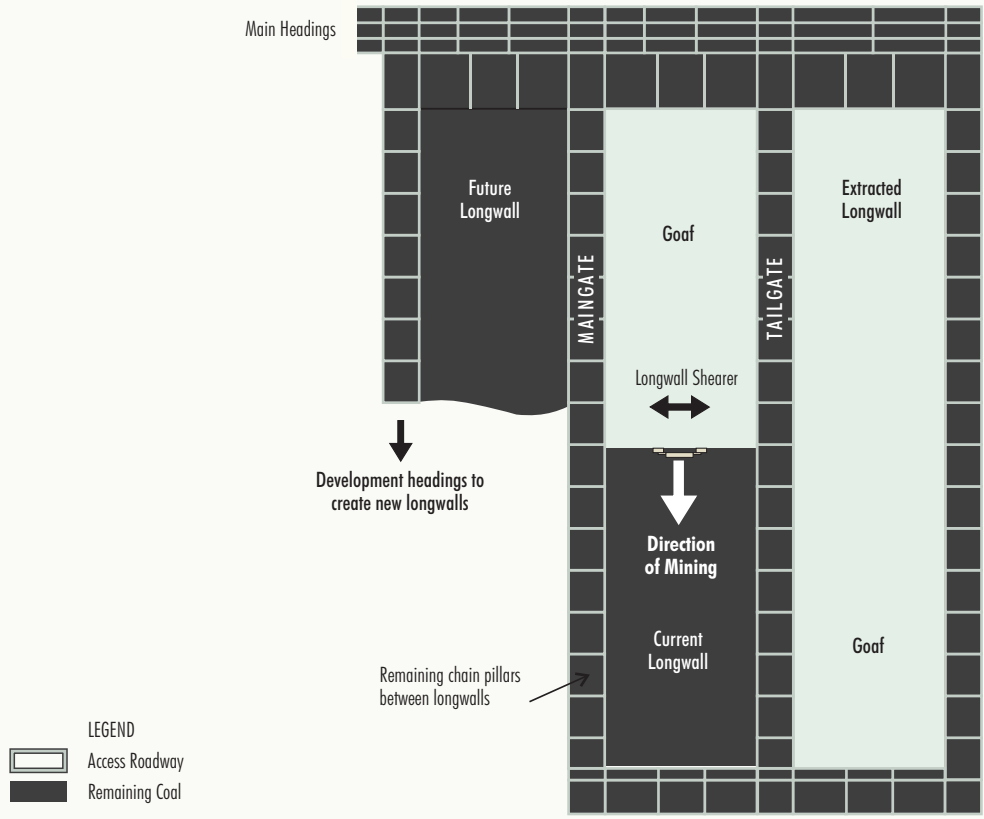
The approved Longwalls 101 to 111 are located north of the existing underground main headings (Figure 2-1). The mining layout of these panels described in Section 2.1.1 (i.e. overall void widths, lengths and extraction heights) would remain generally unchanged for the Project. The approved Longwalls 201 and 202 would similarly remain generally unchanged for the Project.

The approved Longwalls 203 to 209 are located south of the existing underground main headings and would be extended into MLAs 1 and 2 for the Project (Figure 2-5). The southern longwalls would have overall lengths of between approximately 1.3 km and 10.2 km (i.e. an extension of up to approximately 6.2 km for some panels). Consistent with the approved Narrabri Mine, the southern longwall panels would have overall void widths of approximately 400 m (including first workings), and an average extraction height of approximately 4.3 m.

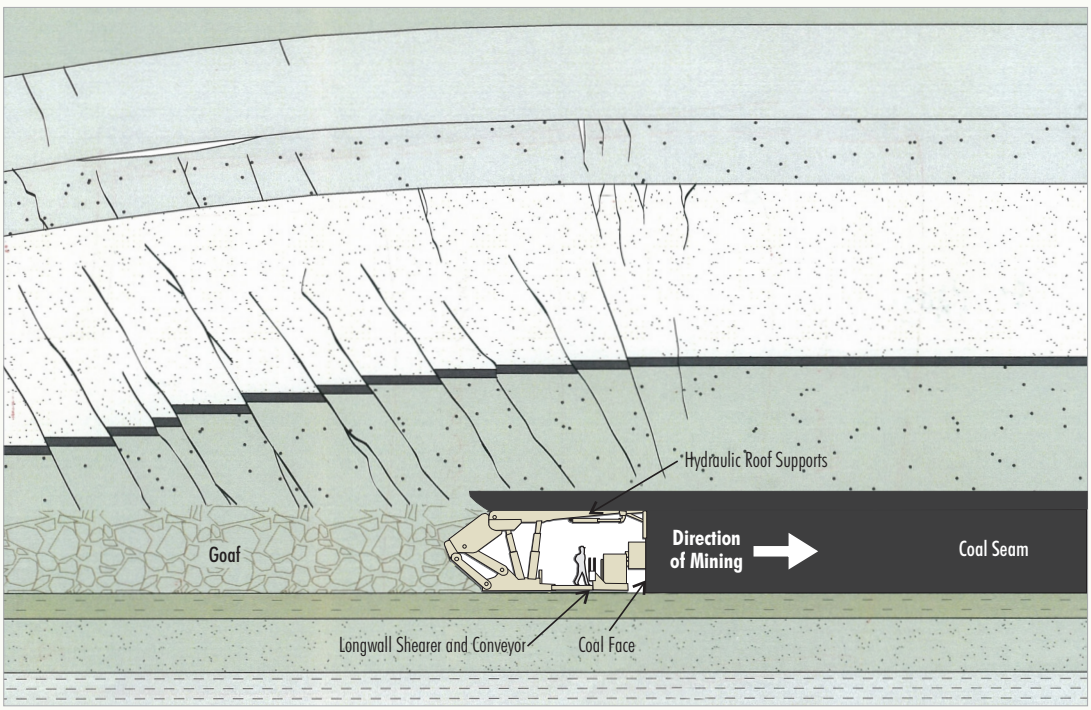
The southern extent of Longwalls 204 and 205 incorporates a setback from the Bulga Hill, which is a known topographic feature within MLA 2. The setback distance has been developed in consideration of potential subsidence effects and biodiversity impacts. Further detail regarding the setback from Bulga Hill is provided in the Subsidence Assessment (Appendix A) and the BDAR (Appendix D).

The Project would also include mining of a new longwall panel (i.e. Longwall 210) located within MLA 1 (Figure 2-5). Longwall 210 would have a length of approximately 4.0 km, an overall void width of approximately 410 m (including first workings), and an extraction height of up to approximately 4.3 m.

The Project seeks to maximise resource recovery within geological, environmental and infrastructure constraints via the extension of Longwalls 203 to 209.



PLAN VIEW



SECTION VIEW

Note: Conceptual only - not to scale

Source: After Hansen Consulting (2008)

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Longwall Mining Method - Conceptual Cross-section and Plan

Figure 2-9

The conceptual layout of Longwalls 203 to 209 is depicted in Figure 2-5. However, the final layout and mining order of the longwalls would depend on a number of factors, including:

- localised geological features;
- detailed mine design; and/or
- adaptive management requirements.

The final layout of Longwalls 203 to 209 and mining order would be subject to review and approval as a component of future Extraction Plans.

The final layout and mining order of the longwalls approved under future extraction plans may include installation of additional gate roads in Longwalls 203 to 209 as currently approved (Figure 2-1) and/or installing additional gate roads due to geology considerations (similar to Longwall 108 [Section 2.1.1]). If appropriate, these additional workings would result in longwall panels being spilt into two (or more) continuous panels, which would be described in the relevant future Extraction Plans.

An alternative underground mining layout reflecting these changes is shown in Figure 2-10. Potential changes in key impacts associated with the alternative layout are assessed in Attachment 11.

As the conceptual underground mine geometry maximises resource recovery within the underground mining area, such adaptations to the conceptual mine geometry are expected to result in reduced subsidence effects and consequential environmental impacts, as would be detailed in the relevant future extraction plans.

2.6.3 Indicative Mining Schedule

An indicative mining schedule for the Project is presented in Table 2-3. The maximum amount of ROM coal produced in any one year would be 11 Mt.

The existing Narrabri Mine has involved the extraction of approximately 50.6 Mt of ROM coal to the end of June 2020.

The actual timing, mining sequence and annual coal production profile may vary to take account of localised geological features, coal quality characteristics, detailed mine design, mine economics, market volume requirements, and/or adaptive management requirements.

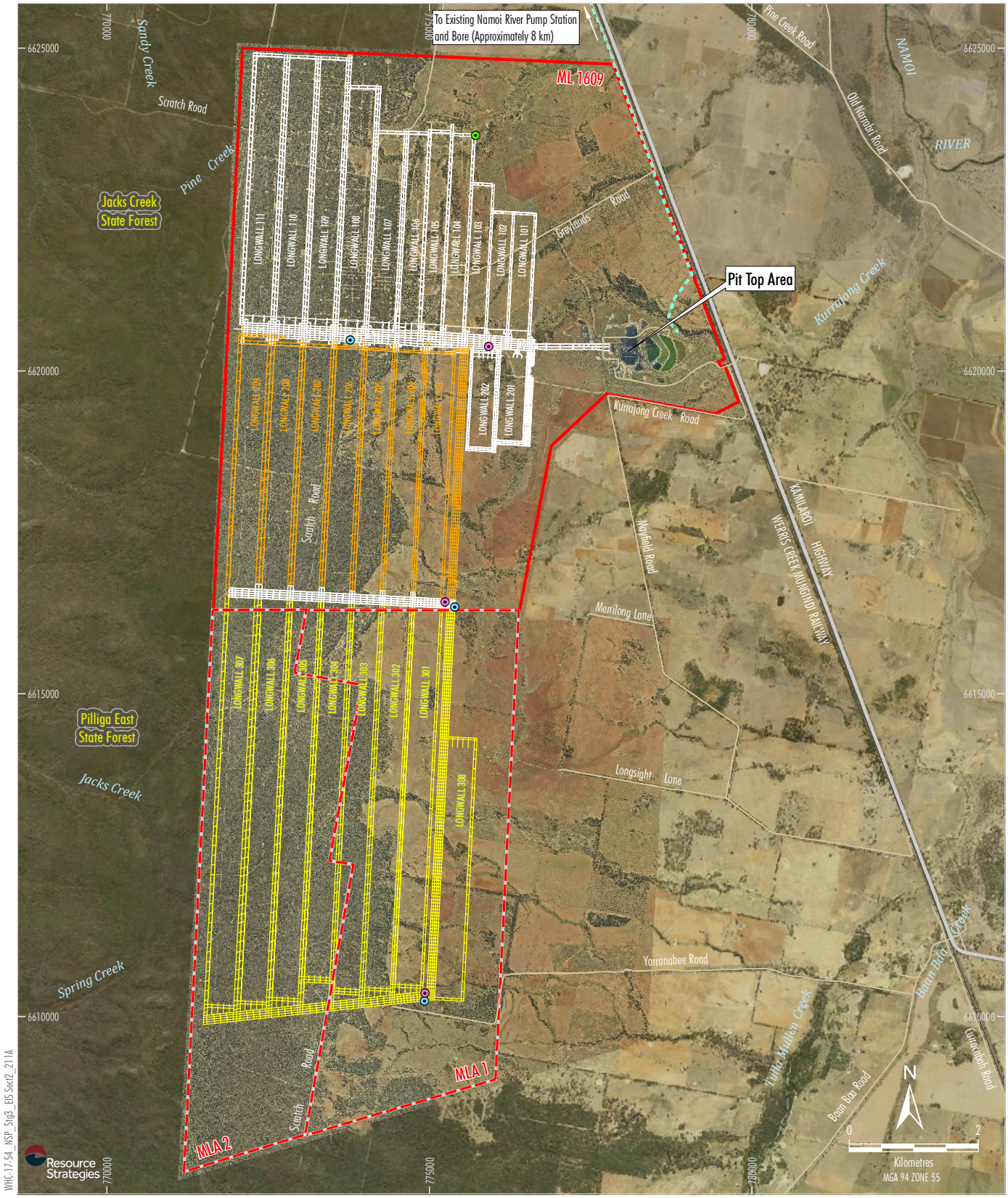
Table 2-3
Indicative Mining Schedule

Project Year	ROM Coal Production (Mt)	Coarse Reject Material (Mt)	Product Coal (Mt)
2021 (Year 0)	6.4	0.02	6.4
1	7.7	0.09	7.6
2	7.1	0.06	7.0
3	6.6	0.03	6.6
4	10.9	0.25	10.7
5	10.9	0.25	10.7
6	9.4	0.17	9.2
7	10.8	0.24	10.6
8	9.0	0.15	8.9
9	10.4	0.22	10.2
10	8.4	0.12	8.3
11	10.3	0.22	10.1
12	9.4	0.17	9.2
13	8.3	0.12	8.2
14	9.4	0.17	9.2
15	8.1	0.11	8.0
16	9.2	0.16	9.0
17	9.2	0.16	9.0
18	7.7	0.09	7.6
19	8.4	0.12	8.3
20	7.5	0.08	7.4
21	9.1	0.16	8.9
22	6.1	0.00	6.1
23	1.3	0.00	1.3

2.6.4 Underground Mine Access

The existing underground mine personnel, materials and coal access (Section 2.1.1) would remain unchanged for the Project (Figure 2-1).
PED cables would also be installed at ventilation complexes to facilitate emergency transportation to/from the underground mining operations.

Underground main headings would be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).



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LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing Namoi River Pipeline (Buried)
- Approved Underground Mining Layout
- Indicative Underground Mining Layout to be Extended for Project
- Indicative Underground Project Mining Layout
- Indicative Ventilation Complex (Downcast)
- Indicative Ventilation Complex (Upcast)
- Indicative Ventilation Complex (Upcast - Decommissioned)

Source: NCOPL (2019); NSW Spatial Services (2019)

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Project General Arrangement - Indicative Alternative Underground Mining Layout

Figure 2-10

Each longwall would be formed by developing gate roads (the tailgate and maingate roads). To construct the gate roads, underground roadways (headings) would be driven parallel to each other using continuous miners.

The headings that form the gate roads would be connected by driving a "cut-through" from one heading to another at regular intervals (Figure 2-9). This leaves a series of pillars of coal along the length of the gate road that support the overlying strata.

In some cases, additional gate roads may be required within the longwall panel footprint due to geology and mine planning considerations (similar to Longwall 108 [Section 2.1.1]).

2.6.5 Major Underground Equipment and Mobile Fleet

The existing underground equipment and mobile fleet (Section 2.1.1) is expected to remain unchanged for the Project. The equipment and mobile fleet may be revised over the life of the Project as operational requirements change.

Over the life of the Project, a range of underground mining equipment would be replaced or upgraded as a component of general maintenance or to increase efficiency (Section 2.5.3).

2.6.6 Mine Ventilation Systems

The existing, approved and additional Project ventilation complexes would continue to ventilate the Project underground areas. The ventilation system would continue to be progressively established for the Project (including the development of the proposed additional ventilation complexes) to maintain a safe working environment and reduce the potential for spontaneous combustion.

The additional ventilation complexes would be constructed progressively, ahead of mine development.

Each ventilation complex would include ventilation shafts which could be upcast or downcast. The upcast ventilation component would include a shaft and fans with a cumulative flow rate of up to approximately 250 cubic metres per second (m^3/s) at each complex.

The downcast ventilation shafts (including the drifts) would draw fresh air underground through the pressure differential created by fans located at the upcast ventilation shafts.

The requirement for each ventilation complex is subject to detailed mine planning (i.e. some ventilation infrastructure may not be required).

Ventilation fans, electrical infrastructure and other infrastructure may be upgraded, converted between upcast and downcast, replaced or decommissioned and removed during the life of the Project subject to detailed mine planning.

Ventilation complexes would be progressively decommissioned and sealed where no further beneficial use is identified. Ventilation shafts would be backfilled with mined rock from development of the shafts, which would be stored at the ventilation complexes during operations.

Further detail of ventilation complex decommissioning and rehabilitation is provided in Section 2.14.

2.6.7 Mine Safety Gas Management

Pre-mining gas drainage and goaf gas drainage would be required for the Project, to reduce the gas content in the coal seams to levels suitable for safe underground mining operations. The progressive development of gas drainage infrastructure is described in Section 2.5.6.

Gas extracted from the Hoskissons Coal Seam associated with the Project is expected to have a higher methane content than the approved mine area, but a lower volume than for the existing Narrabri Mine (Palaris, 2020b). Gas from the Narrabri Mine is currently vented to the atmosphere (Section 2.1.6). Ongoing monitoring of gas volumes and composition and investigation of developments in flaring technology would determine whether flaring is a viable option to manage gas associated with the Project. Accordingly, depending on localised gas volumes and composition, there may be opportunities to flare gas for the Project.

Ongoing monitoring of gas volumes and composition and investigation of developments in flaring technology would determine whether flaring is a viable option to manage gas associated with the Project.

If required for the Project, flaring infrastructure would be constructed within the indicative Surface Development Footprint shown on Figure 2-6. Any flares constructed for the Project would be constructed via the enclosed flare method, which is described as (NSW Environment Protection Authority [EPA], 2015):

> *An enclosed flare surrounds the burner head with a refractory shell that is internally insulated. The shell helps to reduce noise, luminosity and heat radiation. Enclosed flares allow better combustion by maintaining temperature, air flow and more stable combustion conditions, maximising the conversion of methane to carbon.*

Gas monitoring systems would be implemented for the Project to monitor gas composition of the air in the underground workings (e.g. carbon dioxide [CO_2] and methane levels) to maintain a safe working environment.

Pre-mining and goaf gas drainage development for the Project would occur ahead of longwall development (i.e. typically approximately one to six months or approximately 500 m ahead of longwall development).

Pre-mining gas drainage infrastructure would be decommissioned after the longwall has passed or where no further beneficial use is identified. Goaf gas drainage infrastructure would be decommissioned as required, or where no further beneficial use is identified (i.e. typically commencing within approximately 2.5 years after the longwall has passed the location).

Further detail of pre-mining gas drainage and goaf gas drainage decommissioning and rehabilitation is provided in Section 2.14.

2.6.8 Mine Safety Pre-conditioning

Pre-conditioning of the Digby Conglomerate and other geological units would be required for the Project to mitigate the potential for wind blast events occurring underground. The progressive development of pre-conditioning areas is described in Section 2.5.9.

Pre-conditioning is conducted at the Narrabri Mine by injecting water under pressure into a section of the strata overlying the coal seam through vertical holes. This practice would be continued for the Project.

Pre-conditioning for the Project would occur approximately one to six months ahead of longwall development as required.

The pre-conditioning areas would be rehabilitated and decommissioned as required, or where no further beneficial use is identified (i.e. typically commencing within approximately 12 months after the longwall has passed the location).

Further detail of mine safety pre-conditioning decommissioning and rehabilitation is provided in Section 2.14.

2.6.9 Water Management

Water would be supplied to the underground mining operations for equipment cooling and dust suppression.

Groundwater and operational water that accumulates in the underground workings would be pumped to the surface via underground sumps, access drifts and/or boreholes. Overlying and adjacent workings may also be dewatered, if required for safety reasons.

Further discussion on the site water management system is provided in Section 2.10.

2.6.10 Other Supporting Infrastructure

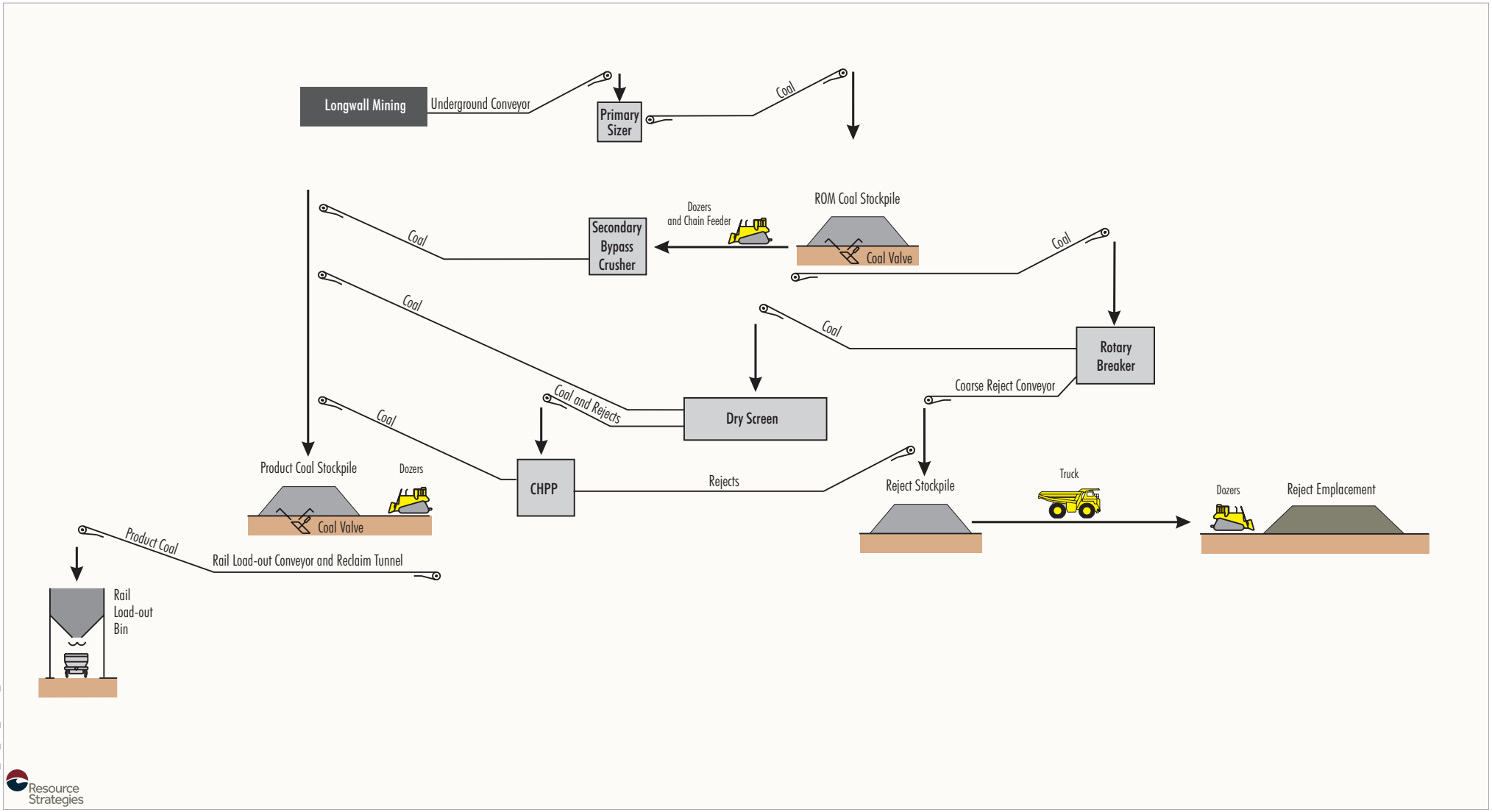
Other infrastructure and activities associated with underground mining operations would include:

- infrastructure at the Pit Top Area, such as administration, bathhouse and parking facilities (Section 2.11.1);
- infrastructure for servicing of underground mining equipment;
- infrastructure for electricity distribution and communication systems; and
- storage and handling of materials used by underground mining equipment (e.g. hydraulic fluids, roof bolts, wear plates, miscellaneous consumables and safety equipment).

2.7 ROM COAL HANDLING AND PREPARATION

The Project would use the existing coal handling and processing infrastructure located at the Narrabri Mine.

An indicative coal handling and processing schematic is provided as Figure 2-11.



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WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Indicative Coal Handling Schematic

Figure 2-11

Over the life of the Project, a range of equipment within the CHPP and its associated infrastructure would be replaced or upgraded as a component of general maintenance or to increase efficiency.

2.7.1 ROM Coal Sizing, Stockpiling and Transport

ROM coal is generally primary sized underground before it is transferred to the ROM coal stockpile on the surface via the drift conveyor. A reversible tripper stacks the ROM coal on the ROM coal stockpile in conjunction with dozers.

The ROM coal is then either fed via reclaim valves to a rotary breaker or by dozer push to a chain feeder which feeds a secondary bypass crusher.

The rotary breaker reduces the size of the ROM coal before it is either transferred to the CHPP, or directly to the product coal stockpile.

2.7.2 Coal Handling and Preparation Plant

The CHPP would produce the following main streams:

- combined (partly washed) thermal coal;
- washed PCI coal;
- coarse coal reject material; and
- coal fines.

The existing CHPP comprises a range of components that can be generally classified into three major circuits; the coarse coal, small coal and coal fines circuits. Each of these circuits includes components that separate coal materials on the basis of size (e.g. screens) and on the basis of material type (e.g. cyclones, flotation cells, jig/drum). Each circuit has links to each of the other circuits for recycling of undersize or oversize material.

The small coal and fine coal circuits also include components that are used to dewater coal products (e.g. centrifuges) and the fine coal circuit includes components that are used to dewater coal and coal fines (e.g. thickeners, filters and tailings presses).

Product coal from the CHPP is transferred to the product coal stockpile via conveyor in conjunction with dozers.

The product coal from the secondary bypass crusher is blended with the thermal coal from the CHPP on the product coal stockpile or during train loading. No waste is generated from the secondary bypass crusher except for minor amounts of tramp material.

Further details on product coal handling and transportation and CHPP reject material management are provided in Section 2.8.

2.8 PRODUCT COAL HANDLING AND TRANSPORTATION

An indicative schedule for product coal production is provided in Table 2-3.

Consistent with existing operations, product coal would typically be transported from the Narrabri Mine via the Werris Creek Mungindi Railway to the Port of Newcastle.

Product coal would be loaded onto trains 24 hours per day, seven days per week. Consistent with the approved Narrabri Mine, an average of four trains are loaded each day and a maximum of eight trains each day are loaded during peak coal transport periods.

Product coal would continue to be transported via the Werris Creek Mungindi Railway to the Port of Newcastle for export.

2.9 MANAGEMENT OF REJECT AND EXPLORATION WASTE MATERIAL

2.9.1 CHPP Reject Material Production

Coal reject generated during coal preparation at the Narrabri Mine would include coarse reject and coal fines. Consistent with the approved Narrabri Mine, coarse coal reject generated from the CHPP is disposed of in the reject emplacement area and coal fines are either blended with the unwashed (thermal) coal or disposed in the reject emplacement area.

Approximately 3.53 Mt of coarse reject material would be produced over the life of the Project (including the existing and approved Narrabri Mine). An indicative CHPP reject material production schedule is provided in Table 2-3. The actual quantity produced in any one year may vary with ROM coal production and product coal specifications.

The expected quantity of reject material disposed within the reject emplacement area would continue to be significantly less than the approved reject emplacement area capacity of 8 Mt (Section 2.1.4).

2.9.2 Geochemical Characteristics of CHPP Reject Material

An assessment of the geochemical characteristics of the coarse rejects associated with the Project has been undertaken in the Environmental Geochemistry Assessment (Appendix N) prepared by GEM. A summary of the assessment is provided below.

The Environmental Geochemistry Assessment (Appendix N) concluded that the coarse rejects would be slightly to highly saline.

The Environmental Geochemistry Assessment (Appendix N) concluded that the coarse reject would be predominately non-acid forming (NAF) with a small amount of potentially acid forming – low capacity material and that mixing during disposal would result in an overall NAF material.

Results of the test work on the coarse rejects indicated enrichment of Arsenic (As), Antimony (Sb), Molybdenum (Mo) and Selenium (Se). The contained Se would be readily soluble and the As would be relatively insoluble (Appendix N).

The management of coarse reject is described in Section 2.9.4 and Appendix N.

2.9.3 Exploration Waste from Other Whitehaven Exploration Activities

The Project would involve the co-disposal of up to approximately 15,000 cubic metres of exploration drilling waste (over the life of the Project) from other Whitehaven exploration activities in the area.

Exploration drilling waste would be transported to site by heavy vehicles (e.g. a 11,000 L hydro-excavation vacuum truck) between 7.00 am and 10.00 pm, seven days a week.

The typical geochemical characteristics of exploration waste has been assessed in the Environmental Geochemistry Assessment (Appendix N), which concludes the material would typically be NAF.

Given the minor quantities of drilling waste from other Whitehaven exploration activities proposed to be disposed, the Narrabri Mine reject emplacement area would not require a change to the approved footprint, maximum height or batter angles.

2.9.4 Reject Management

The reject emplacement area is shown on Figure 2-2. The progressive reject emplacement design has been reviewed and updated by ATC Williams (2019) based on the expected quantity and geochemical characterisation of reject and exploration waste to be disposed for the Project.

The reject emplacement area has been designed with specific design criteria such that there is a low risk of geotechnical failure (ATC Williams, 2019).

2.10 WATER MANAGEMENT

The Project would involve the use of the existing/approved water management infrastructure with minor augmentations and extensions, including the progressive development of pumps, pipelines, water storage and other water management infrastructure.

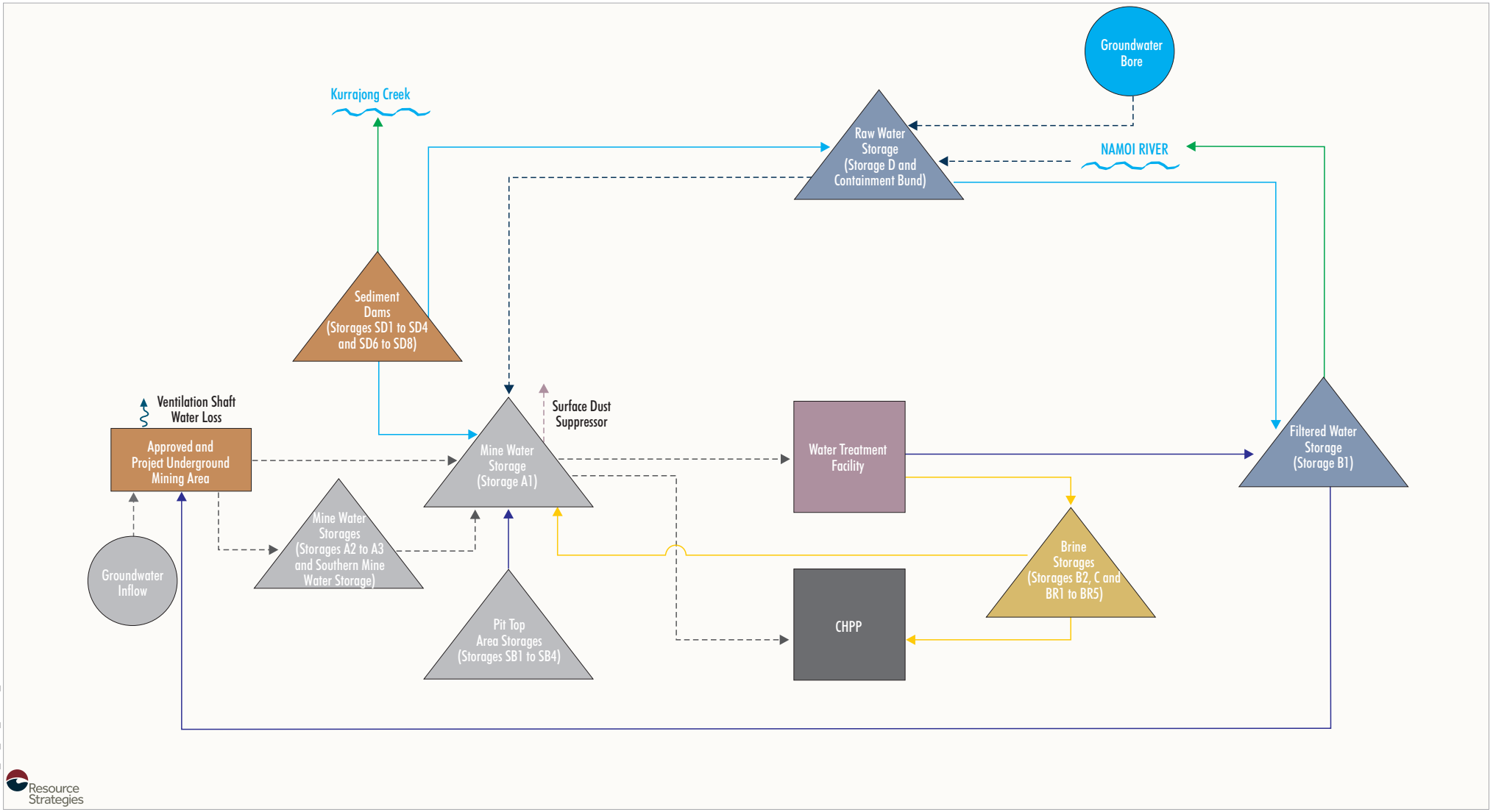
An indicative Project water management schematic is presented as Figure 2-12.

A detailed description of the operation and predicted performance of the Project site water management system is provided in the Surface Water Assessment (Appendix C), prepared by WRM (2020).

2.10.1 Project Site Water Management System

The objectives and design criteria of the Project site water management system would be to:

- protect the integrity of local and regional water resources;
- separate runoff from undisturbed, rehabilitated and mining-affected areas;
- design and manage the system to operate reliably throughout the life of the Project in all seasonal conditions, including both extended wet and dry periods;



LEGEND

- Controlled Off-site Discharge or Overflow Due to Rainfall in Excess of Design Storm
- Mine Water / Pit Top Runoff Transfer
- Disturbed Area Runoff Transfer
- Raw Water Transfer
- Filtered Water Transfer
- Brine Water Transfer

Notes:
1. All dams are subject to direct rainfall and evaporation.
2. The Southern Mine Water Storage would be constructed as mining progresses south of mains.
3. BR1 to BR5 would be constructed as required.
4. SD7 has not been constructed.

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Indicative Water Management Schematic

Figure 2-12

- provide water for use in mining and CHPP operations that is of sufficient volume and quality, including during periods of extended dry weather;
- provide sufficient storage capacity in the system to store, treat and discharge runoff as required, including during periods of extended wet weather; and
- maximise the re-use of water on-site.

To effectively develop a site water management system that addresses the above objectives and design criteria, runoff has been classified into the following categories for the Project:

- Undisturbed Area Runoff – runoff from catchments that have not been disturbed by mining activities. Undisturbed area runoff may be diverted around mining activities to downstream receiving waters.
- Rehabilitated Mine Area Runoff – runoff from rehabilitated mine areas that have established stable vegetation cover. This runoff is expected to have similar water quality characteristics to undisturbed area runoff. The Project site water management system has been designed to allow runoff from these areas to be discharged without control.
- Disturbed Area Runoff – runoff from disturbed areas and areas under active rehabilitation that may contain silt and sediment. The Project site water management system has been designed to capture this runoff in sediment dams or managed in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004). Water captured in sediment dams would be:
  - transferred to the Project site water management system for re-use in mine operations; and/or
  - released via licensed discharge points, in accordance with the conditions of EPL 12789 following rainfall events that exceed sediment dam design capacity.
- Pit Top Area Runoff – runoff from Pit Top Areas that may contain silt, sediment and other pollutants (e.g. chemicals and hydrocarbons). The Project site water management system has been designed to contain and re-use this water on-site.

Water would be required for underground mining operations (e.g. for cooling and underground dust suppression), CHPP operations, washdown usage, dust suppression on roads, stockpile dust suppression, and other minor non-potable uses.

The main water sources for the Project would be:

- groundwater inflows to underground workings (mine water);
- catchment runoff and infiltration (refer to runoff types above);
- supplementary licensed extraction from the Namoi River and/or Namoi River alluvium (raw water); and
- potable water transported to site.

The water treatment facilities would treat mine water, disturbed area runoff and Pit Top Area runoff to produce filtered water and a brine waste product. The filtered water would be used in mining operations and the brine would be used for stockpile dust suppression. NCOPL may also investigate options for the beneficial re-use of excess water such as internal use (e.g. irrigation) or provision of water to other water users in the region.

Untreated disturbed area and Pit Top Area runoff would be used in CHPP operations.

Raw water would be used to supplement mining and CHPP operations demand and/or to supply a separate water treatment plant used to produce potable water. Potable water would also be transported to site to supplement the potable water supply from the water treatment plant.

Post-mining water management would incorporate some aspects of the site water management system (i.e. some storages and water management structures would be retained as permanent features) (Attachment 5).

Consistent with the current post-mining water management strategy, brine from the Brine Storage Ponds would be re-injected into the longwall goaf through the disused goaf gas drainage holes or via the underground infrastructure.

Up-catchment Runoff Control

Temporary and permanent up-catchment diversion structures would be constructed over the life of the Project to divert runoff from undisturbed areas around disturbed areas.

Stabilisation of up-catchment diversions would be achieved by the design of appropriate channel cross-sections and gradients and the use of channel lining materials, such as grass or rock fill.

Water Storages

The Project would continue to use existing and approved water storages including (Figure 2-12):

- raw water storage dams (Storage D and Containment Bund);
- mine water storages (Storages A1 to A3);
- Pit Top Area storages (Storages SB1 to SB4);
- a filtered water storage dam (Storage B1);
- brine storage dams (Storages B2, C and BR1 to BR5[5]); and
- sediment dams (SD1 to SD4 and SD6 to SD8[6]).

An additional mine water storage would be constructed south of Longwall 210 (Figure 2-6) as described in Section 2.5.10. This mine water storage would be used for mine dewatering of the southern longwall panels, and to transfer water to the Pit Top Area, as required.

The Pit Top Area storages would capture runoff from the Pit Top Area (e.g. CHPP). The water captured in the Pit Top Area storages would be transferred to the mine water storages.

Water contained in the mine water storages would be transferred to the water treatment facilities for treatment and/or re-used on-site (e.g. CHPP operations, washdown and/or dust suppression).

The filtered water and brine produced from the water treatment facilities would be stored in the filtered water storage and brine storages, respectively, prior to re-use.

Brine storages would be lined with a low permeability HDPE with a permeability of less than 1 x 10^{-14} m/s to minimise the potential for seepage.

Evaporator spray systems may be installed on water storages to increase evaporation of mine water and brine to remove excess water from the Project site water management system, consistent with the approved Narrabri Mine.

The Pit Top Area, mine water and brine storages have been designed to contain and re-use water on-site. This would involve operating the storages with a maximum operating level to provide freeboard for storm runoff storage. The freeboard for storm storage would be maintained by transferring excess water to other contained storages.

Periodic reviews of the site water balance would be conducted to enable the Project site water management system to be adjusted as necessary.

Water Treatment

The Project would include the continued use of water treatment facilities (and/or other suitable water treatment technologies) to treat water for supply to underground mining operations and potable water.

The capacity of the water treatment facilities would be reviewed as part of the periodic site water balance reviews and the capacity of the water treatment facilities may be adjusted as necessary.

Sedimentation Control

Sedimentation control for the Project would be implemented using sediment dams. Sediment dams would contain runoff from disturbed areas and areas under active rehabilitation that may contain silt and sediment.

Sediment dam storage capacity would be restored through transfer of water to other water storages or through controlled release via licensed discharge points, in accordance with the requirements of an EPL following rainfall events that exceed sediment dam design capacity.

[5] BR1 to BR5 have not been constructed. The construction of BR1 to BR5 is described in Section 2.5.10.

[6] SD7 has not been constructed.

Sediment dams would be maintained until runoff from catchment areas reporting to the sediment dams has similar water quality characteristics to areas that are undisturbed by mining activities (i.e. when vegetation successfully establishes on partially rehabilitated areas), at which point they would be decommissioned and rehabilitated (Section 2.14.2).

Transfer of Water

The transfer of water between water storages is integral to the Project site water management system.

Water transfer infrastructure would include storage tanks, pumps, pipelines and associated power supply. This infrastructure would be developed and relocated progressively over the life of the Project and, as such, this minor ancillary infrastructure is not shown on Figure 2-6.

Farm Dam Decommissioning

As part of the Project, NCOPL would decommission two existing farm dams on Kurrajong Creek prior to longwall mining occurring in those areas. Decommissioning activities would occur generally in accordance with Landcom (2004).

2.10.2 Groundwater Inflows

Groundwater and operational water that accumulates in the underground workings would be pumped to the surface via underground sumps, access drifts and/or boreholes. Groundwater would also be extracted as part of ongoing mine safety management activities.

Predicted groundwater inflows to the underground workings over the life of the Project are predicted to be up to approximately 6.7 megalitres per day (ML/day) (Appendix B).

Licensing of the predicted groundwater inflows for the Project is assessed and described in Section 6.4.4, Attachment 7 and the Groundwater Assessment (Appendix B).

2.10.3 Water Consumption

The main water requirements for the Project would be for mining operations, CHPP operations, washdown usage, dust suppression on roads, stockpile dust suppression, and other minor uses.

Water required for the Project would be preferentially sourced from groundwater inflows to underground workings and catchment runoff and infiltration. Supplementary water supply required over the life of the Project would be sourced from the Namoi River and/or Namoi River alluvium.

The water consumption requirements and water balance of the system would fluctuate with climatic conditions, production rate and as the extent of the mining operation changes over time.

Supplementary water supply from the Namoi River and/or Namoi River alluvium is predicted to range from 0 megalitres per year (ML/year) to 30 ML/year (Appendix C).

Consistent with current practice, water would be preferentially extracted from the Namoi River in accordance with WALs held by NCOPL. When low or no-flow conditions in the Namoi River prevent the extraction of water from the river (or other circumstances such as the Namoi River pump station not being operational), groundwater would be extracted from NCOPL's bore to provide a supplementary water supply, in accordance with WALs held by NCOPL.

A summary of the estimated Project water demands is provided below.

Underground Mining Operations

Treated water used in underground mining operations is predicted to peak at approximately 1.9 ML/day (Appendix C).

Coal Handling and Preparation Plant Make-up Demand

Water used in the CHPP would be recycled with any necessary make-up water obtained from water contained on-site.

The CHPP make-up demand is related directly to the rate of ROM coal feed to the CHPP, the amount of coal bypassed around the coal processing plant, and the rate of production and moisture content of CHPP rejects. The estimated make-up demand is predicted to peak at approximately 1.2 ML/day (Appendix C).

Dust suppression would be required for surface activities and for ROM and product coal stockpiles.

Dust suppression usage would be in the order of approximately 0.5 ML/day (Appendix C).

2.10.4 Namoi River Discharge

Under some climactic conditions, the Project has the potential to receive groundwater and surface water inflows in excess of its consumption requirements.

In the event that excess water accumulates at the Project, consistent with Project Approval 08_0144 and EPL 12789, filtered water that meets the following water quality criteria would be pumped to the Namoi River (Figure 2-1) for release:

- 50th percentile of all samples (volume-based) are below 250 mg/L of TDS;
- 100th percentile of all samples (volume-based) are below 350 mg/L of TDS; and
- pH values of all sampled water to be between 6.5 and 8.5.

In addition, NCOPL would investigate options for the beneficial re-use of excess filtered water with other water users in the Project area (e.g. irrigation) or passing the water to local landholders.

Lastly, consideration would also be given to the injection of excess mine water of suitable quality into the longwall goaf through the disused goaf gas drainage holes or via the underground infrastructure. Any beneficial re-use or underground injection of excess water would be undertaken in accordance with an updated Water Management Plan.

2.10.5 Simulated Performance of the Site Water Management System

A simulated site water balance based on 129 years of climatic data has been prepared by WRM (2020), to simulate the performance of the site water management system over the life of the Project.

The site water balance modelling demonstrates that the proposed site water management system has sufficient capacity and flexibility to accommodate a wide range of groundwater inflows and climate scenarios while (Appendix C):

- providing security of supply for Project operations;
- containing brine on-site, with no uncontrolled off-site release; and
- maintaining a low risk of uncontrolled off-site release of mine water and Pit Top Area water.

2.11 INFRASTRUCTURE AND SERVICES

The Project would involve the continued use of existing and approved surface infrastructure at the Narrabri Mine for the life of the Project, as required.

2.11.1 Surface Facilities

The Project would use the existing surface facilities (such as administration buildings, bathhouses, workshops and storage areas) described in Section 2.1 with minor upgrades and extensions as required.

The Project would use the existing major mobile fleet described in Section 2.1.2. Additional detail of the indicative surface mobile equipment fleet, which would be used during periods of typical operations, is provided in Appendix J.

Additional surface fleet may be present for short periods, for example during longwall change-outs, scheduled plant shutdowns or other maintenance programs over the life of Project.

2.11.2 Site Access

The existing primary access to the Narrabri Mine site from the Kamilaroi Highway is via Kurrajong Creek Road and an internal sealed mine access road connecting to the Pit Top Area (Figure 2-3), which would be retained for the Project.

For environmental monitoring (Figure 2-4), general land management, exploration activities and other ancillary activities, alternative access points to the Narrabri Mine area would also be used as required, consistent with the current access arrangements to the approved Narrabri Mine.

2.11.3 Electricity Supply and Distribution

The existing Narrabri Mine receives electricity via a spur line from a 66 kV supply system adjacent the Kamilaroi Highway (Figure 2-1). Transformers in the Pit Top Area step down the 66 kV supply to 11 kV for distribution by overhead cable or underground cable where necessary.

The 66 kV electricity transmissions would continue to supply most of the electricity requirements of the Project.

The 66 kV electricity transmission line would be progressively extended as ventilation complexes and the mine is developed (Figure 2-5). The Project would involve the development of additional service boreholes for electricity supply to the underground workings (Section 2.11.4). The Project is expected to result in an increased demand for electricity due to additional infrastructure and extension of the underground mining area.

In addition, supplementary diesel fuel generations would also be used as required.

2.11.4 Service Boreholes, Access Tracks and Services Corridors

Services such as compressed air, diesel, electricity, nitrogen and water required for the advancing longwall and development operations or ventilation would be delivered from the surface via the drifts and service boreholes. The development of service boreholes is described in Section 2.5.8.

Service boreholes for the Project would be progressively installed approximately one month or 500 m ahead of longwall development.

Service boreholes would be progressively decommissioned as required, or where no further beneficial use is identified (i.e. typically commencing approximately 2.5 years after the longwall has passed the location).

Services corridors would be progressively constructed over the life of the Project. Construction of the main services corridor running north-south would most likely commence in Year 1 of the Project. Services corridors would typically be decommissioned following mine closure or when no longer required.

Access tracks and post-drainage corridors would be constructed ahead of longwall development (i.e. typically approximately one to six months or 500 m ahead of longwall development). Access tracks and post-drainage corridors would be progressively decommissioned once goaf gas drainage areas have been decommissioned and rehabilitated (i.e. typically commencing approximately 2.5 years after the longwall has passed the location), or otherwise when no longer required.

Further detail of surface infrastructure decommissioning and rehabilitation is provided in Section 2.14.

2.11.5 Site Security and Communications

Existing site security measures would be retained for the Project with upgrades as necessary. Additional security fencing for the Project may be erected where necessary (for example at ventilation complex sites).

The existing communications systems at the surface facilities and underground mining operations would be retained for the Project with augmentations as necessary.

2.11.6 Namoi River Pump Station, Production Bore and Pipeline

The Namoi River pump station, alluvial production bore and pipeline are described in Sections 2.1.9 and 2.10.

2.12 WASTE MANAGEMENT

The Project would generate waste streams of a similar nature to current waste generation at the Narrabri Mine, which can be categorised as production and non-production wastes (NCOPL, 2015a):

- Production wastes:
  - Mined rock from development of ventilation shafts.
  - Drill cuttings (e.g. from development of gas management infrastructure, exploration boreholes and service boreholes).
  - Reject generated by the CHPP and underground areas.
  - Brine.
- Non-production wastes:
  - General waste.
  - Hydrocarbons.
  - Treated sewage and effluent.
  - Minor quantities of other waste from mining and workshop activities (e.g. worn tyres and used oil filters) as well as hazardous wastes.

An overview of the waste types likely to be generated by the Project is presented to Table 2-4. Further details on the management of waste is provided below.

Table 2-4
Waste Types Likely to be Generated by the Project

Waste Stream	Indicative Waste Class	Management Method
CHPP Reject	-	Refer to Section 2.9.1.
Brine	-	Refer to Section 2.10.1.
Exploration waste	-	Refer to Section 2.9.3.
Worn tyres	Special	Worn tyres would be segregated and collected for either repair (if possible) or disposal by licensed waste contractor(s).
Sewage and effluent	Liquid	The existing wastewater treatment plant would continue to be used to treat effluent on-site, with the treated water discharged to a rehabilitation area.
Excess hydrocarbon material	Liquid	Stored in bunded areas within the workshop or at the waste oil depot prior to collection by licensed contractor(s) for processing off-site.
Asbestos (if identified)	Special	Further assessment and advice would be sought regarding waste classification, handling, treatment, disposal and reporting requirements prior to appropriate disposal.
General solid waste such as Timber, cardboard, paper, steel, scrap metal, food waste, etc.	General Solid Waste (non-putrescible and putrescible)	Transported to an approved waste handling facility and recycled or disposed.
Other general solid waste, such as used oil filter, used particulate filters, and workshop wastes (e.g. rags and oil-absorbent materials that only contain non-volatile hydrocarbons and do not contain free liquids)	-	Temporary storage on-site in designated bins prior to removal from site by appropriately licensed waste contractors.

2.12.1 Production Wastes

Mined rock from the development of ventilation shafts would be used as fill material for the Southern Mine Water Storage, sediment dams and/or other infrastructure construction activities. Any excess material would be stockpiled at the ventilation complex, temporarily revegetated and used for future rehabilitation of the shaft sites upon decommissioning.

Drill cuttings would be excavated from sumps and disposed of in the reject emplacement area, or consolidated with excavated soil to backfill the sump (where minor amounts of cuttings are present). An area at the reject emplacement area has been established to allow excess water from drill cuttings to decant off prior to cuttings being incorporated into the reject emplacement area (NCOPL, 2019c).

Management of rejects and the receipt of exploration drilling waste from other Whitehaven exploration activities is described in Section 2.9. Management of brine is described in Section 2.10.1.

The *Waste Classification Guidelines Part 1: Classifying Waste* (EPA, 2014) classifies production waste as general solid waste (non-putrescible).

2.12.2 General Waste

Consistent with the NSW waste hierarchy (EPA, 2017a), general waste produced by the Project would be deposited into waste bins segregated to separate general, hydrocarbon and recyclable waste. General waste bins would then be transported to an off-site approved waste handling facility for further segregation.

EPA (2014) classifies general waste as general solid waste (non-putrescible and putrescible).

Waste quantities would vary from year to year and would continue to be reported in Annual Reviews. In 2019, approximately 2,296 tonnes (t) of general waste was generated (NCOPL, 2019b). In addition, approximately 14 t of cardboard/paper, 252 t of timber and 397 t of steel were recycled (NCOPL, 2019b).

2.12.3 Hydrocarbons

Any excess hydrocarbon material that is collected during maintenance activities or through the waste separator would be stored in bunded areas within the workshop or at the waste oil depot prior to removal by a licensed waste oil recycler.

EPA (2014) classifies hydrocarbons as general solid waste (non-putrescible and putrescible).

2.12.4 Sewage and Effluent

At the Pit Top Area, the existing wastewater treatment plant would continue to be used to treat effluent on-site, with the treated water discharged to a rehabilitation area. Treated effluent would be irrigated in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (Department of Environment and Conservation, 2004), and managed in accordance with the Water Management Plan (NCOPL, 2017a) (or the latest approved version).

The sludge waste process generated from the wastewater treatment plant would continue to be collected and transported offsite by licensed contractors. Waste quantities would vary from year to year and would continue to be reported in Annual Reviews. Approximately 556,200 litres (L) of waste sludge was collected and transported off-site in 2019 (NCOPL, 2019a).

EPA (2014) classifies sewage and effluent as liquid waste.

2.12.5 Hazardous Waste

Hazardous waste as classified by EPA (2014), including explosives, lead-acid or nickel-cadmium batteries and containers that have not been cleaned containing residue of dangerous goods would be temporarily stored on-site in a designated area prior to removal from the site by licensed contractors.

2.12.6 Other Waste

Other general solid waste, such as used oil filter, used particulate filters, and workshop wastes (e.g. rags and oil-absorbent materials that only contain non-volatile hydrocarbons and do not contain free liquids) would be temporarily stored on-site in designated bins prior to removal from site by appropriately licensed waste contractors.

Used tyres would be segregated and collected for either repair (if possible) or disposal by a licensed waste contractor. Tyres are classified as special waste in EPA (2014).

Further assessment and advice would be sought regarding handling, treatment, disposal and reporting requirements for any asbestos found on site, prior to appropriate disposal. EPA (2014) classifies asbestos waste as special waste

2.13 MANAGEMENT OF DANGEROUS GOODS

The transportation, handling and storage of all dangerous goods for the Project would be conducted in accordance with the requirements of the NSW *Work Health and Safety Regulation 2017*.

The dangerous goods stored for the Project would include compressed gases, flammable and combustible liquids, and corrosive substances.

Based on the quantities proposed to be stored for the Project, it is not anticipated that a Dangerous Goods Licence would be required.

2.13.1 Transport

Dangerous goods required for the Project would be transported in accordance with the appropriate State legislation.

2.13.2 Hydrocarbon Storage

Hydrocarbons used on-site for the Project would be consistent with current operations and would include fuels (i.e. diesel), oils, greases, degreaser and kerosene.

Hydrocarbon storage facilities are constructed and operated in accordance with AS 1940:2017 *The Storage and Handling of Flammable and Combustible Liquids* and the NSW *Work Health and Safety Regulation 2017*.

2.13.3 Explosives Storage

Explosives may be used during development of ventilation shafts and boreholes as well as underground development. Explosives storage would be conducted in accordance with the NSW *Explosives Act 2003* and *Explosives Regulation 2013* (or their latest versions). The *Explosives Regulation 2013* details the requirements for the safe storage, land transport and handling, and disposal of the explosive, with reference to AS 2187.2:2006 *Explosives – Storage and Use – Use of Explosives* for specific guidelines.

Explosives would continue to be stored at the Pit Top Area in an existing licensed explosives magazine in accordance with Workcover requirements and applicable Australian Standards.

2.13.4 Other Dangerous Goods

The management and storage of chemicals for the Project would be conducted in accordance with NCOPL's prescribed management procedures, and relevant Australian Standards and Codes.

Spill kits would be available onsite and contaminated soil would be rehabilitated in accordance with NCOPL procedures.

NCOPL would continue to assess new substances before their use on-site by completing a substance evaluation and risk assessment. Safety Data Sheets and substance evaluations would be available to site personnel.

2.14 REHABILITATION AND REMEDIATION ACTIVITIES

Rehabilitation is currently undertaken at the Narrabri Mine as described in Section 2.1.12.

The Project would require the progressive rehabilitation of surface development areas and the remediation of subsidence impacts in the underground mine area.

The Project would be rehabilitated to a safe, stable and non-polluting landform of a similar character to surrounding areas.

Rehabilitation would be undertaken progressively as soon as reasonably practicable as areas become available following mining operations.

A summary of the key components is provided below. Further details of the Project rehabilitation and mine closure activities are provided in Attachment 5.

2.14.1 Conceptual Final Landform Design

The Project would not require significant changes to the approved final landform design (Section 2.1.12). The conceptual final landform for the Project would continue to generally approximate the pre-mining landscape with the exception of the reject emplacement area and surface impacts from subsidence in the underground mining area.

Following the completion of mining, mine entrances in the box cut would be sealed in accordance with the requirements of *MDG6001 Guideline for the Permanent Filling and Capping of Surface Entries to Coal Seams* (NSW Trade and Investment, 2012). Consistent with the approved final landform, the box cut would then be backfilled with material recovered from the amenity bund and other areas on-site before being re-profiled to be consistent with the surrounding landscape.

Following the dewatering of the Brine Storage Ponds (Section 2.10.1), accumulated salts would be removed from the brine storage pond floor and walls and placed in the box cut. Brine Storage Pond liners would be removed from site by an appropriately licensed waste contractor. The Brine Storage Pond walls would then be pushed in and re-profiled to be consistent with the surrounding landscape (Attachment 5).

The rehabilitated reject emplacement area would be approximately 15 m high with batter slopes of generally 1:5 (V:H) with a maximum grade of 1:4 (V:H) on the north-east batter. An approximate 400 millimetre (mm) clay capping layer would be placed over the final landform prior to revegetation (ATC Williams, 2019).

Landform changes would occur as a result of subsidence in the underground mining area. Surface impacts from subsidence would be progressively remediated in accordance with the procedures referenced in Section 6.3. Post-mining subsidence monitoring would continue for a period of time detailed within the Extraction Plans, and any observed surface impacts would continue to be remediated by NCOPL in accordance with the Extraction Plan.

2.14.2 Post-mining Land Use

For the purposes of rehabilitation and mine closure planning for the Project, NCOPL proposes the post-mining land use of the Project would continue to comprise a combination of native vegetation, agricultural (pasture) and forestry (State Forest) land uses.

Project infrastructure (e.g. rail loop, site access roads, water storages) may be retained for alternate post-mining uses (where agreed with relevant regulatory authorities and landholders).

2.15 IMPACT REDUCTION AREA DEVELOPMENT FOOTPRINT

The indicative Surface Development Footprint (Figure 2-6) excludes some areas of surface development associated with the approved Narrabri Mine (Figure 2-1).

The approved Narrabri Mine surface development areas that are not required for the Project would be foregone subject to approval of the Project. The indicative Impact Reduction Area for the Project is shown on Figure 2-13.

Further detail is provided in the BDAR (Appendix D).

2.16 WORKFORCE

The Project would allow for the continued employment of up to approximately 520 full-time equivalent personnel at the Narrabri Mine.

In addition to ongoing coal mining operations, the existing operational workforce would undertake the following development activities, which would occur throughout the life of the Project:

- Development of underground roadways to access Project underground mining areas.
- Development of coal clearance infrastructure and other ancillary infrastructure required to support Project underground mining areas.
- Development of ventilation complexes and associated infrastructure.
- Gas management works.
- Minor maintenance, replacement or upgrades to areas and infrastructure at the Pit Top Area.

Operations would continue to occur 24 hours per day, seven days per week. The current shift arrangements described in Section 2.1.11, which may be amended from time to time, would continue for the Project.

The operational workforce would continue to predominantly reside locally (e.g. within the NSC and GSC LGAs).

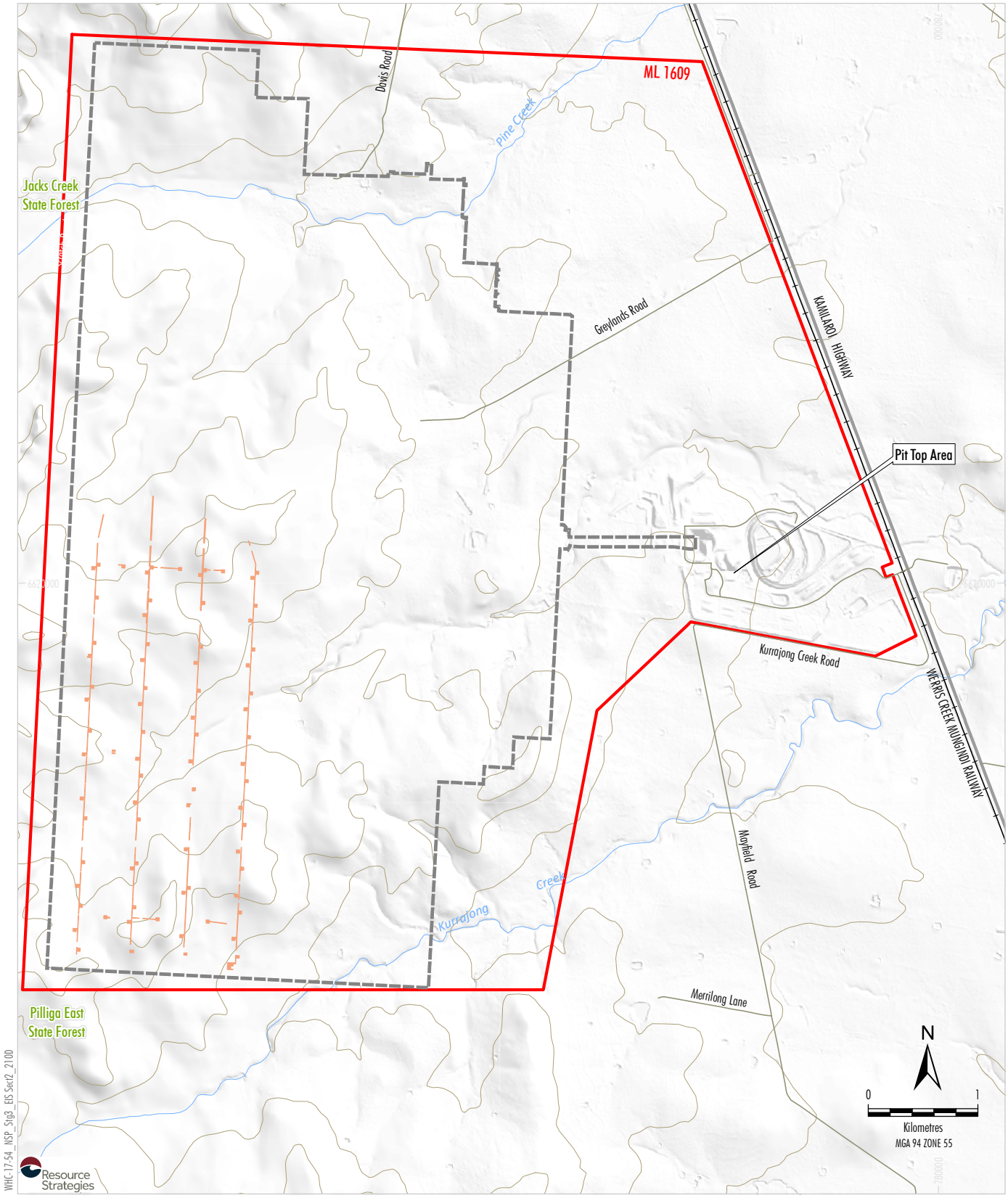
There would be multiple, short periods of development activity throughout the Project life as infrastructure development occurs, which would require additional personnel (Section 2.5). Activities would include longwall change-outs, periods of higher underground development activities, drilling programs, ventilation shaft development, scheduled plant shutdowns or other maintenance programs.

These activities would require approximately 20 full-time equivalent personnel (in addition to the current operational workforce) for multiple, short periods throughout the Project life.

These activities would generally occur 7.00 am to 6.00 pm Monday to Sunday. Activities undertaken outside of these hours would include:

- activities that cause $L_{Aeq(15\ minute)}$ of no more than 35 dB at any privately-owned residence, or at a higher level that has been agreed with the resident;
- the delivery of materials of which delivery is required, by the NSW Police or RMS, to be undertaken for safety reasons outside the normal construction hours; and
- emergency work to avoid the loss of life, damage to property or to prevent environmental harm.

Some development works (e.g. drilling and underground development activities) would occur on a 24-hour-per-day basis.



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

- Mining Lease (ML 1609)
- Approved Underground Mine Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

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Project Impact Reduction Area

Figure 2-13