Environmental & Social Consultants

STATEMENT OF ENVIRONMENTAL EFFECTS

Middle Creek Quarries Modification

FINAL

May 2023

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Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Oberon Earthmoving Pty Ltd

Project Director:	Alex Irwin
Project Manager:	Alex Irwin
Report No.	4722/R06
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Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Abbreviations

Abbreviation	Meaning
AHIP	Aboriginal Heritage Impact Permit
BCD	Biodiversity Conservation Division
DCP	Development Control Plan
DoE	Department of Environment
ENM	Excavated Natural Materials
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
LGA	Local Government Area
NRAR	Natural Resources Assessment Regulator
POEO (Waste) Reg	Protection of the Environment Operations (Waste) Regulation 2014 (NSW)
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
RLMP	Rehabilitation and Landscape Management Plan
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SRD SEPP	State and Regional Development State Environmental Planning Policy
VENM	Virgin Excavated Natural Materials
WAL	Water Access Licence
WM Act	*Water Management Act 2000* (NSW)
WRHCMP	Waste Receival, Handling and Compost Management Plan
WRPP	Western Regional Planning Panel

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1.0 Introduction

1.1 Scope

This Statement of Environmental Effects (SEE) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Oberon Earthmoving Pty Limited (Oberon Earthmoving) to support an application to Oberon Council (Council) for the modification of operations at the Middle Creek Quarry (the Quarry)[1]. The Quarry is located on Lot 2 DP 1112479 at 50 Sewells Creek Road approximately 4 kilometres (km) west of Oberon, within the Oberon Council Local Government Area (LGA) (refer to **Figure 1.1**). The Quarry operates under development consent DA 10.2016.38.1 which was approved by the Western Regional Planning Panel (WRPP) on 21 March 2018 (refer to **Appendix 1**). The existing development consent permits the extraction of gravel and the importation of waste materials for on-site disposal or processing.

Oberon Earthmoving has identified several constraining conditions associated with the existing development consent and several opportunities for the addition of ancillary development activities. Oberon Earthmoving intends to modify the existing development consent to allow for the following:

- Construction of a new pad for the relocation of composting operations and supplementary stockpiling.
- A washing circuit to produce fine aggregates / sand from the crushed gravel.
- Extended resource recovery activities to include:
  - concrete crushing, and
  - plasterboard.
- An increase in maximum extraction and production rates.
- An increased in truck movements.

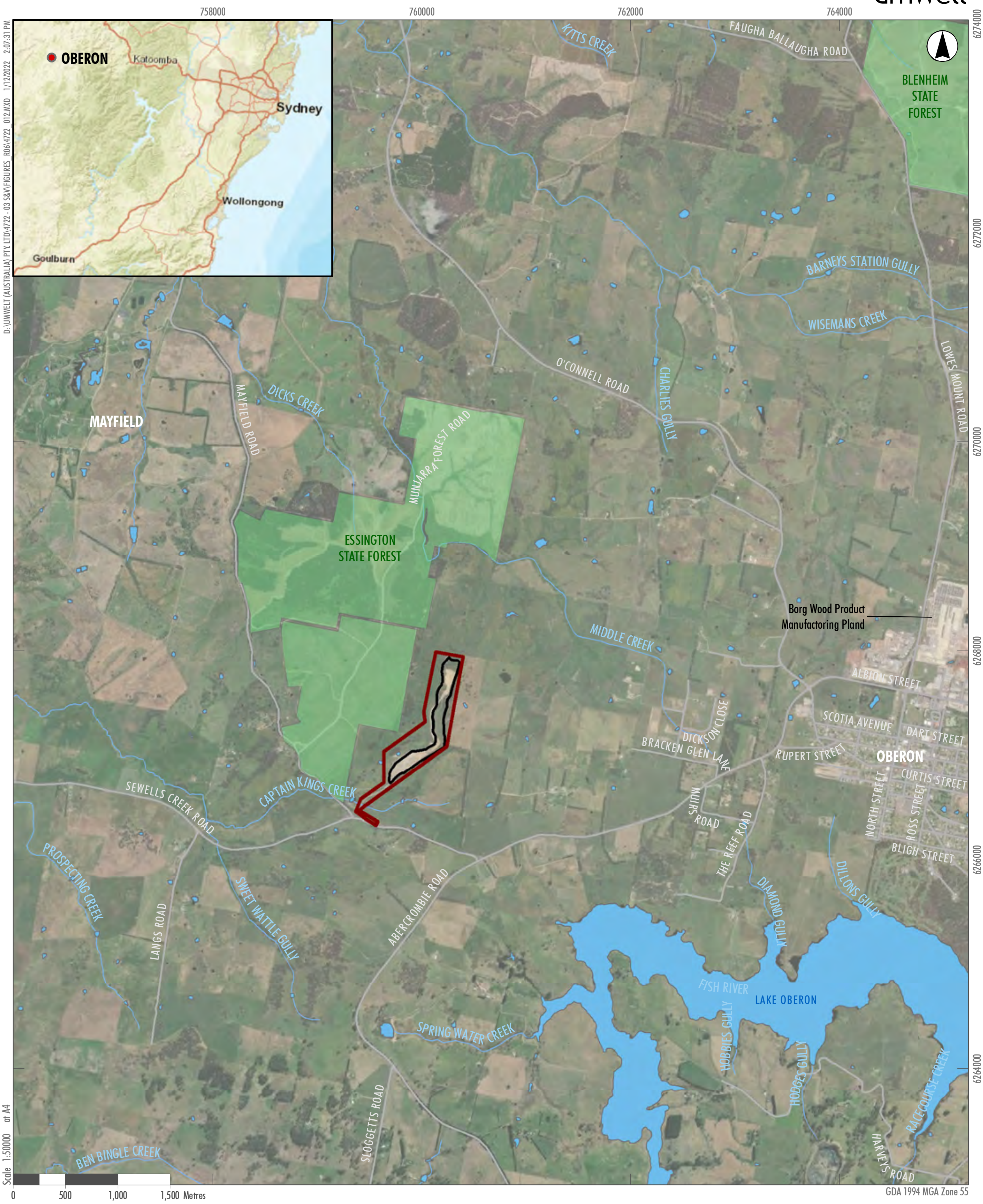
On the basis that operations remain substantially the same as that approved in 2018, an application to modify the existing development consent is being made to Council under Section 4.56 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The development is also classified as Regional Development under the *State Environmental Planning Policy (Planning Systems) 2021*. As a result, the development application will be determined by the independent WRPP. The WRPP provides an opportunity for any individual or other entity who makes a submission on the development application to present at a hearing where the application is determined.

1.2 The Applicant

Oberon Earthmoving Pty Limited was established in 2014 to provide earthmoving and civil construction services to Oberon and the surrounding region. Through the development of the Middle Creek Quarry, Oberon Earthmoving has expanded services to include rehabilitation and environmental work, materials supply and bulk earthworks with a specialty in rural forestry and shire roadworks. Materials are currently supplied to Forestry Corporation NSW, Oberon Council and other private construction companies for use as road base, drainage material, construction materials or select fill.

[1] The development was previously referred to as Middle Creek Quarries.



Legend

- Quarry Site Boundary
- Approved Extraction Area
- State Forest
- Drainage Line

FIGURE 1.1

Locality Plan and Regional Context

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

1.3 Planning Approval History

The Quarry was originally approved as a non-designated development (DA 10.2010.66.1) to supply gravel products for Council and State Forest roadwork projects. DA 10.2010.66.1 limited operations of production to 30,000 m^3 from a disturbance area of 2 hectares (ha).

A new development consent (DA 10.2016.38.1 – the development consent) was approved by the WRPP on 21 March 2018. Following legal challenge, the development consent was confirmed, with some modification to conditions, under a Notice of Orders Made of the NSW Land and Environment Court on 3 December 2018. Environment Protection Licence (EPL) 21098 was subsequently issued in accordance with the General Terms of Approval (GTAs) issued by the NSW Environment Protection Authority (EPA) supporting the development application on 4 February 2019 (refer to **Appendix 2**).

The Proposed Modification described in this report will be the first modification to DA 10.2016.38.1.

1.4 Report Structure

This SEE has been prepared with reference to Sections 4.2 and 4.15 of the EP&A Act (refer to **Section 6.5**) and comprises a main text component and supporting studies, which are included as appendices.
An overview of the layout of the main text is presented in **Table 1.1**.

Table 1.1 Statement of Environmental Effects Structure

SEE Section	Environmental Assessment Details
Section 1.0	Provides an introduction to the Proposed Modification and Applicant (Oberon Earthmoving), history of planning approvals and the assessment team.
Section 2.0	Identifies the existing approvals, describes the existing operations and identifies the activities to be modified.
Section 3.0	Describes the Proposed Modifications to approved activities.
Section 4.0	Describes how the issues to be assessed were identified and prioritised through consultation and review of the current planning context and environmental performance.
Section 5.0	Provides a comprehensive analysis and assessment of the potential environmental and community impacts of the Proposed Modification.
Section 6.0	Evaluates and summarises the key conclusions arising from the detailed environmental assessment, discusses the justification for the Modification and sets out how it is consistent with the principles of ecologically sustainable development.
Section 7.0	References.

2.0 Approved Development

2.1 Existing Approvals

In addition to DA 10. 2016.38.1, Oberon Earthmoving hold the following approvals and agreements:

- Environment Protection Licence (EPL) 21098 for the scheduled activities of composting, extractive activities, resource recovery and waste storage (as listed in Schedule 1 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act)). EPL 21098 establishes conditions relating to water and noise emissions from the site.

- Water Access Licence (WAL) for extraction of groundwater from the Lachlan Fold Belt groundwater source of the Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan. An allocation of 50 units (ML) is associated with this WAL.

2.2 Approved Activities

The existing development consent for the Quarry allows for a total extraction of no greater than 5,000,000 tonnes (t) of material over the life of the quarry, from an area of approximately 15 ha of land. The layout of the approved Quarry Site is shown in **Figure 2.1**.

Key features of the approved Quarry operations are as follows.

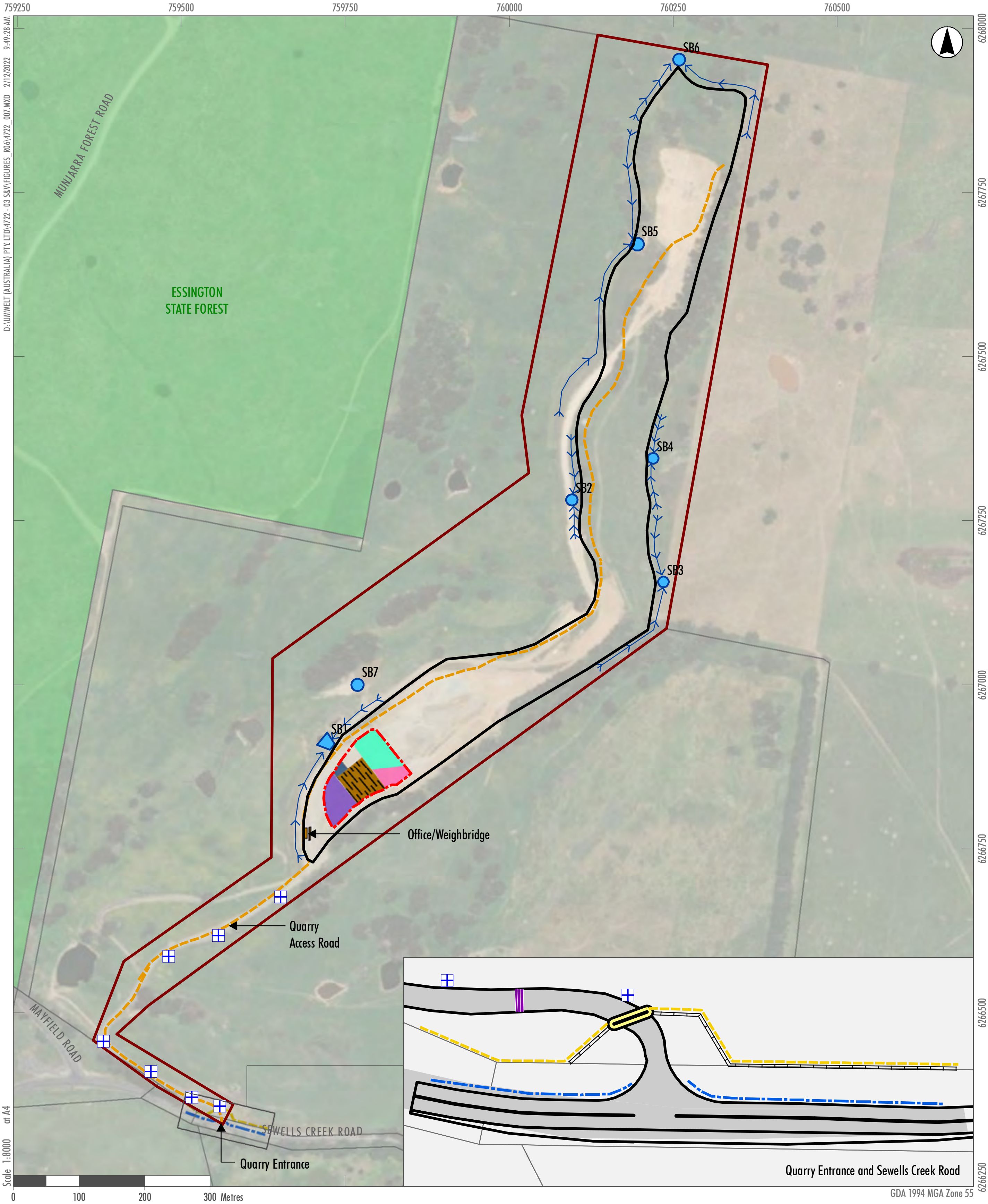
- Extraction of up to 150,000 tonnes per annum (tpa).
- Combined production of all products of up to 250,000 tpa.
- On-site crushing, screening and stockpiling of extracted material to produce a range of aggregate and crushed rock products.
- Importation of green waste and clean fill material for application to land, composting or other processing to produce composts and other specialty products.
- Rehabilitation of a final landform that will be geotechnically stable and will be suitable for a final land use of intermittent grazing, consistent with the current land use.

The following sections provide further detail on the key components of the approved activities and identify if and how these could be modified.

2.3 Resource, Product and Markets

The Quarry currently produces a range of crushed rock products for concrete manufacture, road and other infrastructure construction, land stabilisation and other development to local and regional markets. The development consent approves the importation, storage, processing (blending) and reapplication to land or sale of the following waste materials:

- Organic (green) waste up to 25,000 tpa.
- Virgin Excavated Natural Materials (VENM) up to 25,000 tpa and ENM up to 50,000 tpa.
- Treated Drilling Mud up to 60,000 tpa.



Legend

- Quarry Site Boundary
- Approved Extraction Area
- Initial Resource Recovery and Processing Area
- Office
- Weighbridge
- Collection Sump (900mm @ 1 x 10^{-9} m/s)
- Compost and Mulch Product Storage
- Windrow Composting
- Mulch Storage
- VENM, ENM and Treated Drilling Mud Storage
- Existing Roads
- Mire Drain
- Diversion Drains
- Sediment Fence
- Sediment Basin

Inset Legend

- Sediment Fence
- Table Drain
- New Fence
- Shaker Grid

FIGURE 2.1

Approved Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

Changes to the current product range including processing waste concrete and sand washing are proposed. These changes are described in **Section 3.2** and **Section 3.3**.

2.4 Extraction Operations

Extraction Area

Figure 2.1 identifies the approved limit of extraction which was designed with the criteria provided in **Table 2.1**.

Table 2.1 Design Criteria of Extraction Area

Parameter	Criteria
Area	15 ha
Elevation of Final Floor	Between approximately 1,100 m and 1,140 m AHD[1]
Operational Face Height	<15 m: friable rock (typically above 1,140 m AHD) <20 m: harder rock (typically below 1,140 m AHD)
Operational Bench Width	20 m to 100 m (longitudinal i.e. north-south)
Terminal Bench Width	3 m to 5 m (approximate)
Face Angle	70° to 75º The proposed maximum 70° to 75º face angle would be subject to further geotechnical investigation throughout the life of the Quarry to ensure a safe and stable extraction area is achieved.
Depth to resource (average)	3 m
Resource	5,000,000 tonnes

Note [1]: Australian Height Datum.

No change is proposed to the depth and area of extraction for the Quarry Site.

Extraction Method and Sequence

The extraction area is to be developed as three sequentially developed extraction cells using conventional drill and blast, load and haul methods. Extraction will initially be undertaken as an extension to the existing extraction area (Cell 1) and progress in a northerly direction. The existing north-south tree-topped ridge line will be retained to screen views of the extraction area from Sewells Creek and properties to the east of the Quarry Site.

Over the first 12 months of operation under DA 10.2016.38.1, tree planting and bund construction around the perimeter of the extraction area was undertaken in accordance with the Quarry Rehabilitation and Landscape Management Plan (RLMP). These works were completed to provide visual screens from vantage points surrounding the Quarry Site prior to commencement of disturbance.

As extraction is completed in Cell 1, access to Cell 2 at the northern end of the Quarry Site will continue. In accordance with the RLMP, extraction from Cell 2 has commenced along the most elevated (central) section of the Cell. Once developed to approximately 10 m below the surface, extraction will progress to the east and west towards the extraction area perimeter. Extraction from Cell 3 will commence upon completion of works in Cells 1 and 2. No changes to the method and sequence of extraction are proposed for the Quarry Site.

2.5 Processing and Stockpile Management

Trucks carrying woody waste, ENM and treated drilling mud are accepted by the Quarry and these materials are stockpiled within the Initial Resource Recovery and Processing Area (refer **Figure 2.1**). All stockpiles are located such that any runoff is contained within the Resource Recovery and Processing Area.

From the stockpiles, raw mulch is chipped, shredded, mulched and screened to generate the specific size and consistency required for the intended final product. The specific processes used to reduce the size of the organic material is dependent on the size of the final product. A proportion of the raw mulch is retained in stockpiles and composted.

The shredding and mulching activities noted above represent the initial composting activities. There are two phases to the compositing process:

- Pasteurisation: involves the generation of heat within the material to significantly reduce the number of viable pathogens and plant propagules.
- Maturation: sees the decline of microbial activity and an increase in biological stability of the organic material.

These two phases are managed by aerobic processes. The organic material is managed in windrows, segregated from drainage by low bund walls and turned periodically to prevent the temperature of the pile from creating a fire hazard.

From stockpiles, some ENM and treated drilling muds are screened to either remove large rocks and organic material or produce a specific size fraction. Screened rock with suitable properties is stockpiled along with extracted rock and crushed to produce gravel products. Rock unsuitable for this purpose is managed as overburden. The remaining screened material is stockpiled for sale or further blending with the Quarry gravel to generate a specific gravel/fill product.

Changes to the current Processing and Stockpile Management approach including establishment of concrete crushing, plasterboard management and a washing circuit are proposed. These changes are described in **Section 3.0**.

2.6 Waste Management

The development consent approves the importation, storage, processing (blending) and reapplication to land or sale of the following waste materials.

- Organic woody waste (mulch) up to 25,000 tpa.
- VENM and ENM up to 50,000 tpa.
- Treated Drilling Mud up to 60,000 tpa.

The following provides an overview of these waste materials (as accepted to the Quarry Site).

Organic (Green) Waste

Organic (green) waste materials are locally generated (predominantly) by local forestry, milling and wood product manufacture industries and include:

1. horticultural barks, leaf mulch and wood chip mulch produced from forestry and sawmill residues, and urban wood residues.
2. branches, tree stumps and bark that are absent of leaves, flowers, fruit and plant propagules.

While waste of this type meets the definition provided by Section 1.1 of the Mulch Order 20161, issued in accordance under Part 9 (Clause 93) of the Protection of the Environment Operations (Waste) Regulation 2014 (POEO (Waste) Reg), with application of this material to land exempt, in accordance with the Mulch Exemption 2016 issued under Part 9 (Clauses 91 and 92) of the POEO (Waste) Reg, from licensing under the POEO Act.

Notwithstanding the above, EPL 21098 held by Oberon Earthmoving includes recovery of general waste and waste storage for application to land, as well as composting of up to 50,000 tpa, as approved activities. It is proposed to increase the importation of organic (green) waste from existing sources and residential sources, from the current limit of 25,000 tpa to 45,000 tpa. Oberon Earthmoving notes there is a demonstrated need that the source of green waste could vary with waste generated by commercial landscaping, construction or similar activities from the broader Central-West region and other locations to be accepted. Storage of green waste prior to composting or application to land in accordance with the Mulch Exemption would be relocated to a new pad to be constructed to the west of Extraction Cell 1 (refer to **Section 3.4**).

Virgin Excavated Natural Material (VENM)

The POEO Act defines VENM as:

'natural material (such as clay, gravel, sand, soil or rock fines):

i. that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities; and

ii. that does not contain any sulfidic ores or soils or any other waste.

and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.'

Classification of excavated material as VENM requires certainty and certification that all aspects of the definition are met. Chemical testing may be required to ascertain whether an excavated material is contaminated with manufactured chemicals or process residues, or whether it contains sulfidic ores or soils. In order to be accepted and managed as VENM, the waste must be accompanied by a certificate from the supplier certifying the material as VENM (refer to the Quarry Waste Receival, Handling and Compost Management Plan (WRHCMP) provided by **Appendix 3**).

Where an excavated material cannot be classified as VENM, it may be eligible for reuse under the ENM order and exemption.

No change to the importation of VENM and ENM of up to 50,000 tpa is proposed for the Quarry Site.

Excavated Natural Material

The Quarry will accept earth and soil excavated from construction sites on a campaign basis. Where this material cannot be certified as VENM, it may be accepted as ENM where it can be demonstrated (and confirmed through supplier certification) to meet the definition provided by section 1.1 of the *Excavated Natural Material Order 2014* under Part 9, Clause 93 of the POEO (Waste) Reg. That is, naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

- been excavated from the ground
- contains at least 98% (by weight) natural material
- does not meet the definition of VENM (as defined in the POEO Act).

The Quarry is authorised to accept up to 50,000 t of VENM and ENM annually.

No change to the importation of VENM and ENM of up to 50,000 tpa is proposed for the Quarry Site.

Treated Drilling Mud

The Quarry is authorised to accept mud generated by hydro-excavation or other drilling activities. Prior to acceptance, the material must be dewatered such that the resultant solid meets the definition provided by Section 1.1 of the *Treated Drilling Mud Order 2014* issued in accordance under Part 9, Clause 93 of the POEO (Waste) Reg. That is, the material:

- does not have an angle of repose of less than 5° above horizontal
- does not become free-flowing at or below 60°C or when it is transported
- is generally capable of being picked up by a spade or shovel.

The Quarry is authorised to accept up to 60,000 t of treated drilling mud annually.

This Proposed Modification seeks to reduce the quantity of imported treated drilling mud from 60,000 tpa to 15,000 tpa.

Prohibited Waste Materials

The Quarry will exclude the acceptance of any waste materials not prescribed in the WRHCMP (refer to **Appendix 3**) or future versions.

Specifically, the following waste materials are prohibited from acceptance by the Quarry:

- General solid waste (putrescible), and
- engineered wood products (particleboard and fibre board).

Resource recovery activities for the Proposed Modification will include the acceptance of waste concrete and plasterboard as detailed in **Section 3.3**.

On-Site Waste Handling

All storage and processing of the imported waste materials would be undertaken within contained (bunded) areas of the extraction area. Initially, these activities would be undertaken in the available area of Cell 1, however, may be progressively moved to future completed sections of the extraction area as these areas are developed below natural surface level.

While it is the preference of Oberon Earthmoving to sell and dispatch the received waste materials (either in the form received, as a blended quarry product, or compost), should customers for these products not be identified, the waste materials would be used as engineered (back) fill or topdressing for final landforms.

VENM, ENM and treated drilling muds would either be:

- used to backfill sections of the extraction area to assist in final landform construction, or
- stockpiled prior to reprocessing and dispatch as select fill or blended quarry gravel product.

Mulch would either be:

- applied to lands of the Quarry Site in accordance with the Resource Recovery Exemption,
- stored for reprocessing and dispatch, or
- composted.

The only change to on-site waste management is associated with the proposed relocation of composting activities and acceptance of a wider range of green waste material.

2.7 Composting (Woody Waste)

DA 10.2016.38.1 approves the composting (by aerobic process) of the organic woody waste imported to the Quarry Site. The windrow composting method will be implemented at the Quarry. This aerobic method allows for natural ventilation of the windrow ('chimney effect') to provide air into the material to keep it aerobic at all times.

To promote aerobic conditions, the composting materials will be regularly turned (after sufficient time is allowed for pasteurisation to commence, i.e. internal temperature of 55°C achieved for 3 consecutive days).

Composting may be relocated over the life of the Quarry, however, the arrangement of the composting activities, and implementation of controls, will be consistent regardless of location within the Quarry Site. **Figure 2.1** presents the approved layout of composting operations, with the management within the relevant areas discussed in the appended Quarry WRHCMP (refer to **Appendix 3**).

No change to the composting process is proposed for the Quarry Site.

A relocation of these activities is proposed along with a broadening of the type of green waste accepted, to include general green waste generated by commercial landscaping or similar activities, for composting (refer to **Section 3.4**).

2.8 Site Access and Transportation

Access to the Quarry is via Sewells Creek Road, which intersects with Abercrombie Road to the east and Mayfield Road to the west. Transport operations via Mayfield Road are prohibited unless delivering to addresses on Mayfield Road.

The Quarry is approved to transport up to 250,000 tonnes annually of combined products. Daily truck movements are limited to 50 truckloads/100 movements per weekday and 30 truckloads/60 movements per Saturday.

An increase in the number of truck movements is included in the Proposed Modification, as detailed in **Section 3.5**.

2.9 Site Infrastructure and Equipment

There is one demountable building on the Quarry Site that provides an office and site personnel facilities (including washroom and toilet). A weighbridge is located on the Quarry Site (refer to **Figure 2.1**).

The Quarry Site is approved for the operation of the following equipment:

- 1 x 475 hp Bulldozer
- 1 x 30 t Excavator
- 1 x 40 t Dump Truck
- 2 x 18 t Front-end Loaders
- 1 x IC13 Mobile Impact Crusher
- 1 x Mobile Screen Water Truck
- fixed 16 m trommel screen plant
- 32 x 32 fan-controlled concrete composting tunnels (concrete tilt panel).

The addition of a sand washing unit, relocation of the mobile crushing unit and composting areas is included in the Proposed Modification as detailed in **Section 3.2**, **Section 3.3** and **Section 3.4**.

2.10 Operating Hours and Workforce

The Quarry is approved for the following hours of operation:

- Monday–Friday: 7:00 am to 6:00 pm.
- Saturday: 8:00 am to 2:00 pm.
- Sunday & Public Holidays: No work permitted.

The Quarry Site has a current workforce of 2 to 3 people, and up to 5 people during peak production periods.

No change is proposed to the hours of operation or the workforce for the Quarry Site.

2.11 Rehabilitation and Landscape Management

2.11.1 Rehabilitation and Landscape Management Plan

Rehabilitation activities for the Quarry are guided by the approved Rehabilitation and Landscape Management Plan (RLMP) (refer to **Appendix 4**). The aims and objectives of rehabilitation for the Quarry are as follows.

2.11.2 Decommissioning and Landform Establishment

- To remove all processing related infrastructure not required for the ongoing use of the Quarry.
- To stabilise all disturbed areas and minimise erosion and dust generation.
- To provide a geotechnically stable, safe and non-polluting landform which provides land suitable for the final land use of grazing and agriculture.

Growth Media Development

- To provide for soil management over the life of the Quarry which addresses the constraints related to stripping, storage and replacement on the final landform.
- To achieve a soil profile capable of sustaining the specified final land use.
- To provide for surface micro-habitats such as fallen timber, surface rocks or other features which will encourage colonisation by native flora and fauna.

2.11.3 Revegetation

- To establish native grass, shrub and tree species comparable with the existing vegetation communities in the area. Particular emphasis will be placed on the use of endemic species associated with eucalypt woodland communities.
- To return all disturbed areas to a final land use of grazing and agriculture, and enhancing and maintaining the woodland vegetation within and surrounding the final Quarry landform.

No change is proposed to the current objectives and approach to rehabilitation of the Quarry.

2.11.4 Rehabilitation Methods

The methods to be used to rehabilitate the areas disturbed by quarrying operations are summarised as follows.

2.11.4.1 Infrastructure Decommissioning and Removal

At the completion of extraction and processing activities, Oberon Earthmoving will either sell or scrap processing infrastructure within the Quarry. This will include removal of the following.

- All processing infrastructure, including ancillary equipment.
- All buildings, including the office, crib room, ablutions, and workshop.
- Internal access roads.

The Quarry entrance and Access Road will be retained for ongoing property access. The majority of sediment basins established to prevent the discharge of dirty water from the Quarry will be retained for water storage on the property.

The areas of the Quarry surrounding hydrocarbon storage areas will be inspected for hydrocarbon contamination. In the event contamination is identified, the area will be segregated, the contaminated material excavated and transferred to a facility licensed to accept hydrocarbon contaminated material.

All concrete footings and foundations of buildings or structures will be broken up and removed or covered. The materials used to form roads and hardstands will be removed and/or the areas ripped.

2.11.4.2 Landform Establishment

As very little overburden will be produced over the life of the Quarry, landform establishment will primarily involve the following:

Extraction Area

Prior to extraction from the terminal faces of the extraction area, a geotechnical review will be completed to confirm the slope that will provide for a safe and stable landform.

Processing and Stockpiling Area/Quarry Infrastructure and Services Area

Following the removal of all infrastructure and product stockpiles, the surface of these areas will be ripped to break-up the compacted hardstand surface.

Any available overburden stockpiled over the life of the Quarry will be transferred and placed against the cut slope of these areas. The landform will then be profiled to approximate the pre-proposal landform. The profiled landform will then be lightly ripped again or scarified in preparation for the application of growth media.

2.11.4.3 Growth Media Development

The depth of the growth medium on the final landform will be dependent on the amount of growth medium salvaged and will be representative of the surrounding area.

2.11.4.4 Revegetation

Given the final land use would be predominantly agricultural, agriculture pasture species would be used over the flatter extraction area floor landform. An example of the type and rate of seeding is presented in **Table 2.2**.

Table 2.2 Seed Mix for Revegetation

Species	Application Rate
Microlaena (Weeping grass), *Microlanea stipodes*	1 kg/ha
Phalaris, *Phalaris aquatica*	2 kg/ha
Fescue, *Festuca arundinacea*	3 kg/ha
Rye Grass, *Lolium rigidum*	1 kg/ha
Cocksfoot, *Dactylis glomerata*	1 kg/ha
White Clover, *Trifolium repens*	3 kg/ha

Seed of native tree and shrub species would also be applied to the final benches and selected areas of the quarry floor to improve the visual amenity of the final landform. Species would be chosen based on provenance, speed of establishment and localised conditions.

Noxious weeds would be managed and where possible eradicated. Targeted weed spraying would be undertaken following germination of noxious weeds.

No change is proposed to the methods of rehabilitation.

2.11.5 Final Landform and Land Use

Sections of the Quarry no longer required for operational purposes will be decommissioned and rehabilitated to produce a final landform which incorporates the following.

- Retained voids. These areas would be stabilised, with soil applied to retained benches and revegetated using native and introduced pasture, tree and shrub species. Where the final face is not stable, restoration blasts would be initiated to reduce the final slope.

- On revegetation of the extraction area, any sediment basins would be retained as dams for future property management purposes with the final landform profiled such that the majority of runoff flows towards these. Water within these dams not used for agricultural purposes would either infiltrate to groundwater or evaporate.

The final land use will be consistent with the existing land use, namely grazing and agriculture.

The indicative final landform is shown in **Figure 2.2**.

There is no change proposed to the final void for the Quarry Site. A change to the proposed final landform to include an additional area of disturbance is required and this is described in **Section 3.7**.

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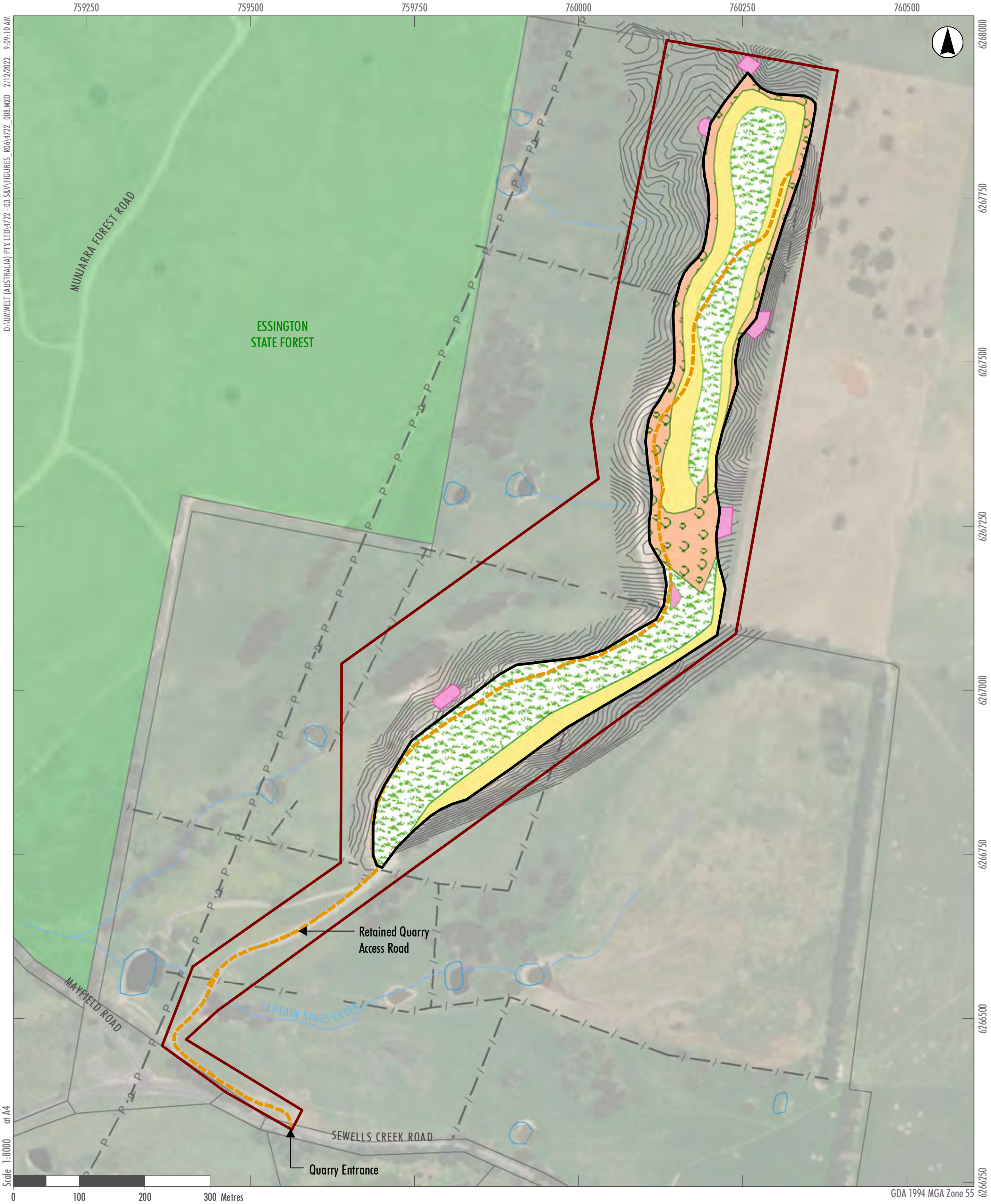


Legend

- Quarry Site Boundary
- Approved Extraction Area
- Existing Roads
- Open Woodland (10 - 30°)
- Pasture/Grassland (<10°)
- Retained Sediment Basin
- Steep Face (>30°)

FIGURE 2.2

Existing Conceptual Final Landform

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

3.0 Proposed Modification

3.1 Summary

Oberon Earthmoving has identified several constraining conditions associated with the development consent and several opportunities for the addition of ancillary development activities. Oberon Earthmoving is seeking to modify the development consent to allow for the following:

- Inclusion of a washing circuit for the preparation of washed sand and aggregate products.
- Extended resource recovery limits and activities including waste concrete importation and crushing for sale.
- The construction of a new pad for the relocation of composting operations and supplementary stockpiling.
- An increased maximum annual production level (to account for the additional resource recovery and processing operations proposed).
- An increase in the number of allowable daily truck movements.

Table 3.1 provides a comparative analysis of the Proposed Modification against the current approved Quarry operations.

Table 3.1 Comparison of Approved Quarry and Proposed Modification

Element	Approved	Proposed	Section
Extraction Method	Drill and blast	No change	N/A
Extraction Area	As identified on **Figure 2.1**	No change	N/A
Extraction Design Features	Refer to **Section 2.4**	No change	N/A
Extraction Rate	Up to 150,000 tpa	Up to 200,000 tpa (increase of 33%)	**3.6**
Overburden Management	Sale as select fill Void backfill (rehabilitation)	No change	N/A
Resource Recovery	Importation of VENM, ENM, Treated Drilling Muds for land application or processing and sale	Importation of waste concrete for crushing and sale Importation of plasterboard under Resource Recovery Exemption	**3.3**
	Importation of organic (green) waste with a limit of 25,000 tpa. Importation of treated drilling mud with a limit of 60,000 tpa.	Up to 45,000 tpa (increase of 80%) Up to 15,000 tpa (decrease of 75%)	**3.4**
Composting	Aerobic windrow composting of mulch within the completed extraction area	No change	N/A

Element	Approved	Proposed	Section
Processing Operations	Campaign crushing and screening	Addition of a washing circuit	**3.2**
Production Rate	Up to 250,000 tpa	Up to 315,000 tpa (increase of 26%)	**3.6**
Transport Operations	Maximum of 100 truck movements per day (Monday to Friday) Maximum 60 truck movements per day (Saturday)	Maximum of 180 truck movements per day (Monday to Friday) Maximum 90 truck movements per day (Saturday)	**3.5**
Rehabilitation and Final Landform	Retained void with stable final slopes	No change to residual voids	**3.7**
Hours of Operation	• Monday–Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 2.00 pm • Sunday & Public Holidays: No work.	No change	N/A

The following sections provide the specific details of these modifications in sufficient detail to allow for the assessment of environmental impact (refer to **Section 5.0**). See **Figure 3.1** for the modified Quarry Site layout.

3.2 Washing Circuit

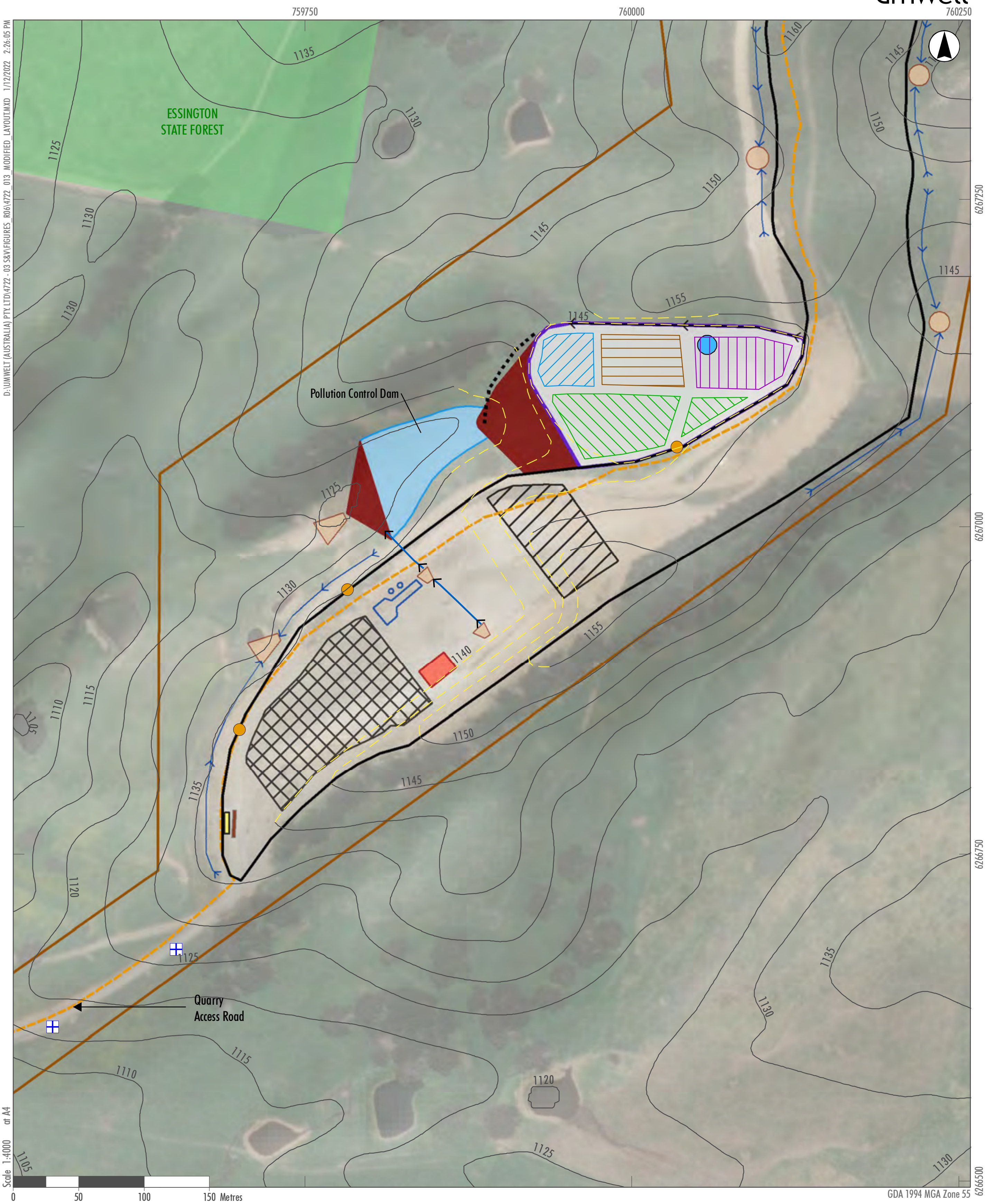
To satisfy local demand for washed sand and gravel products, it is proposed to establish a wash plant on the Quarry Site. The washing circuit will include the following elements:

- A loading hopper which would feed a vibrating wet screen and rotating/log washer.
- A second (multi-deck) screen, with water sprays would be used to remove additional clays and silts, and to separate the washed materials into sizes. Washed aggregates would be separated into sizes for sale at this point.
- Fine aggregates / sand would be delivered to a mixing tank. Pebbles would subsequently be delivered by conveyor to stockpile, while the sand and clay would be delivered via belt feeder to a mixing tank where the heavier materials (aggregates and sand) would move to the bottom of the tank and the silt containing water would be drawn off the top.
- The silt containing water would be pumped to one or more settlement cells to allow for the silts and clays to settle out with the water returned to the washing circuit.

Water would be periodically drawn off the settlement cells and returned to the washing circuit. The consolidated silts removed from the sand and aggregate / pebble would be dried and used as a backfill material in the preparation of the final landform.

Initially the washing circuit is likely to be located within the completed Extraction Area of Cell 1 which would be below natural surface level and allow for control and recycling of water used (see **Figure 3.1**). As Cell 2 of the Quarry continues to be developed, the washing circuit may be relocated to a completed section of this cell to be closer to the primary source of crushed aggregate/sand.

umwelt



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Legend

- Quarry Site Boundary
- Approved Extraction Area
- Batter Slope
- Composting Area
- Crushing Unit
- Office
- Pollution Control Dam
- Sediment Basin
- VENM, ENM and Treated Drilling Mud Storage
- Wash Plant
- Weighbridge
- Quarry Sales Product Stockpiles
- Access Roads
- Mire Drain
- Spillway
- Dirty (sediment) Water Drain
- Contaminated Water Drain
- Gravity Pipe
- Access Points
- Contours
- Modified Contours
- Collection Sump
- Compost and Mulch Products
- Mulch Storage
- Windrow Composting
- Water Tank 2.7ML

FIGURE 3.1

Modified Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

The proposed washing circuit would consume between 150 and 250 kL of water per hour to produce between 100 and 150 t of sand or gravel. Feedback from the proposed wash plant supplier indicates that between 80 to 85% of the water requirement could be recycled (losses of up to 5% as retained moisture content of the product, and 10 to 15% from evaporation of seepage from water storages, stockpiles and hardstand surfaces). The proposed source of additional water requirements is discussed further in **Section 5.5.5.1** but will come from a combination of additional on-site water storage capacity for high rainfall events and extraction of groundwater under licence (refer to **Section 2.1**).

Washing operations would be undertaken on a campaign basis and restricted to the daytime hours of 7:00 am to 6:00 pm. Washing may cease temporarily for periods when stockpiles of product reach (approximately) 10,000 t, with material drawn from stockpiles until these are reduce to (approximately) 5,000 t, at which time washing would recommence.

The amount of washed product produced on an annual basis will vary based on local project requirements, however, it is considered that up to 50,000 t of washed product could be produced each year.

3.3 Waste Concrete and Plasterboard Importation and Crushing Activities

Oberon Earthmoving has been approached by third parties regarding the potential to accept and crush waste concrete and plasterboard. While currently not approved, the Quarry presents an ideal site for these activities being already disturbed with hardstand stockpiling areas available, already associated with industrial noise sources, relatively isolated from sensitive receivers, but also close to Oberon.

Waste Concrete

While dependent on markets and supply of waste concrete, it is anticipated that up to 35,000 tpa to 45,000 tpa could be available and imported to the Quarry, sourced from builders, civil contractors and Council. A maximum 15,000 t of waste concrete would be stockpiled on the Quarry Site at any one time, with crushing undertaken on a campaign basis once sufficient volumes are available. In accordance with approved crushing operations for the extracted gravels, the concrete would be loaded to a mobile crushing unit to reduce the size and either separate into specific sizes or produce graded products. A secondary impact crusher and screen may be operated as well depending on size and grading requirements. The capacity of the mobile crushing unit would provide for production at a rate of approximately 150 t to 250 t per hour depending on grade and size.

Imported waste concrete would be stored in the Imported Materials Stockpile Area located at the southern end of the Quarry (refer to **Figure 3.1**). Initially, the mobile crusher unit would be located within the Previous Compost Area (refer to **Figure 2.1**), however, as Cell 2 continues to be developed, it may be relocated to a completed section of this cell to be closer to the primary source of extracted rock which will remain the main source of the crusher feed.

Any oversize material would be retained within separate stockpiles for environmental works on the Quarry Site, e.g. drainage line stabilisation, or sold for similar purposes. Any scalps generated by the crushing and screening would be treated as overburden and sold as select fill.

Plasterboard

Again dependent on markets and supply, it is anticipated up to 10,000 tpa of plasterboard (as defined by the recovered plasterboard order 2014 issued under Part 9, Clause 93 of the POEO (Waste) Reg) (refer to **Appendix 6**) could be available and imported to the Quarry, sourced from builders, civil contractors and Council. A maximum 2,000 t of plasterboard would be stockpiled on the Quarry Site at any one time, with crushing undertaken on a campaign basis once sufficient volumes are available.

The plasterboard would be crushed for application to land owned by the Application as a soil ameliorant in accordance with the recovered plasterboard exemption 2014 issued under Part 9, Clauses 91 and 92 of the (Waste) Reg) (refer to **Appendix 6**).

Crushing

Crushing operations would be undertaken on a campaign basis and restricted to the day-time hours of 7:00 am to 6:00 pm. Crushing may cease temporarily for periods when stockpiles of crushed product reach (approximately) 10,000 t, with material drawn from stockpiles until these are reduced to (approximately) 5,000 t, at which time crushing would recommence.

3.4 Modified Composting Activities

While no change to the composting process is proposed, the source of green waste accepted for composting would be extended to included green waste from additional sources such as commercial and horticultural landscaping projects. Notably, the existing procedures for documentation, inspection and management of these materials as contained in the Quarry WRHCMP (refer to **Appendix 4**).

It is also proposed to alter the annual quantity of imported green waste and imported treated drilling mud. The Proposed Modification seeks to increase green waste limits from existing sources and residential sources from the current limit of 25,000 tpa to 45,000 tpa, and decrease imported drilling mud from 60,000 tpa to 15,000 tpa. With the inclusion of sand washing and additional crushing activities on the Quarry Site, it is proposed to relocate the approved composting activities from the completed extraction area where sand washing and concrete crushing are now proposed to be located.

A new pad and hardstand would be constructed to the immediate west of Cell 1 by filling the upper section of a gully with material quarried from the extraction area. The new pad (as identified on **Figure 3.1**) would be approximately 1.4 ha in area, with 1.0 ha constructed as a flat surface at an elevation of approximately 1,145 m AHD and 0.4 ha being the batter slope at an angle of approximately 18^{o} to the gully below at an elevation of approximately 1,132 m AHD.

Immediately, downslope of the constructed batter slope, a water storage dam would be constructed with a dam crest of between 1,130 and 1,132 m AHD. This dam, identified as the Pollution Control Dam (PCD), would serve the following functions.

1. For the storage of water which accumulates within the completed extraction area under high rainfall.
2. For the collection of water diverted from upslope of the new pad, and delivered to the PCD via a rock-lined spillway.
3. As a secondary control for water contained and stored on the relocated composting area.

The layout of the proposed composting operations would replicate that of the approved composting operations, currently approved for within the completed Cell 1 of the Extraction Area. **Figure 3.2** provides the conceptual arrangement of the composting operations on the new pad, which would also be available as a supplementary storage area of quarried material, imported waste and final products.

During construction of the new pad and PCD, a sediment basin will be constructed and maintained further downslope (refer to **Figure 3.1**). The specifications of this sediment basin (SB7) are provided in **Section 5.5.4.2** (**Table 5.18**) and **Appendix 15**.

3.5 Modified Transport Operations

To account for the additional material to be imported to the Quarry Site, as well as in recognition of the limiting nature of Condition 3 of the development consent, Oberon Earthmoving is seeking an increase in the allowable number of trucks movements as follows:

- From 100 truck movements per day to 180 movements per day (Monday to Friday).
- From 60 truck movements per day to 90 movements per day (Saturday).

Oberon Earthmoving does not propose any additional modifications to the limitations imposed by Condition 3 of a Transport Code of Conduct (required by Condition 4 of the development consent).

Double B trucks (26 m) would be the maximum size of vehicles used for Quarry transport operations.

3.6 Increased Extraction and Production Rate

Oberon Earthmoving is seeking to add the washing circuit (refer to **Section 3.2**) and increase the annual extraction limit by 33% (from 150,000 to 200,000 tpa) in order to fulfill the growth potential of the local and regional extractive markets.

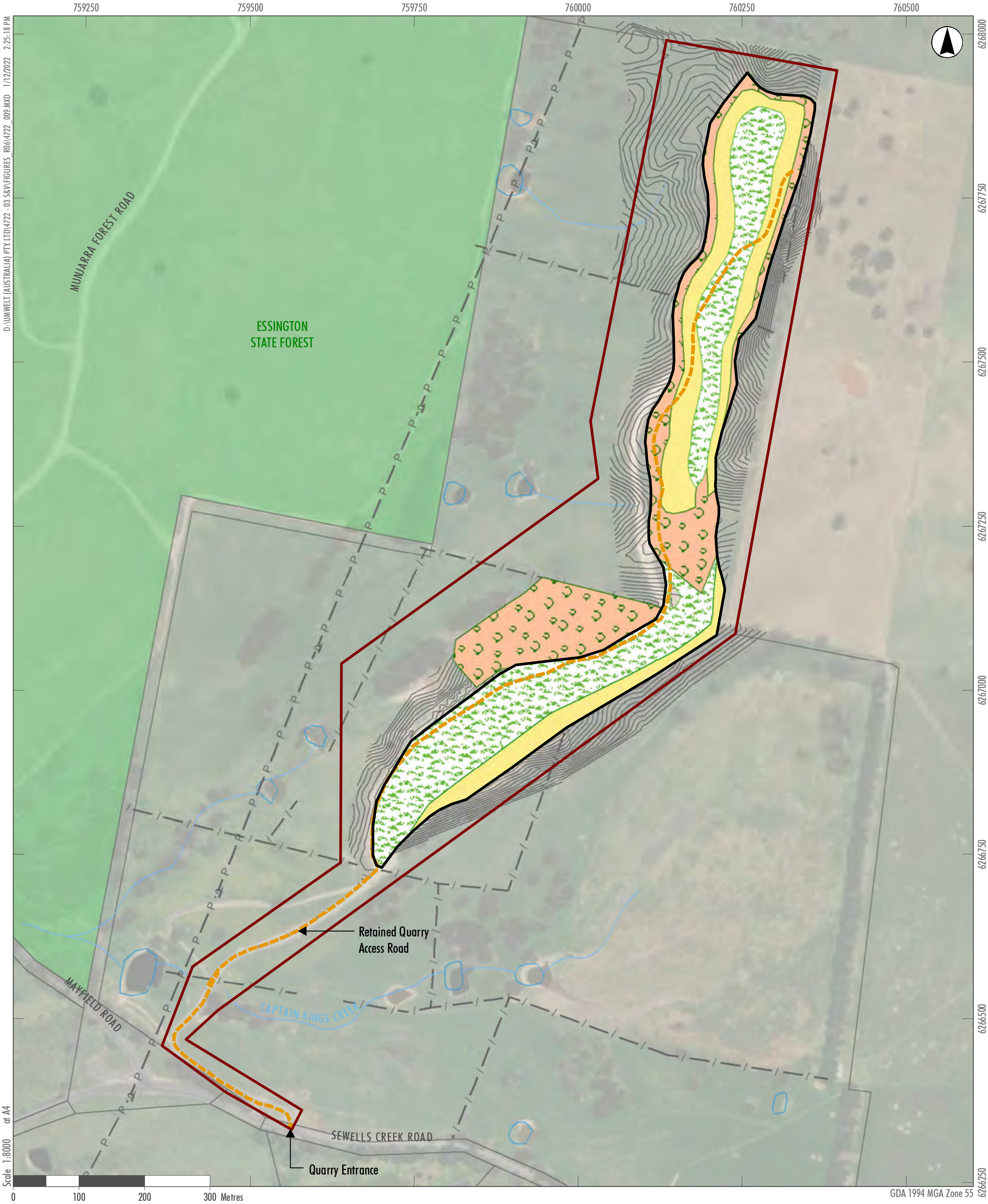
Oberon Earthmoving is also seeking a 26% increase in production limit, from 250,000 tpa to 315,000 tpa to account for the proposed additional materials to be imported and processed on the site.

The increase in extraction and production would not require any additional equipment (mobile or fixed) other than the proposed new washing circuit (refer **Section 3.2**). The proposed increases in extraction and production would be possible simply by operating for more days annually (within the approved hours of operation).

3.7 Final Landform and Rehabilitation

A minor modification to the final landform is required to integrate the relocated composting area into the top of the tributary of Captain Kings Creek. The modified conceptual final landform is shown in **Figure 3.2**. The area proposed to be disturbed due to relocation of the composting area will be rehabilitated to open woodland comparable with the surrounding vegetation.

No changes are proposed to the methods of rehabilitation for the Proposed Modification.



Legend
- Quarry Site Boundary
- Approved Extraction Area
- Existing Roads
- Open Woodland (10 - 30°)
- Pasture/Grassland (<10°)
- Steep Face (>30°)

FIGURE 3.2

Modified Conceptual Final Landform

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

3.8 Alternatives Considered

In assessing the feasibility of the Proposed Modification, Oberon Earthmoving considered a number of alternatives to the proposed development. These included:

- Modification to composting arrangements to include additional organic materials, e.g. Food Organics and Garden Organics (FOGO), manure.
- It was identified that this would require additional buildings and infrastructure to ensure impacts associated with potential odour, air and water pollution could be managed. The decision was subsequently made to provide for the relocation of composting operations first (this modification) and potentially make a future application to extend the composting operations once the area is established and funding for the additional infrastructure obtained. This approach allows the Application to demonstrate the suitability of the new composting area before applying to expand these operations.
- Do nothing.

The alternative of not proceeding with the Proposed Modification has also been considered, however, this option is not considered appropriate as it is predicted that the environmental and social impacts of the modification can be effectively managed and minimised through appropriate environmental controls.

4.0 Issue Identification and Prioritisation

4.1 Issue Identification

4.1.1 Approach

In order to undertake a comprehensive assessment of the environmental impacts arising from the Proposed Modification, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the local and broader community. To ensure this has occurred, the following has been undertaken to identify relevant environmental issues for assessment:

- a program of community and government agency consultation
- a review of environmental planning documentation
- a review of environmental performance.

4.1.2 Stakeholder Consultation

4.1.2.1 Community Consultation

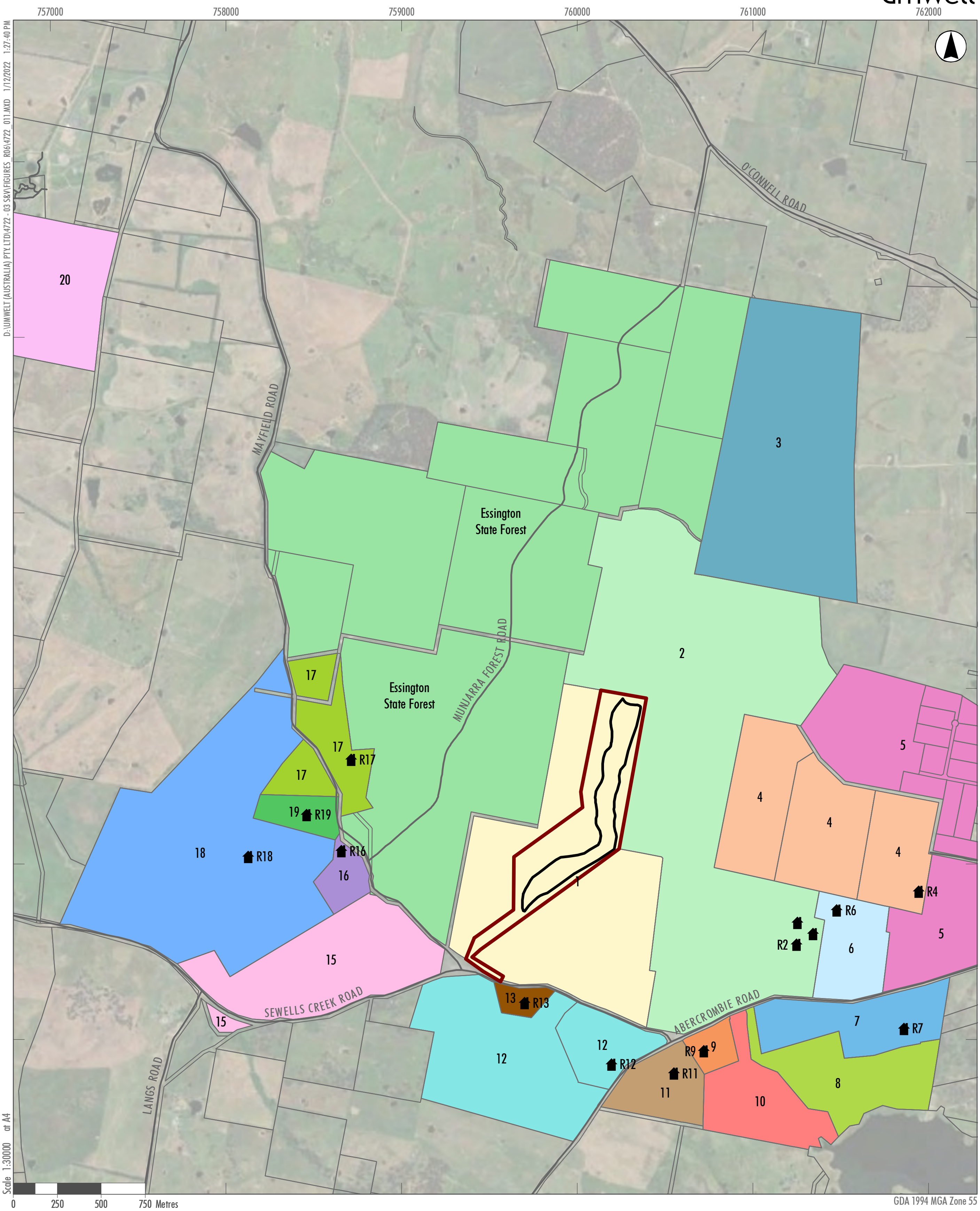
Oberon Earthmoving prepared a community information sheet, containing key details on the Proposed Modification and an invitation to identify key issues of concern, for distribution to landowners surrounding the Quarry as well as key stakeholders on Sewells Creek Road and Mayfield Road. A copy of the community information sheet, which was delivered to the properties identified on **Figure 4.1** on 14 August 2020, is provided as **Appendix 7**. No correspondence was received by Oberon Earthmoving, either in written or verbal form, in response to this notification.

It is noted that the consultation was undertaken on 14 August 2020, however, Oberon Earthmoving is not aware of any changes in land ownership and is confident the lack of response, coupled with an absence of complaints against Quarry operations, demonstrates no significant concerns or objections of local landowners and residents to the current or proposed modified Quarry operations.

4.1.2.2 Government Agency and Public Authority Consultation

Council Consultation

Prior to the written notification and invitation to provide feedback, Oberon Earthmoving invited representatives of Oberon Shire Council to a meeting at the Quarry to review current operations and discuss a Proposed Modification. In December 2019, Mr Dylan Furnell and Mr Shane Wilson of Council, Mr Andrew Helms of the NSW EPA, Mr Zac Rowlandson of Oberon Earthmoving and Mr Alex Irwin of Umwelt, completed an inspection of the Quarry Site. Mr Rowlandson presented background to, and preliminary information on the Proposed Modification, including the additional processing components and planned increase in the disturbance footprint to extend areas available for processing and composting.



Legend

- Quarry Site Boundary
- Approved Extraction Area
- Residence Location

CIS Disturbance Private Land

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, Essington State Forest

FIGURE 4.1

Notification Area and Residential Receivers

The Council and EPA representatives present did not identify any significant concerns with the overall plans, however, requested further information on which to provide advice on environmental assessment requirements. At the meeting Mr Wilson indicated his tenure at Council was to be completed with Mr Furnell to take on planning assessment responsibilities.

Request for Environmental Assessment Requirements

An initial notification letter including an overview and preliminary environmental assessment of the Proposed Modification was sent to Council and the following government agencies in July 2020.

- Oberon Council.
- Natural Resources Assessment Regulator (NRAR).
- NSW Environment Protection Authority (EPA).
- Biodiversity and Conservation Division (BCD), now the Environment & Heritage Group, within the Department of Planning and Environment[2].

As the Proposed Modification was delayed due to the unforeseen impacts associated with COVID-19, follow-up notification letters were sent to the above government agencies in September and October 2021. A copy of the follow-up letters to the Council, NRAR, DPA and BCD which included an invitation to provide assessment requirements for the Proposed Modification.

A consultation log and records of responses and assessment requirements provided by Oberon Council and government agencies is included as **Appendix 8**.

4.1.3 Planning and Legislative Context

4.1.3.1 Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the primary environmental and planning regulatory instrument relevant to the Modification at a Commonwealth level.

Under the EPBC Act, approval by the Commonwealth Minister for the Environment, is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage properties.
- National Heritage Places.
- Wetlands of international importance (Ramsar wetlands).
- Migratory species, threatened species, critical habitats or ecological communities listed in the EPBC Act.
- Commonwealth land, marine areas or reserves.
- Nuclear actions.
- A water resource in relation to coal seam gas development and large coal mining development.

2 At the time of consultation, BCD was a division of the Environment, Energy and Science Group with the Department of Planning, Industry and Environment (DPIE).

The Modification does not interact with any Commonwealth land, Commonwealth marine areas, the Great Barrier Reef Marine Park and is not a nuclear action, coal seam gas development or large coal mining development.

4.1.3.2 State Legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act is the primary legislation governing environmental planning and assessment for NSW. The objectives of the EP&A Act relevant to the Proposed Modification encourage:

- the proper management, development and conservation of natural and artificial resources
- the promotion and co-ordination of the orderly and economic use and development of land
- the protection of the environment
- ecologically sustainable development.

D2016-482 was originally granted under Division 4.3 of the EP&A Act on 5 July 2017 and is classified as Designated Development. On the basis that the development as modified remains substantially the same to the development for which consent was originally granted, D2016-482 may be modified under Section 4.56 of the EP&A Act.

On review of the Proposed Modification, it is noted that no additional development type or activity is proposed. The Quarry would continue to be operated as an extractive industry (basalt quarry), with no increase in disturbance footprint or introduction of new methods proposed. While the parameters of the extraction area are proposed to be modified, the size of the resource which is the subject of the development consent would remain unchanged. With respect to the intensity of operations, there are differences between the development as originally approved and the Proposed Modification. The rate of extraction and production is proposed to increase, as is the maximum number of daily and annual truck movements. However, these increases in the intensity of operations are to be balanced by the implementation of operational and environmental controls aimed at minimising any additional impacts associated with the Proposed Modification. On the basis that the environmental impacts of the Quarry, as modified, remain similar to those of the approved Quarry and comply with relevant environmental criteria, these modifications would not impact on 'material and essential' elements of the current development.

On the basis of there being no additional activities proposed, with increases to extraction, production and transportation limits managed to minimise impacts, it is concluded that the modified development will be substantially the same as the current operations, as last modified, for the purpose of Section 4.56 of the EP&A Act.

This SEE has been prepared in consideration of the factors identified in Section 4.56 of the EP&A Act and clause 115 of the EP&A Regulation. Section 5.0 includes an assessment of relevant environmental impacts associated with the Proposed Modification to determine the level of assessment completed to support the SEE. This has been completed to satisfy the relevant requirements of Section 4.15 of the EP&A Act.

Other State Legislation

A summary of the NSW legislation potentially applicable to the Modification is included in **Table 4.1**, along with an indication of which additional approvals will be required.

Table 4.1 Summary of Other Potentially Relevant State Legislation

Act	Comments	Approval Required
Protection of the Environment Operations Act 1997	Oberon Earthmoving currently holds an Environment Protection Licence (EPL 21098) for the scheduled activities of: • Composting • Extractive activities • Resource recovery • Waste storage. An update to EPL 21098 will be required to include Crushing, Grinding or Separating.	Yes
National Parks & Wildlife Act 1974	In accordance with Section 4.41 of the EP&A Act an Aboriginal Heritage Impact Permits (AHIPs) is not required under Section 90 of the *National Parks & Wildlife Act 1974* for Aboriginal sites proposed to be impacted by development where authorisation is provided by the development consent. No Aboriginal sites would be disturbed by the Proposed Modification.	No
Water Management Act 2000	All water extraction from water sources (surface and groundwater) regulated by a Water Sharing Plan will require licensing under the *Water Management Act 2000* (WM Act) where they are in addition to extractions permitted under harvestable rights. The Proposed Modification is located within the following Water Sharing Plans: • Macquarie Bogan Unregulated and Alluvial Water Sources 2012. • Murray Darling Basin Fractured Rock Groundwater Sources 2011. The Proponent holds a Water Access Licence for extraction of groundwater. No additional approvals are proposed or required under the WM Act.	No
Mining Act 1992	A mining lease under this Act is not required as no prescribed mineral under Schedule 2 of the Mining Regulation 2016 will be extracted and therefore no approval is required.	No
Biodiversity Conservation Act 2017	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act and therefore no approvals are required.	No
Heritage Act 1912	No heritage sites will be affected and no s140 or s60 excavation permits are required under this Act for works associated with the Proposed Modification.	No
Roads Act 1993	Under Section 138 of the *Roads Act 1993*, approval is required from the road authority for works to be undertaken within a road reserve. No additional road works are required as a result of the Proposed Modification.	No
Local land Services Act 2013	The provisions of this Act do not apply to any activity undertaken in accordance with a development application granted for designated development under the EP&A Act and therefore do not apply to the Proposed Modification.	No

Act	Comments	Approval Required
Environmentally Hazardous Chemicals Act 1985	Under the *Environmentally Hazardous Chemicals Act 1985* a licence is required for any storage, transport or use of prescribed chemicals. Oberon Earthmoving does not propose to store, transport or use any chemicals currently subject to a Chemical Control Order under this Act.	No

4.1.3.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments created by the State government. The SEPPs that are potentially relevant to the Modification are discussed in the following section.

State Environmental Planning Policy (Planning Systems) 2021

Since 1 March 2022, State Environmental Planning Policy (Planning Systems) 2021 (Planning SEPP) replaced SEPP (State and Regional Development) 2011, SEPP (Aboriginal Land) 2019, and SEPP (Concurrences and Consents) 2018. 'Chapter 2 – State and regional development' contains planning provisions from the State and Regional Development SEPP and identifies state or regionally significant development, state-significant infrastructure, and critical state-significant infrastructure.

The Proposed Modification makes no change to the development with respect to type and scale, remaining designated development. As designated development for the purpose of extractive industry, the Quarry is also classed as Regional Development and the Proposed Modification will be determined by a Regional Planning Panel of the Planning Panels Secretariat of the DPE.

State Environmental Planning Policy (Transport and Infrastructure) 2021

Since 1 March 2022, the State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) regulates the permissibility and assessment requirements for key infrastructure and service facilities across the State. The T&I SEPP provides specific development controls for specific infrastructure or infrastructure supporting development or facilities to ensure a consistent and sustainable approach to infrastructure and service facilities across NSW.

While no specific development controls are nominated for extractive industries under Part 2.3 of the T&I SEPP, Schedule 3 requires a consent authority to inform and take into consideration any issues raised by TfNSW for any developments listed in Schedule 3 of the SEPP. The consent authority is also required to consider any accessibility, road safety, parking and transport efficiency issues caused by the development.

Under Schedule 3 of the T&I SEPP, industrial development greater than 20,000 m^2 in area with access to any road requires referral to TfNSW. The Quarry is located on a site >20,000 m^2 with access to the site from a classified road, therefore it is expected the Proposed Modification will be referred to TfNSW in accordance with the T&I SEPP.

State Environmental Planning Policy (Resources and Energy) 2021

The Resources and Energy SEPP regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. The SEPP outlines where various activities are permissible both with and without development consent. The SEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments.

Table 4.2 presents a summary of the matters that the Minister or his/her delegate needs to consider when assessing a new or modified Proposed Modification (Part 2.3 – Clauses 2.16 to 2.23).

Table 4.2 Application of the Extractive Industries SEPP

Clause	Description
2.16 Non-discretionary development standards for mining	The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with).
	The matters set out in this clause are identified as non-discretionary development standards for the purposes of Section 4.15 (2) and (3) of the Act in relation to the carrying out of development for the purposes of mining. Note: The development standards do not prevent a consent authority from imposing conditions to regulate project-related noise, air quality, blasting or ground vibration impacts that are not the subject of the development standards.
	Cumulative noise level. The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with *Table 2.2* of the Noise Policy for Industry, for residences that are private dwellings.
	Cumulative air quality level. The development does not result in a cumulative annual average level greater than 25 µg/m^3 of PM_{10} or 8 µg/m^3 of $PM_{2.5}$ for private dwellings.
	Airblast overpressure. Airblast overpressure caused by the development does not exceed: • 120 dB (Lin Peak) at any time, and • 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.
	Ground vibration. Ground vibration caused by the development does not exceed: • 10 mm/sec (peak particle velocity) at any time, and • 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

Clause	Description
	Aquifer interference. Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of *Table 1* of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table. Note: The taking of water from all water sources must be authorised by way of licences or exemptions under the relevant water legislation.
2.17 Compatibility with other land uses	Consider: • the existing uses and approved uses of land in the vicinity of the development; • the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and • any ways in which the development may be incompatible with any of those existing, approved or preferred land uses. Evaluate and compare the respective public benefits of the development and the above land uses. Evaluate any measures proposed by the applicant to avoid or minimise any incompatibility.
2.18 Consideration of voluntary land acquisition and mitigation policy	Consideration is given to any applicable provisions of the voluntary land acquisition and mitigation policy and, in particular: • any applicable provisions of the policy for the mitigation or avoidance of noise or particulate matter impacts outside the land on which the development is to be carried out, and • any applicable provisions of the policy relating to the developer making an offer to acquire land affected by those impacts.
2.19 Compatibility with mining, petroleum production or extractive industry	Consideration is given to whether the development is likely to have a significant impact on current or future mining, petroleum production or extractive industry and ways in which the development may be incompatible. Measures taken by Oberon Earthmoving to avoid or minimise any incompatibility are considered. The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.
2.20 Natural resource and environmental management	Consideration is given to ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure: • impacts on significant water resources, including surface and groundwater resources, are avoided or minimised; • impacts on threatened species and biodiversity are avoided or minimised; and • greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided.
2.21 Resource recovery	The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered.

Clause	Description
2.22 Transport	The following transport related issued are considered. • The transport of some or all of the materials from the site by means other than public road. • Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. • The preparation of a code of conduct for the transport of materials on public roads.
2.23 Rehabilitation	The rehabilitation of the land affected by the development is considered including: • the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; • the appropriate management of development generated waste; • remediation of any soil contaminated by the development; and • the steps to be taken to ensure that the state of the land does not jeopardize public safety, while being rehabilitated or at the completion of rehabilitation.

State Environmental Planning Policy (Resilience and Hazards) 2021

Chapter 3 of the State Environmental Planning Policy (Resilience and Hazards) 2021 (R&H SEPP) replaces the former State Environmental Planning Policy No. 33 (SEPP 33) and provides for the identification, effective control and assessment of hazardous and offensive industry.

Hazardous and offensive industries, and potentially hazardous and offensive industries, relate to industries that, without the implementation of appropriate impact minimisation measures, would (or potentially would) pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment.

The Proposed Modification would not result in any modifications to the types, volumes, storage or use of hazardous or dangerous goods within the Quarry Site. These operations have been determined to not be a hazardous or offensive development. No further consideration of Chapter 3 of the R&H SEPP is required.

Chapter 4 of the R&H SEPP replaces the former State Environmental Planning Policy No. 55 (SEPP 55) and requires the consent authority to consider whether the land on which the proposed development will be undertaken is contaminated and if it is suitable for the proposed use. A search of the EPA contaminated land record was undertaken for the Quarry Site and surrounding areas. No records of land contamination were identified within or in proximity to the Quarry. No potentially contaminating historical land uses are known to have been undertaken on the site and no noticeable evidence of contamination is present. The site is therefore considered suitable for the continued use as a Quarry.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Commencing on 1 March 2022, the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (B&C SEPP), Chapter 2 aims:

a. to protect the biodiversity values of trees and other vegetation in non-rural areas of the State.

b. to preserve the amenity of non-rural areas of the State through the preservation of trees and other vegetation.

As the Proposed Modification does not require any additional clearing, no further consideration of the requirements of the B&C SEPP is required.

4.1.3.4 Local Planning Requirements

Oberon Local Environmental Plan 2013

The Quarry Site is located within land zoned Rural RU1 – Primary Production under the *Oberon Local Environmental Plan 2013*. Extractive industry is permissible within land zoned Rural RU1 with development consent.

Development for the purpose of resource recovery or waste management is not identified as permissible with consent. The carrying out of development for the purpose of Waste or Resource Management Facilities is permissible with consent within this zone in accordance with Division 23 of the T&I SEPP.

Development Control and Contributions Plan

In order to minimise land use conflicts and avoid undue interference with the amenity of residents, *Development Control Plan 2001* (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries.

The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities. In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.

The Proposed Modification also meets the objectives of the DCP for non-agricultural development within the rural zone, namely:

- the extension is not located on prime agricultural land
- the Proposed Modification has been designed to minimise the potential to inhibit or give rise to complaints about surrounding normal farming and forestry practices
- the Proposed Modification has been designed to minimise the potential impacts on adjoining land, and
- the Proposed Modification would generate sustainable ongoing employment.

In addition to the above, the *Development Contributions & Water Management Works Plan (Amendment) 2004* requires contributions to be paid to Council for various development types. For the Proposed Modification, contributions would be applicable as follows.

- A 'one off' contribution for services. This would include public open space, emergency services and community facilities.
- An ongoing contribution for rural roads charged at a contribution per tonne of product transported via public road.

The exact values of the contributions will be confirmed with Council as part of the development application process.

4.1.4 Environmental Performance

4.1.4.1 Environmental Incidents and Complaints

There have been no environmental incidents and complaints received in relation to Middle Creek Quarries.

4.1.4.2 Environmental Management and Monitoring

Dust

In accordance with the Quarry Air Quality Management Plan (AQMP), dust is monitored monthly through samples collected and composition recorded at four gauges across the Site (see **Figure 4.2**). The results are presented in **Table 4.3** and results have been generally in accordance with the compliance criteria of <4 g/m^2/month.

Table 4.3 Annual Average Dust Deposition (g/m^2/month)

Period	DG1	DG2	DG3	DG4	Comments
2019 (Jun-Dec)	2.0	1.0	2.1	1.9	N/A
2020 (Jan-Dec)	1.5	0.9	0.6	1.4	This includes elevated results from January / February bushfires
2021 (Jan-Dec)	0.7	0.7	0.4	0.8	Occasional samples missing due to lack of wet weather access
2022 (Jan-Sep)	0.9	0.8	1.2	1.2	N/A
Total	**1.4**	**0.9**	**1.0**	**1.4**	

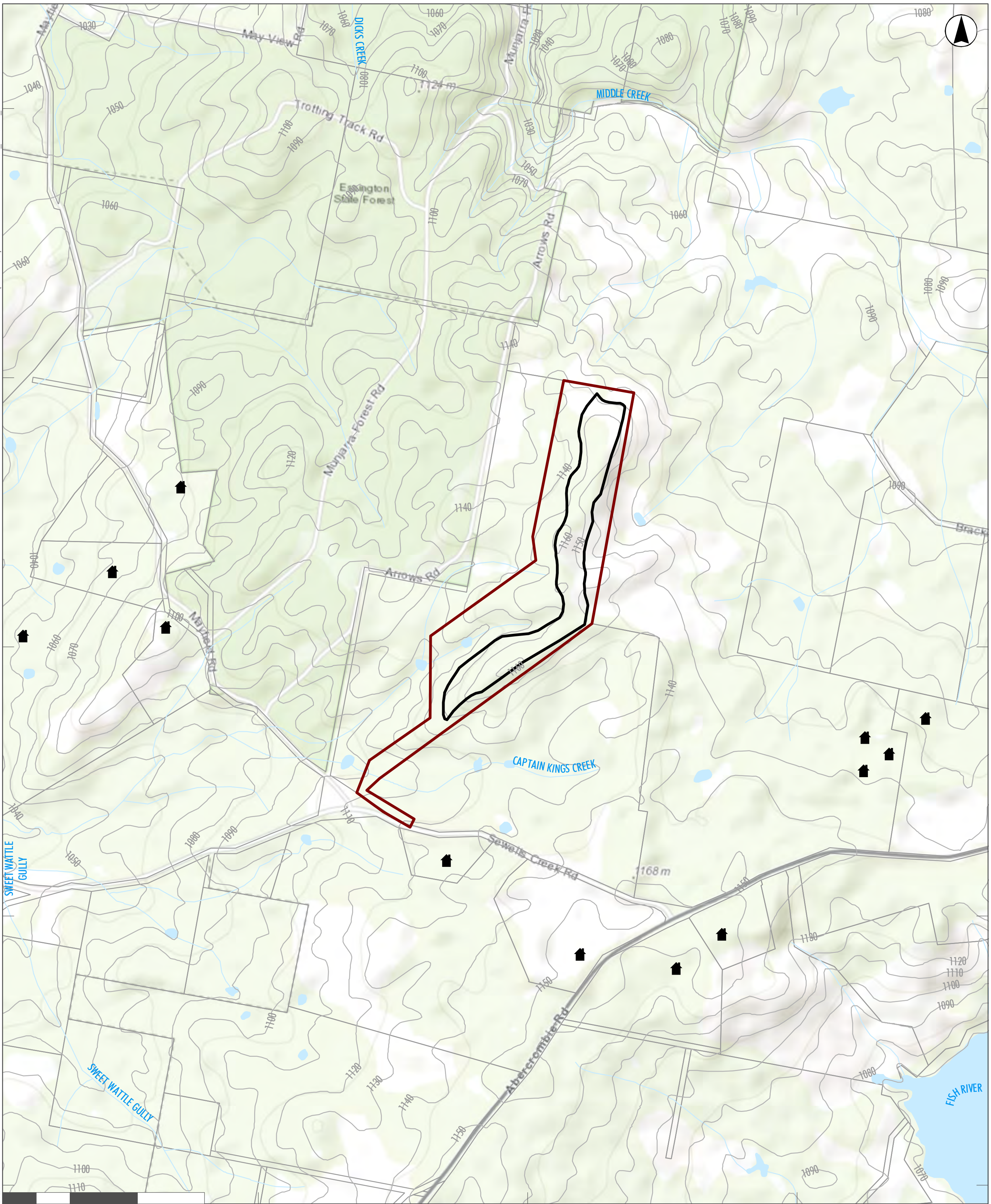
Noise

Attended noise monitoring was completed at three residential receivers to the west, south and east of the Quarry on 26 May 2022 (refer to **Figure 4.2**). The distance from these to Quarry operations was between 400 m (to the south) and 1,200 m (to the east).

In each case, the measured contribution of the Quarry to noise was <35 dB(A) was below the noise limits of EPL 21098 (39 dB(A)). Furthermore, the combined sound power level of the operating equipment of 116 dB(A) was below the target sound power level nominated in the Quarry Acoustic Management Plan (AMP).

Water

There have been no recorded discharges of water from the licensed discharge points of the Quarry and as such no monitoring of water quality has been undertaken.



Legend
- Quarry Site Boundary
- Approved Extraction Area
- Cadastral Boundary
- Residence Location
- Contour 10m
- Drainage Line
- Dam

FIGURE 4.2

Environmental Monitoring Locations

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

4.1.4.3 Compliance

An Annual Review to Council is prepared by Oberon Earthmoving each year in accordance with Condition 20 of DA 10.016.38.1. Umwelt completed a statement of compliance for the purpose of the Annual Reviews prepared in 2021 and 2022 and found the Quarry to be generally compliant with the conditions of development consent. Some minor non-compliances were observed, however, these are understood to have been rectified.

- Condition 17: Sediment and Erosion Control. On inspection of the Quarry Site, the placement and function of erosion and sediment control structures was not in accordance with the Quarry Surface Water and Sediment Management Plan (SWSMP).
- Condition 18: Rehabilitation Plan Implementation. The purchase and planting of tubestock to support the RLMP was commenced within 3 months, however, completion was not achieved in 12 months due to drought conditions affecting plant survival. The plantings have now been completed.
- Condition 4: Code of Conduct. A code of conduct is retained by the Proponent, however, a register of signatories was not maintained until 2022.
- Condition 6: Business Identification Signage. Signage was not provided for a period whilst landscaping of the entrance was undertaken.
- Condition 28. Toilet Facilities. Toilet facilities were not available until the installation of the Quarry office building in late 2021.
- Condition 15. Weigh Bridge. A weigh bridge was not installed until 2022.

Overall, these non-compliances represent primarily administrative matters which do not present high risk of environmental impact. Notably, all have subsequently ben addressed and rectified.

4.1.5 Summary

Considering the results of consultation, review of planning issues and assessment of environmental performance of the Quarry, the following environmental parameters have been identified as potentially affected by the Proposed Modification.

- Traffic and Transport. The Proposed Modification would increase the number of trucks travelling to and from the Quarry. This has the potential to impact on local traffic and the performance of local roads.
- Air Quality and odour. With an increase in production, relocation of composting operations, and introduction of concrete crushing, there is a potential for changes to the exposure of surrounding residential receivers to air emissions and odour generated by the Quarry. Notably, the Quarry has easily complied with air emission limits since commencement.
- Noise and vibration. As for air emissions, the Proposed Modification to operations has the potential to result in changes to the noise and vibration levels generated by the Quarry and received at receivers surrounding the Quarry and haulage route. Notably, the Quarry the most recent noise monitoring indicates compliance with licensed noise limits.

- Surface Water. With a proposed increase in production and washing, the rate of water usage at the Quarry is likely to increase. Ensuring adequate supply of water to manage air emissions and management to prevent pollution is identified as an important consideration of the modification.

- Groundwater. No change to the depth of extraction or controls associated with composting operations is proposed and therefore no additional impacts on groundwater are anticipated.

- Biodiversity. The R&E SEPP requires that impacts on threatened species and biodiversity are to be avoided or minimised. The NSW *Biodiversity Conservation Act 2016* identifies controls for entry into the NSW Biodiversity Offsets Scheme. The proposed construction of a new pad for composting and stockpiling operations requires consideration with respect to these planning instruments.

- Cultural heritage. The proposed construction of a new pad for composting and stockpiling operations requires consideration with respect to possible impacts on sites or artefacts of cultural heritage significance.

- Land Resources (rehabilitation and final land use). The Proposed Modification requires a minor change to the final landform and rehabilitation of the Quarry. This has the potential to impact on local landforms and land use and the R&E SEPP requires that rehabilitation of the land affected by the development is considered.

- Socio-economic setting. The proposed increase in production, and associated environmental impacts, could impact on the local social setting which is likely to change over the next 10 to 15 years as residential development extends from the west and north.

Section 4.2 further considers these environmental issues to determine the level of priority and coverage to be assigned to each.

4.2 Issue Prioritisation

For each of the environmental issues identified (refer to **Section 4.1**), a preliminary environmental evaluation was undertaken for the Proposed Modification to identify, from a technical perspective, the key environmental and community issues of relevance and the level of assessment required as part of the environmental assessment process. This analysis was undertaken in conjunction with a review of the currently approved operations to determine whether the Proposed Modification would result in any material change to the impacts assessed originally (and therefore warrant further assessment).

The method used for the environmental risk analysis encompassed the following key steps:

- identify each element of the Proposed Modification

- identify the environmental and community aspects and potential impacts associated with each element of the Proposed Modification in the context of the existing approved operations (that is, whether or not there is likely to be a change to the impacts approved as part of the existing consent for the Quarry)

- assess the potential scale of the modified impact to determine the key issues requiring further assessment and the level of assessment required.

The outcomes of the preliminary environmental risk analysis are detailed in **Table 4.4**.

Table 4.4 Potential Environmental Impact Analysis

Environmental Issue	Potential Effect	Priority/Coverage	Mitigation
Air Emissions / Odour / Greenhouse Gas & Energy	The Proposed Modification has the potential to result in changes to air emissions due to additional processing activities (concrete and B&D waste crushing). Additional material proposed for importation and compositing present the potential for additional odour impacts.	High Priority. An Air Quality Impact Assessment has been undertaken by Jacobs Pty Ltd to assess the predicted air emissions against relevant criteria (refer to **Section 5.2** and **Appendix 9**).	Management measures outlined in **Section 5.2.5** will mitigate any adverse environmental impacts relating to air emissions.
Noise	The Proposed Modification has the potential to result in changes to noise emissions due to the introduction of concrete and B&D waste importation and crushing, and increase in road traffic movements.	High Priority. A Noise Impact Assessment has been undertaken by MAC to assess the predicted noise emissions against relevant criteria (refer to **Section 5.3** and **Appendix 10**).	Management measures outlined in **Section 5.3.5** will mitigate any adverse environmental impacts.
Traffic and Transport	Increased transport associated with the operation of the Proposed Modification has the potential to impact local traffic and a traffic impact assessment is required.	High Priority. A Traffic Impact Assessment has been completed by Cardno (refer to **Section 5.4** and **Appendix 11**).	Management measures for Traffic and Transport impacts outlined in **Section 5.4.3** will mitigate any adverse environmental impacts
Water Resources	The Proposed Modification will require additional water and water management features to accommodate the modified operations proposed. Without controls in place, the stockpiling of waste materials could result in the movement of contaminants to surface or groundwater resources.	Medium Priority. The Quarry water balance for has been reviewed along with the Water Management Plan (refer to **Section 5.5** and **Section 5.6**).	Adverse Surface and Groundwater impacts will be mitigated by management measures outlined in **Section 5.5.4** and **Section 5.6.3.**

Environmental Issue	Potential Effect	Priority/Coverage	Mitigation
Waste Management	The Proposed Modification introduces additional waste materials to be imported to and process on the Quarry Site. This has the potential to introduce additional pollutants which could impact on land, air or water resources.	High Priority. A review of the Quarry Waste Receival, Handling and Compost Management Plan and specifically measures to prevent seepage of contaminated has been completed (refer to **Section 5.7**).	Adverse environmental impacts from waste will be mitigated by management measures outlined in **Section 5.7.2**.
Biodiversity	Although the Proposed Modification area of disturbance represents a small extension to areas previously assessed, an assessment of the ecological values of the extension area is still required to determine the extent of offsetting required (if any) under the Biodiversity Conservation Act 2016.	Medium Priority. A Biodiversity Assessment Report has been complete by AREA Environmental (refer to **Section 5.8** and **Appendix 12**).	Management measure outlined in **Section 5.8.5** will mitigate any adverse environmental impacts.
Cultural Heritage	The Proposed Modification disturbance area will need to be assessed for both Aboriginal and historic heritage values to determine the extent of assessment required.	Medium Priority. A Cultural Heritage Assessment Report has been complete by AREA Environmental (refer to **Section 5.9** and **Appendix 13**).	Mitigation measures outlined in **Section 5.9.4** will mitigate any adverse environmental or social impacts
Land Resources (Rehabilitation, Final Landform and Land Use)	The overall approach to rehabilitation of the Quarry will remain unchanged, however, due to the extension to the extraction area there will be some change to the final landform of the site. An updated rehabilitation and closure strategy will therefore be required for the Proposed Modification.	Medium Priority. A review of the proposed final landform and rehabilitation has been provided (refer to **Section 5.10**).	Adverse environmental impacts will be mitigated by the Rehabilitation and Landscape Plan in **Appendix 4**.
Soils and Agriculture	Potential soil erosion issues are addressed as part of the surface water assessment. Upon closure of the Quarry, the additional stockpiling and processing area, as with the adjoining extraction areas, will be rehabilitated to allow agricultural land uses to recommence.	Further assessment not required.	**Section 5.5.4** outlines surface water management measures that addresses any environmental impacts to soil.

Environmental Issue	Potential Effect	Priority/Coverage	Mitigation
Visual Amenity	The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).	Further assessment not required.	N/A
Bushfire	No changes likely to influence potential for fire on the Quarry Site are proposed.	Further assessment not required.	N/A
Contaminated land	A search of the NSW EPA contaminated land database completed in November 2022 identified that there are no registered contaminated sites in proximity to the Quarry.	Further assessment not required.	Management measures outlined in **Section 5.7.2** will mitigate any adverse environmental impacts
Hazard and risk	Existing operations at the Quarry are not considered as hazardous or offensive. The Proposed Modification includes a relocation of composting operations which has the potential for additional odour or air quality impacts. No other hazards or risks are introduced by the Proposed Modification.	Medium Priority. Considered as part of air quality impact assessment (refer to **Section 5.2**).	Management measures outlined in **Section 5.2.5** will mitigate any adverse environmental impacts.
Public Infrastructure	The Proposed Modification does not require any changes to public infrastructure.	Further assessment not required.	N/A
Socio-economic	The Proposed Modification will not have any socio-economic impact.	Low Priority. The relative costs (impacts) and benefits (contributions) of the Proposed Modification are reviewed and assessed (refer to **Section 5.11**).	Management measures outlined in **Section 5.11.4** will mitigate any adverse social impacts.

5.0 Environmental Assessment

5.1 Site Context

The following provides an overview of the local setting with respect to components which may influence other environmental parameters.

5.1.1 Land Zoning and Use

The Quarry Site is located within a rural area (zoned RU1 Primary Production) (see **Figure 5.1**) with the surrounding land use predominantly agricultural, grazing and some cropping. As noted in **Section 4.1.3.4**, development of the purpose of extractive industry and waste management / resource recovery are permissible within land zoned Rural RU1 with development consent.

The Essington State Forest, a soft wood plantation, is located on the western boundary of the Quarry Site and extends to the north (within land zoned RU3 Forestry). Forestry is a prominent feature of the local and regional setting, with vehicles carrying logs and other raw wood materials a feature of the local road network. Active logging of Essington State Forest adjacent to the Quarry Site was undertaken circa 2019–2020, with the forest currently in a regeneration phase.

Large lot residential zoning (R5) occurs approximately 1.2 km to the east. Development within on these lots is ongoing. Oberon's general residential zone (R1) is approximately 3.2 km to the east.

5.1.2 Land Ownership and Sensitive Receivers

The Quarry Site lies within Lot 2 of DP 1112479 which is owned by Clift Engineering Pty Ltd, a company with common ownership and management to Oberon Earthmoving.

There are 12 residential receivers located within 2 km of the Site, and land ownership is demonstrated on **Figure 5.2**. Notably, the proximity of Quarry activities would not increase toward any residence.

5.1.3 Topography and Drainage

Elevations range from 1,138 m AHD at Humphries Bald Hill approximately 2 km north of the Quarry Site, to 1,000 m AHD at Captains Kings Creek approximately 2 km west of the Quarry Site (refer to **Figure 5.3**).

The landform is undulating with the Quarry Site principally located on a north-south ridge with elevations ranging up to 1,160 m AHD across the top of the ridge and down to 1,100 m AHD at the base of the ridge.

5.1.4 Climate

The closest Bureau of Meteorology station is Oberon (Albion St) (Station Number 063063), located approximately 5 km northeast of the Quarry Site, at an elevation of 1,053 m which is similar to the Quarry Site elevation. The closest available evaporation data was sourced from the Bathurst Agricultural Station (Station Number 063005). **Table 5.1** provides the monthly meteorological data applicable to the Quarry Site.

Table 5.1 Monthly Meteorological Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Years
Temperature (°C) – Oberon (Albion St) (No. 063063)														
Mean Max	25.1	23.9	21.5	17.3	13.2	9.6	8.8	10.4	13.9	17.3	20.2	23.5	17.1	48
Mean Min	11.1	11.2	9.1	5.5	2.6	0.9	-0.3	0.4	2.3	4.8	6.9	9.1	5.3	48
Lowest	-0.5	1.7	-2.2	-4	-6.3	-8.5	-8.7	-7.2	-5.8	-3.5	-2.5	-3		37
Highest	36.9	38.6	32.6	28.1	23.1	17.1	16.8	20.2	26.5	30.1	35.3	37.9		37
Days <2°C	0.1	0	0.5	3.9	12.4	15.4	20.3	19	12.3	5.8	2	0.4	92.1	37
Rainfall (mm) – Oberon (Albion St) (No. 063063)														
Mean	79.7	61.3	66.1	57.1	59.8	77.9	69.9	74.4	66.9	77.4	70.8	74.5	835.7	112
Mean Rain Days	8.1	7.5	8.1	7.9	9.2	11.9	11.3	11	9.7	9.7	8.2	7.8	110.4	116
Lowest	0.6	0	1.3	0	0.3	4.3	5.9	0	6.4	1	0	0	351.5	116
10^{th} Percentile	20.2	11.9	15	7.8	14.2	27.3	20.6	28.3	27.4	29	17.6	14.3	537.5	116
90^{th} Percentile	147	124.2	145.9	113.6	115.4	150.7	134.4	124.4	117.4	129.4	134.3	132.7	1116.5	116
Highest	279.1	249	261.2	193.1	267.8	267.4	210.9	259.6	204.2	200.5	187.4	268.8	1462.5	116
Evaporation (mm) – Bathurst Agricultural Station (No. 063005)														
Mean Monthly Pan Evaporation	210.8	159.6	139.5	87	52.7	33	37.2	55.8	84	127.1	159	201.5	1350.5	44
Wind Speed (km/h) – Oberon (Albion St) (No. 063063)														
Mean 9:00am	15.4	16.4	15.8	16.1	14.4	14.6	15.2	16.5	17.2	18.5	19.1	16.9	16.3	21
Mean 3:00pm	16.2	16.7	15.7	15.9	14.8	16.5	18.5	18	18.9	18.9	19.3	18.1	17.3	15

Source: Bureau of Meteorology.

5.1.4.1 Rainfall

Rainfall at the Quarry Site is relatively evenly distributed throughout the year. January is the wettest month receiving on average 79.5 mm and April the driest month receiving on average 57.1 mm although it is noted rainfall is relatively evenly distributed throughout the year. The average annual rain fall is 835.7 mm with the average number of rain days being 110.

5.1.4.2 Evaporation

The closest station measuring pan evaporation is Bathurst Agricultural Station (Station 0063005) 48 km northwest of the Quarry Site. As identified in the original EIS for the Quarry (RWC, 2018), the highest evaporation is in January (~211 mm) and lowest evaporation in June (33 mm). On average, annual evaporation is approximately 1,350 mm, which is approximately 1.6 times greater than the average annual rainfall recorded at the Oberon (Albion Street) Station. It is noted that average rainfall exceeds evaporation during the months of May to August. For the remaining months, evaporation exceeds rainfall.

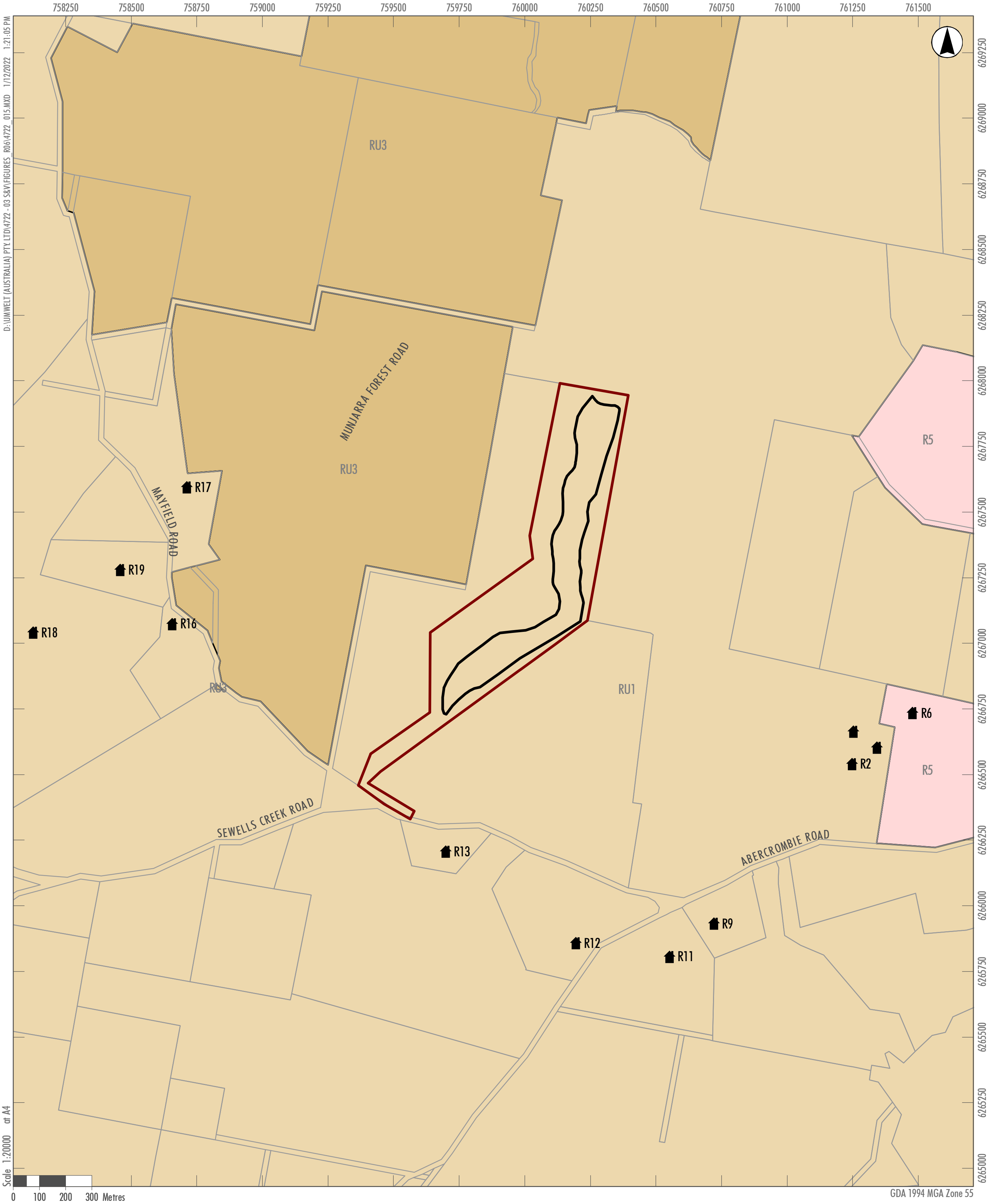
5.1.4.3 Temperature

Average daily maximum and minimum temperatures recorded are presented in **Table 5.1**. The Oberon area is generally cool with frosts common in autumn, winter and spring and with several snowfalls generally received each year. Mean daily temperatures range from -0.5°C (minimum) to 10.4°C (maximum) in winter, and from 6.9°C (minimum) to 25.1°C (maximum) in summer. January is the warmest month and July the coldest month.

5.1.4.4 Wind

An analysis of local winds is presented in *Section 4.3* of the Air Quality Impact Assessment (Jacobs, 2022) (refer to **Appendix 9**). In summary,

- On an annual basis, winds blowing from the west southwest and east northeast most common, with winds from the north and east southeast also occurring often.
- When considered seasonally:
  - During the summer months, conditions are similar to those observed annually, winds blowing from the east-northeast most are most common in summer.
  - During Autumn, conditions are similar to those observed annually, with winds blowing from the southeast also common.
  - During Winter, winds blowing from the north and west-southwest occurring most often.
  - During Spring, conditions are similar to those observed annually.



Legend

- Quarry Site Boundary
- Approved Extraction Area
- Cadastral Boundary
- Residence Location

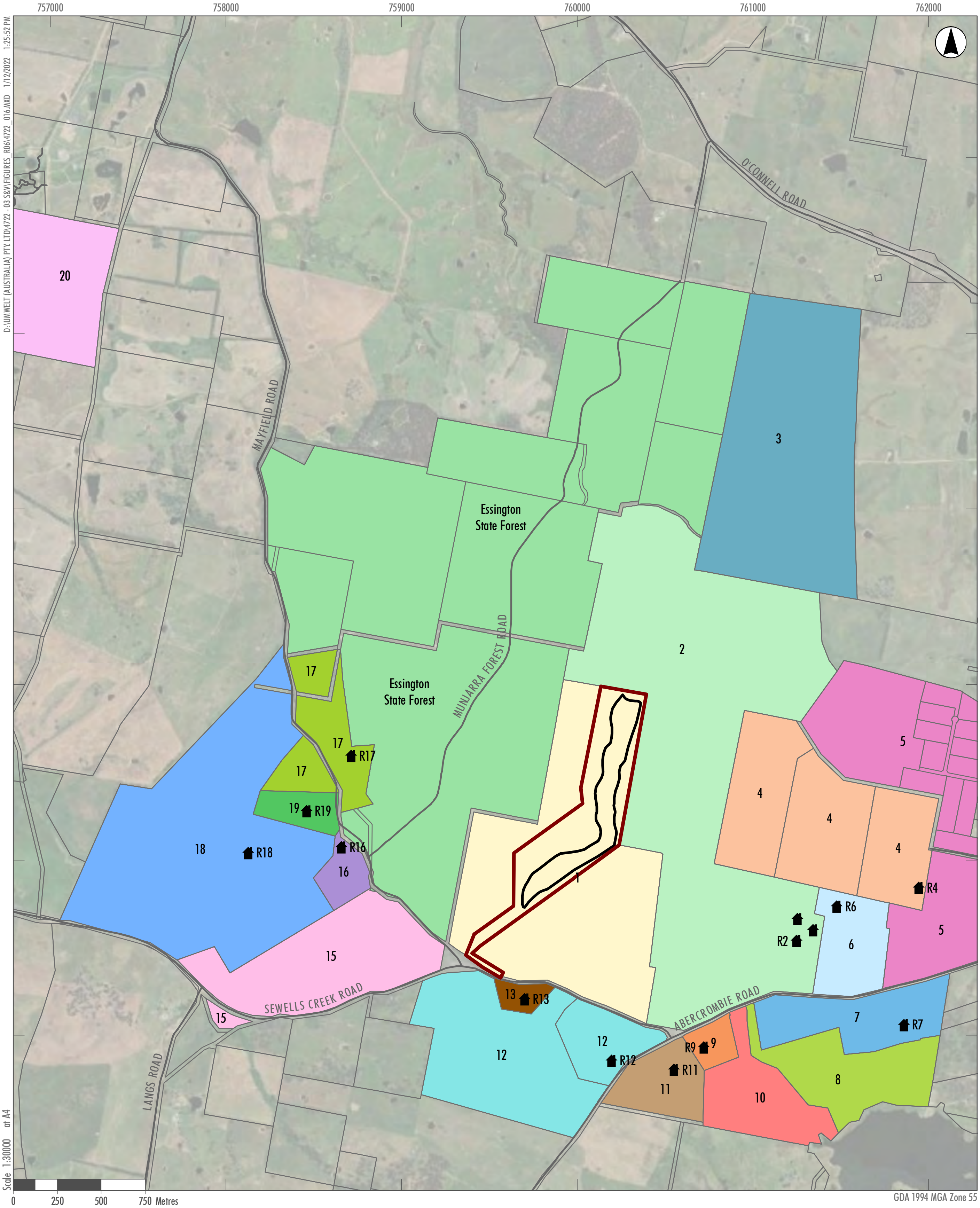
Land Zoning

- R5 - Large Lot Residential
- RU1 - Primary Production
- RU3 - Forestry

FIGURE 5.1

Local Setting
Land Zoning and Land Use

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)



Legend

Quarry Site Boundary
Approved Extraction Area
Residence Location

Private Land Ownership

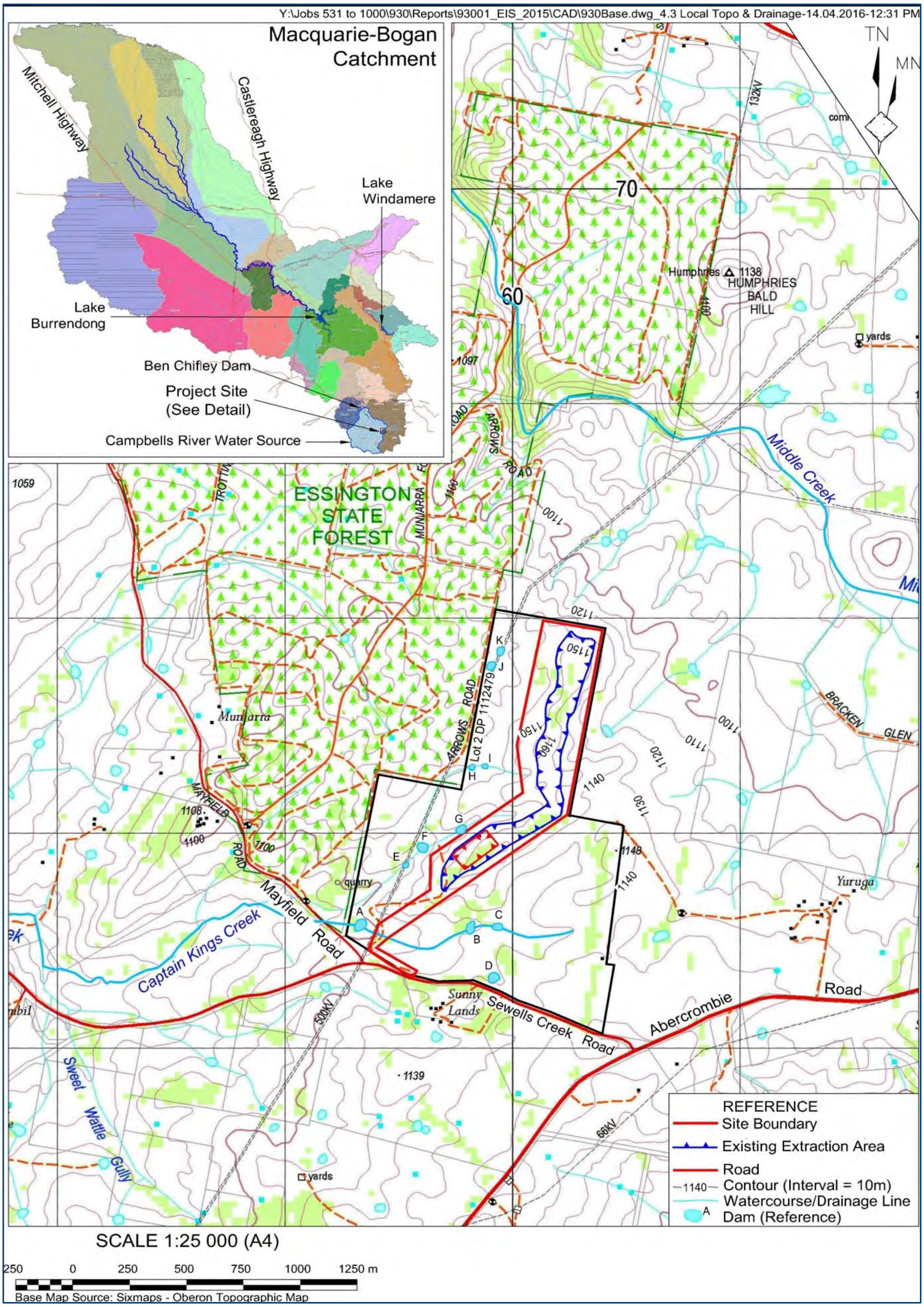
1
2
3
4
5
6
7
8
9
10
11
12
13
15
16
17
18
19
20
Crown Land

umwelt

FIGURE 5.2

Local Setting Land Ownership and Sensitive Receivers

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)



Source: Modified after RWC (2017) – Figure 4.3).

Figure 5.3 Local Setting – Topography and Drainage

5.2 Air Quality

5.2.1 Introduction

An Air Quality Impact Assessment (AQIA) for the Proposed Modification has been undertaken by Jacobs Pty Ltd (2022) in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* ("the Approved Methods") (EPA, 2016). The resulting report is presented as **Appendix 9** and this subsection provides a summary of the methods, recommended mitigation and impacts of Jacobs (2022).

5.2.2 Existing Environment

5.2.2.1 Emission Types

Dust generation is the main air quality issue relevant to Quarry operations. Airborne contaminants that can be inhaled into the human respiratory system are classified on the basis of their physical properties such as being gases, vapours or particulate matter. Particulate matter refers to a category of airborne particulates, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm. This type of dust is termed total suspended particulate (TSP).

Emissions of particulate matter less than 10 µm (termed PM_{10}) and 2.5 µm (termed $PM_{2.5}$) are considered important pollutants to human health as their ability to penetrate the respiratory system can cause cardiovascular and respiratory diseases, pulmonary and heart diseases, as well as reduced lung capacity.

Particles that are too large to remain in suspension in the air are referred to as 'deposited dust' and are typically in the order of greater than 35 µm in diameter. Even though these particles lack the ability to cause significant harm to humans, they can contribute to reductions in amenity and therefore are considered within the assessment, e.g. dust on window-sills or cars.

Gas emissions, principally from burning of diesel fuel and blast emissions, are and would continue to be produced as a consequence of the Quarry, as well as other construction, industry and transport within the local area.

5.2.2.2 Local Emission Sources

There are a variety of land uses within the local setting likely to generate air emissions. The principal sources of emissions in the vicinity of the Quarry are considered to be the following:

- Land cultivation for cropping or pasture improvement.
- The movement of farm vehicles or livestock over unsealed access roads, farm tracks and areas devoid of vegetation.
- Land clearing and forestry, including wind erosion from cleared surfaces and vehicle movements, from the neighbouring Essington State Forest.
- Vehicle movements on local roads.
- Land clearing and construction for residential development.
- Wind-blown dust from cleared or heavily grazed areas.

5.2.2.3 Surrounding Receivers

Sensitive receivers in the form of existing residences have been identified as potentially affected by emissions from the modified Quarry operations (refer to **Section 5.1.2** and **Figure 5.2**).

5.2.2.4 Background Air Quality

Background air quality was established using DPE regional air quality monitoring stations in similar rural areas, in combination with the four existing deposited dust monitoring stations located on-site (refer to **Section 4.1.4.2** and **Figure 4.2**). The nearest particulate monitoring stations are Bathurst (40 km northwest) and Orange (82 km northwest). The nearest rural NO_2 monitoring stations are Goulburn (115 km south), Albion Park (130 km southeast) and Beresfield (200 km northeast).

Jacobs (2022) identify the year 2021 as of site conditions for the purpose of air quality impact assessment, although it is noted that meteorological conditions do vary significantly from year to year, and air quality is strongly correlated to the climatic conditions at the time. For example, air quality between 2017 to early 2020 was heavily influenced by drought, bushfires and dust storms.

Jacobs (2022) used a combination of locally and regionally acquired monitoring data to determine appropriate background levels in accordance with the Approved Methods (EPA, 2022) (refer to **Table 5.2**).

Table 5.2 Adopted Background Air Quality Conditions

Pollutant	Averaging time	Adopted value	Justification	Assessment Criterion (EPA)
Particulate matter as PM_{10}	24-hour	Variable by day, noting the maximum daily concentration observed being 29.2 µg/m^3	Measured PM_{10} concentrations from DPE Bathurst in the representative year, 2021.	50 µg/m^3
	Annual	11.3 µg/m^3		25 µg/m^3
Particulate matter as $PM_{2.5}$	24-hour	Variable by day, noting the maximum daily concentration observed being 13.8 µg/m^3	Measured $PM_{2.5}$ concentrations from DPE Bathurst in the representative year, 2021.	25 µg/m^3
	Annual	5.1 µg/m^3		8 µg/m^3
Particulate matter, TSP	Annual	28.3 µg/m^3	Estimated annual average concentration for Bathurst in the representative year, 2021.	90 µg/m^3
Deposited dust	Annual	0.9 g/m^2/ month	Highest deposited dust level measured in Oberon across 2020/21 and 2021/22 reporting periods.	4 g/m^2/ month
Nitrogen dioxide (NO_2)	1-hour	70 µg/m^3	Highest NO_2 concentration from DPE Beresfield, Albion Park and Goulburn in the representative year, 2021.	164 µg/m^3
	Annual	12 µg/m^3		31 µg/m^3

5.2.3 Assessment Criteria

The Approved Methods (EPA, 2022) defines the criteria for air quality indicators including particulate matter. The AQIA has been assessed against the Approved Methods criteria (see **Table 5.3**) and applied to existing and potentially sensitive receptors including dwellings (Jacobs, 2022).

Table 5.3 EPA Air Quality Assessment Criteria

Substance	Averaging time	Criterion
Particulate matter (PM_{10})	24-hour	50 µg/m^3
	Annual	25 µg/m^3
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3
	Annual	8 µg/m^3
Particulate matter (TSP)	Annual	90 µg/m^3
Deposited dust	Annual (maximum increase)	2 g/m^2/month
	Annual (maximum total)	4 g/m^2/month
Nitrogen dioxide (NO_2)	1-hour	164 µg/m^3
	Annual	31 µg/m^3
Carbon monoxide (CO)	1-hour	30 mg/m^3
	8-hour	10 mg/m^3

Adapted from Jacobs, 2022, Table 3.2.

5.2.4 Assessment Methodology

The overall approach to the assessment undertaken by Jacobs (2022) follows the Approved Methods and the following provide an overview of approach. Further detail is provided in *Section 5* of the AQIA (Jacobs, 2022) (refer to **Appendix 9**).

Dust

Potential dust impacts from the Proposed Modification have been quantified using the CALPUFF dispersion model, listed in the Approved Methods. The CALPUFF model uses geophysical, meteorological, sources/emissions and receiver inputs to predict ground-level particulate matter concentrations and dust deposition levels due to the Project and other sources. The model included each of the three extraction stages, and considered differences in volumes and locations of blasting, extraction, excavated materials processing, and waste concrete processing for each stage.

Blast Fumes

Blasting activities have the potential to result in fume (and particulate matter – discussed in **Dust**) emissions which is sometimes visible as an orange/brown plume. Blast fume assessment is based on modelling of the post-blast NO_x and NO_2 concentrations at maximum 1-hour average and at sensitive receivers. Model results were compared with the EPA air quality assessment criterion for NO_2 (see **Table 5.3**).

Diesel Exhaust Emissions

The most significant emissions from diesel exhausts within the Quarry Site are products of combustion including CO, NO_x, PM_{10} and $PM_{2.5}$. NO_x (specifically NO_2) and PM_{10} (including $PM_{2.5}$) which have been assessed. DPE monitoring data have shown that CO concentrations have not exceeded relevant air quality criteria at rural or urban monitoring stations in NSW, indicating that this indicator represents a much lower air quality risk. The modelling for operational dust (see **Dust**) has considered emission factors that represent the contribution from both wheel-generated particulates and the exhaust particulates. These emission factors, including with control factors, are based on measured emissions which included diesel particulates in the form of both PM_{10} and $PM_{2.5}$. It is noted that the emissions factors are based on emissions from trucks measured in the 1980s, and modern trucks are likely to produce less particulate.

The model used was TRAQ (v1.3) and considered worst-case meteorological conditions – wind speed of 1 m per second, Pasquil atmospheric stability Class F (highly stable) and 15 degrees Celsius.

Road Transport

The AQIA also assessed emissions generated from the transportation of Quarry products from the Quarry. The emissions were modelled using TRAQ in the same manner as for internal site emissions (see **Diesel Exhaust**). It adopts emission factors from the EPA's Motor Vehicle Emissions Inventory (MVEI) and uses the CALINE air dispersion model to predict the maximum near-roadside air pollutant concentrations based on traffic volume, traffic mix, traffic speed, road type, road grade, and other factors. The model considers conservative, worst-case conditions to determine the potential for impacts. The key conservative assumptions include worst-case wind angles, stable atmospheric conditions, and low winds that allow for high air pollutant concentrations to occur.

Crystalline Silica

Dust from quarrying activities such as crushing may contain silica, which has the potential to harm human health if inhaled. The potential impacts have been informed by comparison to ambient monitoring carried out by Buttai Gravel at the Martins Creek Quarry (Jacobs, 2022).

5.2.5 Air Quality Management Measures

5.2.5.1 Current Emissions and Odour Management

The Quarry undertakes operations in accordance with an Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions (refer to **Appendix 9**).

Table 5.4 presents the adopted control efficiencies of key emissions management measures.

Table 5.4 Air Quality Emission Control Efficiency

Source/Activity	Control Measure	Control Efficiency (%)
Drilling	Water sprays	70%
Hauling materials	Watering of haulage routes	50%
Wind erosion	Water sprays	50%
	Water sprays and rehabilitation	65%

From Jacobs, 2022, Table 7.1.

In addition to the continued implementation of these measures, and in accordance with the recommendations of the AQIA (Jacob, 2022), the following additional controls and management measures will be implemented.

5.2.5.2 Blast Fume Management

The risk of fume generation from blasting at the Quarry is considered low, due to the low moisture content of the rock, and has not historically been an issue. The primary risk factors for fume generation identified in *Australian Explosives Industry and Safety Group (AEISG) Code of Good Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Edition 2, 2011* ("the Code"), are identified below along with the measures to be implemented to reduce these risks.

Explosive Formulation and Quality Assurance

- Oberon Earthmoving will employ the services of a licensed blasting contractor that operates under the NSW *Explosives Act 2003* and NSW Explosives Regulations 2013.
- Monitoring and calibration of the explosive manufacturing unit will be undertaken to ensure explosive mixing is in the correct proportions will be undertaken.

Geological Conditions

- Blasting will be restricted to confined and competent formations which presents reduced potential for seepage of explosives into cracks.

Groundwater

- Blasting will occur above the groundwater table limiting the potential for water to affect the explosives and detonation.

Blast design

- The depth of blast holes will be less than 20 m and therefore desensitisation of the explosive at depth is unlikely.
- Oberon Earthmoving will commence with conservative assumptions regarding conditions and blast performance.

On bench practices/contamination of explosives

- Blast zones will be maintained free of loose rock and fine materials which could contaminate blast holes and affect explosion.
- Blast holes will be dewatered if subject to heavy rainfall.
- Inspections of blasts before initiation will ensure drilling has been completed as per design.

Each blast will be monitored for evidence of fume (orange or red coloured dust). Should fume emissions be observed, Oberon Earthmoving will implement a review and implement additional mitigation measures in accordance with the Code.

5.2.5.3 Exhaust Gas Management

While diesel combustion emissions are not identified as a significant issue at the Quarry, the following controls would be implemented.

- All machinery would be serviced in accordance with manufacturer recommendations for maintenance.
- Maintenance would be completed to ensure, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle.

5.2.6 Assessment of Impacts

5.2.6.1 Deposited Dust and Particulate Matter Impacts

Annual Average Emissions

Table 5.5 summarises the annual average predicted PM_{10} and $PM_{2.5}$ concentrations at 16 representative receivers surrounding the Quarry Site (refer to **Figure 4.2**) for the three extraction stages. The predicted incremental contribution of the Quarry as well as cumulative emissions when considering background emissions, is presented.

Table 5.5 Predicted Annual Average Concentration (µg/m^3)

Receiver	Stage 1		Stage 2		Stage 3	
	Quarry	Cumulative	Quarry	Cumulative	Quarry	Cumulative
PM_{10}						
R1	<0.1	<11.4	<0.1	<11.4	<0.1	<11.4
R2A	0.1	11.4	0.1	11.4	0.2	11.5
R2B	0.1	11.4	0.2	11.5	0.2	11.5
R2C	0.1	11.4	0.2	11.5	0.2	11.5
R3	<0.1	<11.4	<0.1	<11.4	<0.1	<11.4
R4	0.1	11.4	0.1	11.4	0.1	11.4
R6	0.1	11.4	0.1	11.4	0.1	11.4
R7	0.1	11.4	0.1	11.4	0.1	11.4
R9	0.1	11.4	0.2	11.5	0.2	11.5
R11	0.2	11.5	0.2	11.5	0.2	11.5
R12	0.3	11.6	0.3	11.6	0.3	11.6
R13	0.4	11.7	0.4	11.7	0.4	11.7
R16	0.1	11.4	0.1	11.4	0.1	11.4
R17	0.1	11.4	0.1	11.4	0.1	11.4
R18	<0.1	<11.4	<0.1	<11.4	0.1	11.4
R19	0.1	11.4	0.1	11.4	0.1	11.4
$PM_{2.5}$						
R1	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R2A	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R2B	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R2C	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2

Receiver	Stage 1		Stage 2		Stage 3	
	Quarry	Cumulative	Quarry	Cumulative	Quarry	Cumulative
R3	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R4	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R6	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R7	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R9	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R11	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R12	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R13	0.1	5.2	0.1	5.2	0.1	5.2
R16	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R17	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R18	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2
R19	<0.1	<5.2	<0.1	<5.2	<0.1	<5.2

Source: Modified after Jacobs (2022) – Table 6.1 and Table 6.3.

Figure 6.1 and *Figure 6.3* of the AQIA (refer to **Appendix 9**) provide contour plots for annual average emissions surrounding the Quarry.

The results of the dispersion modelling presented in **Table 5.6** and contour plots of the AQIA indicate that the emissions attributable to the Proposed Modification would comply annual average PM_{10} and $PM_{2.5}$ criteria, even when cumulative emissions are considered.

24-Hour Emissions

Table 5.6 presents the maximum 24 hour concentration of PM_{10} and $PM_{2.5}$ identifying the Quarry generated and background contributions for each of the three extraction stages.

Table 5.6 Predicted Maximum 24-hour Averaged Concentration (µg/m³)

Receiver	Stage 1		Stage 2		Stage 3	
	Quarry	Cumulative	Quarry	Cumulative	Quarry	Cumulative
PM_{10}						
R1	0.1	29.3	0.1	29.3	0.1	29.3
R2A	0.8	30.0	1.2	30.4	1.1	30.3
R2B	1.0	30.2	1.2	30.4	1.2	30.4
R2C	0.9	30.1	1.3	30.5	1.2	30.4
R3	0.2	29.4	0.2	29.4	0.2	29.4
R4	0.6	29.8	0.7	29.9	0.9	30.1
R6	0.7	29.9	1.1	30.3	1.0	30.2
R7	0.8	30.0	1.0	30.2	1.0	30.2
R9	1.7	30.9	1.6	30.8	1.6	30.8
R11	1.4	30.6	1.4	30.6	1.4	30.6
R12	2.2	31.4	2.4	31.6	2.4	31.6
R13	4.2	33.4	4.7	33.9	4.8	34.0

Receiver	Stage 1		Stage 2		Stage 3	
	Quarry	Cumulative	Quarry	Cumulative	Quarry	Cumulative
R16	0.5	29.7	0.7	29.9	0.7	29.9
R17	0.6	29.8	0.7	29.9	0.7	29.9
R18	0.3	29.5	0.4	29.6	0.4	29.6
R19	0.4	29.6	0.4	29.6	0.5	29.7
$PM_{2.5}$						
R1	<0.1	<13.9	<0.1	<13.9	<0.1	<13.9
R2A	0.1	13.9	0.1	13.9	0.1	13.9
R2B	0.2	14.0	0.2	14.0	0.2	14.0
R2C	0.1	13.9	0.2	14.0	0.1	13.9
R3	<0.1	<13.9	<0.1	<13.9	<0.1	<13.9
R4	0.1	13.9	0.1	13.9	0.1	13.9
R6	0.1	13.9	0.1	13.9	0.1	13.9
R7	0.1	13.9	0.1	13.9	0.1	13.9
R9	0.3	14.1	0.3	14.1	0.2	14.0
R11	0.2	14.0	0.2	14.0	0.2	14.0
R12	0.4	14.2	0.3	14.1	0.3	14.1
R13	0.6	14.4	0.5	14.3	0.5	14.3
R16	0.1	13.9	0.1	13.9	0.1	13.9
R17	0.1	13.9	0.1	13.9	0.1	13.9
R18	<0.1	<13.9	0.1	13.9	0.1	13.9
R19	0.1	13.9	0.1	13.9	0.1	13.9

Source: Modified after Jacobs (2022) – Table 6.2 and Table 6.4.

Figure 6.2 and *Figure 6.4* of the AQIA (refer to **Appendix 9**) provide contour plots for maximum 24-hour average emissions surrounding the Quarry.

The results of the dispersion modelling presented in **Table 5.6** and contour plots of the AQIA indicate that the emissions attributable to the Proposed Modification would comply annual average PM_{10} criteria, even when cumulative emissions are considered.

Total Suspended Particulates

Changes in annually averaged TSP concentrations at surrounding sensitive receptors was also predicted by Jacobs (2022). Considering a background concentration of 28.3 µg/m^3, incremental and cumulative concentrations well below the criteria of 90 µg/m^3 was predicted (refer to *Table 6.5* and *Figure 6.5* of Jacobs (2022)).

Deposited Dust

Table 5.7 presents the predicted annual average monthly deposited dust deposition, identifying the Quarry generated and background contributions for each of the three extraction stages.

Table 5.7 Predicted Annual Average Deposited Dust Concentration

Receiver	Stage 1		Stage 2		Stage 3	
	Quarry	Cumulative	Quarry	Cumulative	Quarry	Cumulative
R1	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R2A	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R2B	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R2C	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R3	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R4	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R6	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R7	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R9	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R11	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R12	0.1	1.0	<0.1	<1.0	<0.1	<1.0
R13	0.2	1.1	0.1	1.0	0.1	1.0
R16	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R17	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R18	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0
R19	<0.1	<1.0	<0.1	<1.0	<0.1	<1.0

Source: Modified after Jacobs (2022) – Table 6.6.

Figure 6.6 of the AQIA (refer to **Appendix 9**) provide contour plots for annual average monthly deposited dust surrounding the Quarry.

The results of the dispersion modelling presented in **Table 5.7** and contour plots of the AQIA indicate that the emissions attributable to the Proposed Modification would comply average monthly deposited dust criteria, even when cumulative emissions are considered.

5.2.6.2 Gas Emissions

Blast Fume Emissions

Jacobs (2022) predicts the maximum 1-hour average contribution of NO_2 from blasting would be 4.8 µg/m^3 at Receiver R2C. When combined with background concentrations (70 µg/m^3), this would be significantly below the applicable criteria of 164 µg/m^3.

Diesel Emissions

Jacobs (2022) predicts the annual average contribution of NO_2 from diesel combustion would be 0.1 µg/m^3 at Receiver R13. When combined with background concentrations (12 µg/m^3), this would be significantly below the applicable criteria of 31 µg/m^3. Similarly the maximum 1-hour average contribution of NO_2 would be less than 2.0 µg/m^3 at all receivers and cumulative concentration significantly lower than criteria (164 µg/m^3).

5.2.6.3 Transport Emissions

Table 5.8 show the maximum concentrations at kerbside of carbon monoxide (CO), NO_2 and PM_{10}.

Table 5.8 Predicted Maximum Kerbside Emissions Concentration

Pollutant	Period	Criteria	Quarry Traffic Emissions	Background	Cumulative
CO (mg/m^3)	1-hour	30	<0.1	0.7	<0.8
	8-hour	10	<0.1	0.7	<0.8
NO_2 ($\mu g/m^3$)	1-hour	164	1.2	70	71.2
	Annual	31	0.2	12	12.2
PM_{10} ($\mu g/m^3$)	24-hour	50	0.9	29.2	30.1
	Annual	25	0.3	11.3	11.6

Source: Modified after Jacobs (2022) – Table 6.6.

Emissions generated by Quarry transport on public roads would comply with the relevant criteria.

5.2.6.4 Crystalline Silica

A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 $\mu g/m^3$, well below the noted criteria of 3 $\mu g/m^3$ (Victoria EPA). This is considered a highly conservative comparison given respirable crystalline silica is noted as being a subset of $PM_{2.5}$ (which is predicted to be only 0.1 $\mu g/m^3$ or less at surrounding receivers).

5.2.7 Key Summary

Key points of the Air Quality Impact Assessment are outlined below:

- A variety of land uses within the local setting are likely to generate air emissions with sensitive receivers identified in the area as being potentially affected.
- All Air Quality concentrations are predicted to comply with the relevant criteria, and are not expected to significantly differ from background concentrations.
- The mitigation measures outlined in **Section 5.2.5** will mitigate any adverse environmental impacts of Air Quality.

5.3 Noise

5.3.1 Introduction

A Noise Impact Assessment (NIA) has been undertaken by Muller Acoustic Consulting Pty Ltd (MAC) to quantify the potential noise emissions associated with the Proposed Modification (MAC, 2022, **Appendix 10**), in accordance with the *Noise Policy for Industry* (NPfI) (EPA, 2017), *NSW Road Noise Policy* (RNP) (DECCW), 2011) and *Draft Construction Noise Guideline* (DCNG) (EPA, 2020). The NIA provides a quantitative assessment of potential acoustic impacts to the surrounding community, including noise associated with:

- Construction
- Operations, and
- Traffic and haulage.

The NIA did not include a Vibration Impact Assessment as there are no proposed changes to existing blast locations as a result of the Modification. Therefore, impacts of blasting remain the same as identified in the original Noise and Vibration Impact Assessment (MAC, 2016).

5.3.2 Existing Environment

5.3.2.1 Local Setting

The Quarry Site lies in a rural setting, with no significant surrounding industrial noise other than the established Quarry. Noises which are currently audible at the surrounding residences include the following:

- Traffic on local roads, particularly Sewells Creek Road and Abercrombie Road.
- Agricultural and rural noises such as farm machinery, stock, birds and insects.
- Domestic noises such as lawn mowers, pumps, dogs, etc.
- Wind generated noises such as wind in trees.

5.3.2.2 Receivers

The same sensitive receivers as considered for the AQIA have been identified as potentially affected by noise emissions from the Proposed Modification (refer to **Section 5.1.2** and **Figure 4.1**).

5.3.3 Assessment Criteria

5.3.3.1 Existing Noise Criteria

Noise criteria were previously established for the Quarry under the Industrial Noise Policy (INP) of the NSW EPA (EPA, 1999). **Table 5.9** presents the noise criteria for the Quarry as per Condition L6.3 of EPL 21098.

Table 5.9 Project Noise Trigger Level Criteria for Residential Receivers (db $LA_{eq(15min)}$)

Receiver	Day	Evening[1]	Night[1]
All residential	39	35	35

Note 1: Currently no operations during the evening or night time are permitted.

The criteria of **Table 5.9** apply under all meteorological conditions except:

- Wind speeds greater than 3 meters/second at 10 meters above ground level; or

- Stability category F temperature inversion conditions and wind speeds greater than 2 meters/second at 10 meters above ground level; or
- Stability category G temperature inversion conditions.

5.3.3.2 Proposed Project Noise Trigger Levels

The INP methodology to determine the noise assessment criteria has since been superseded by the NSW Noise Policy for Industry (NPfI). The NPfI sets out the procedure to determine the Project Noise Trigger Levels (PNTLs) relevant to an industrial development. The PNTL is the lower (i.e., more stringent) value of the Project Intrusiveness Noise Level (PINL) and the Project Amenity Noise Level (PANL) determined in accordance with *Section 2.3* and *Section 2.4* of the NPfI.

The most significant difference in noise assessment criteria from the implementation of the NPfI is the change in the minimum applicable daytime Rating Background Level (RBL). The minimum applicable daytime RBL in the INP was established at 30dB $LA_{90(daytime)}$ and is now instituted as 35dB $LA_{90(daytime)}$ in the NPfI. It is noted that the minimum applicable daytime RBLs for evening and night periods has remained at 30dB LA_{90} in the NPI.

It is proposed to adopt the minimum assumed RBLs outlined in *Section 2.3* of the NPfI to establish Project Noise Trigger Levels (PNTLs) (RBL+5) (see **Table 5.10**).

Table 5.10 Project Noise Trigger Level Criteria for Residential Receivers (db $LA_{eq(15min)}$)

Receiver	Day	Evening	Night
All residential	40	35	35

5.3.3.3 Construction Noise Management Levels

Construction activities of the Quarry include upgrade the construction of the new pad for the relocated composting operations. In accordance with the DCNG (EA, 2020), construction noise management level (NML) of 40 dB $LA_{eq(15min)}$ apply during standard construction hours.

5.3.3.4 Road Traffic Noise Criteria

Criteria for assessment of noise from traffic on public roads are set out in the NSW Road Noise Policy (RNP) (DECCW, 2011). Under this policy, Sewells Creek Road would be considered as a sub-arterial road type and therefore assessed against the criteria for the “arterial or sub-arterial road” category (refer to **Table 5.11**).

Table 5.11 Road Traffic Noise Criteria

Road category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7.00 am–10.00 pm)	Night (10.00 pm–7.00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/ sub-arterial roads generated by land use developments.	LAeq, (15 hour) 60 (external)	LAeq, (15 hour) 55 (external)

The RNP also states that, where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB, which has been accepted as the threshold of perceptibility to a change in noise level.

For other sensitive land uses, the following road traffic noise assessment criteria apply as per *Table 4* of the RNP.

- School classrooms – 40 dB $L_{Aeq(1hour)}$ (internal when in use).
- Open space (active use) – 60 dB $L_{Aeq(15hour)}$ (external when in use).

5.3.4 Assessment Methodology

The NIA (MAC, 2022) modelled noise using iNoise software, incorporating a 3D digital terrain map that included all relevant topographic information, noise source data, ground type, attenuation from barriers/buildings and atmospheric information. The model predicts noise levels at the potentially affected receivers. Two scenarios were adopted for the NIA:

- Modelling Scenario 1: was adopted to represent noise emissions during operation at the quarry within Cell 1, this is the closest cell to surrounding receivers and is a worst case scenario with drill, dozer and haul truck operating at surface of existing topography. Further detail of the assessment methodology is provided in Section 4 of (MAC, 2022) (refer to **Appendix 10**).
- Modelling Scenario 2: was completed to represent noise emissions during operation at the quarry within Cell 2. It was assessed as receivers to the west (R16–R19) may experience source to receiver winds under prevailing meteorology (east and northeast winds).

Traffic Noise Parameters

The NIA considered a worst-case scenario of 180 proposed truck movements per day (an increase from the maximum approved 100 truck movements per day) travelling to and from the east along Sewells Creek Road. The minimum receiver setback of 15 m from the road has been used.

Meteorological Analysis

Noise can be increased at a receiver when wind is at low velocities and travels from the direction of the noise source, and with the presence of temperature inversions. To account for potential enhancements, the NPfI specifies that the source to the receiver wind component speeds up to 3 m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions. To determine the meteorological history of the Quarry, weather data from November 2018 to November 2020 was obtained from the Mount Boyce Automatic Weather Station. The data was analysed in the NIA using the EPA's Noise Enhancement Wind Analysis program to determine the frequency of wind speeds up to 3 m/s in each season (MAC, 2022). The detailed meteorological analysis is presented in *Appendix B* of the NIA (MAC, 2022).

5.3.5 Noise Management Measures

The noise controls, safeguards and management measures identified in the Quarry Acoustic Management Plan (AMP) (refer to **Appendix 5**) would continue to be implemented at the Quarry.

In addition, the Application would implement of the standard mitigation strategies listed in the DCNG (EPA, 2022) as recommended by MAC (2022) and presented in **Table 5.12**.

Table 5.12 Mitigation Measure Levels

Mitigation Level	Mitigation Measures
Standard Mitigation	• Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers. • Training (of employees to conduct quieter work practices). • Equipment which is used intermittently is to be shut down when not in use. • Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers. • Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers. • The quietest suitable machinery reasonably available will be selected for each work activity. • Avoid queuing of vehicles adjacent to any receivers. • Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers. • Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm. • Minimising the need for reversing or movement alarms.

5.3.6 Assessment of Impacts

5.3.6.1 Operations

Table 5.13 presents the predicted noise levels at the residential receivers surrounding the Quarry Site during calm and prevailing meteorological conditions. Contours maps which presents interpolated images of noise levels surrounding the Quarry are provided in *Appendix C* of MAC (2020) (refer to **Appendix 10**).

Table 5.13 Predicted Operational Noise Levels

Receiver	Predicted Operational Noise Level $LA_{eq(15min)}$ (dB(A))			
	Calm – Day[1]		Worst-case Meteorology[2]	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
R2	29	34	29	34
R4	27	33	27	33
R6	29	33	29	33
R9	30	32	30	35
R11	30	32	31	34
R12	33	33	35	35
R13	37	35	39	36
R16	36	32	38	34
R17	33	28	35	30
R18	28	28	30	26
R19	30	26	32	28

Note [1]: Day period is 7 am to 6 pm, evening is 6 pm to 10 pm, night period is 10 pm to 7 am.

Note [2]: Based on the highest predicted noise levels during either prevailing winds or inversion meteorological conditions.

Source: Modified after MAC (2022) – Table 10.

The results of the predictive modelling show that noise emissions from the Quarry satisfy the PNTL at all residential receivers, for each operational scenario under both calm and worst-case (noise enhancing) meteorological conditions.

5.3.6.2 Construction Noise

MAC (2022) predicts construction noise levels to exceed the established NMLs by 10 dB during worst case noise-enhancing meteorological conditions at the closest receiver (R13) (see **Table 5.14**). Construction noise at all other receivers is predicted to remain below the NML criteria.

Table 5.14 Predicted Noise Levels from Construction (dB $LA_{eq(15min)}$)

Receiver	Worst Case Construction Predictions	NML
R2	<30	40
R4	<30	40
R6	<30	40
R9	<30	40
R11	<30	40
R12	32	40
R13	50	40
R16	30	40
R17	<30	40
R18	<30	40
R19	<30	40

Source: Modified after MAC (2022) – Table 11.

Notably, the exceedance at R13 is a result of construction noise associated with an upgrade to the Quarry Entrance and Site Access Road which has now been completed. As such, construction noise levels would replicate those received at other receivers, i.e. <32 dB(A).

5.3.6.3 Road Traffic Noise

Road traffic noise modelling predicts that for receivers at the minimum distance from the road (15 m), noise received would remain below the assessment criteria. Results are presented in **Table 5.15**.

Table 5.15 Operational Road Traffic Noise Levels (dB $LA_{eq(15min)}$)

Distance to Nearest Receiver	Assessment Criteria	Current Noise (100 movements)	Predicted Noise (180 movements)	Relative Increase
15	60	47.5	50.1	2.6

Source: Modified after MAC (2022) – Table 13.

5.3.7 Key Summary

The key points of the Noise Impact Assessment are outlined below:

- The Quarry is the only significant industrial noise in the area with other minor noise generators also present. Sensitive receivers' areas are also likely to be impacted by noise generation caused by the Proposed Modification.
- The assessed noise impacts of the Proposed Modification are all predicted to be below the relevant criteria.
- Any adverse environmental impact of noise caused by the Proposed Modification is expected to be mitigated by the management measures outlined.

5.4 Traffic

5.4.1 Introduction

A Traffic Impact Assessment (TIA) (**Appendix 11**) has been prepared by Cardno (now Stantec) (Stantec) to assess the potential impacts of the Proposed Modification (Stantec, 2022). The TIA provides:

- A review of existing transport network conditions.
- An estimate of the traffic generated by the proposed development including likely distribution.
- Analysis of the development's impact on the surrounding road network and intersection network at the design year including impacts on capacity, condition, safety and efficiency.

5.4.2 Existing Environment

5.4.2.1 Local Roads

The Quarry entrance lies on Sewells Creek Road with Mayfield Road intersecting 150 m to the west and Abercrombie Road intersecting 1 km to the east.

Sewells Creek Road

Sewells Creek Road is a sealed local road under the care of the Oberon Council. There are no speed limits marked, resulting in the application of the default limit of 100km/h for rural divided roads. Sewells Creek Road is a two-lane carriageway with one lane provided for in each direction, separated by a double centre line.

Mayfield Road

Mayfield Road is a sealed local road under the care of Oberon Council. There are no speed limits marked and the default rural divided road speed limit of 100km/h is applied. It is configured as a two-lane carriageway with one lane provided for each direction and a double centre line. Quarry transport operations is prohibited on Mayfield Road unless delivering to an address on Mayfield Road.

Abercrombie Road

Abercrombie Road is a sealed local road under the care of Oberon Council. The speed limit is 80 km/h. The road is configured as a sealed two-lane carriageway with one lane provided for in each direction. Abercrombie Road provides connection to the township of Oberon to the west.

5.4.2.2 Traffic Volumes

Traffic volumes for the existing road network were sourced from historical references, with the original EIS (RWC, 2017) providing a comprehensive analysis of existing traffic volumes along Abercrombie Road. The daily traffic volumes are assumed to be consistent with the RWC (2017) and are shown in **Table 5.16**.

Table 5.16 Existing Traffic Volumes

Year	Total Vehicles	Light Vehicles	Heavy Vehicles
2002	752	NA	NA
2005	694	596	98
2013	950	NA	NA
2016[1]	993	853	140
2021[1]	1070	919	151
2026[1]	1153	990	163
2031[1]	1242	1067	175
2036[1]	1338	1149	189
2041[1]	1441	1238	203
2046[1]	1553	1334	219

Note [1]: Interpolated based on assumed annual traffic increase of 1.5%.

Source: Modified after Stantec (2022) – Table 2-1.

Stantec (2022) identifies a morning and afternoon peak representing 8 to 9% of daily traffic.

5.4.2.3 Road Safety

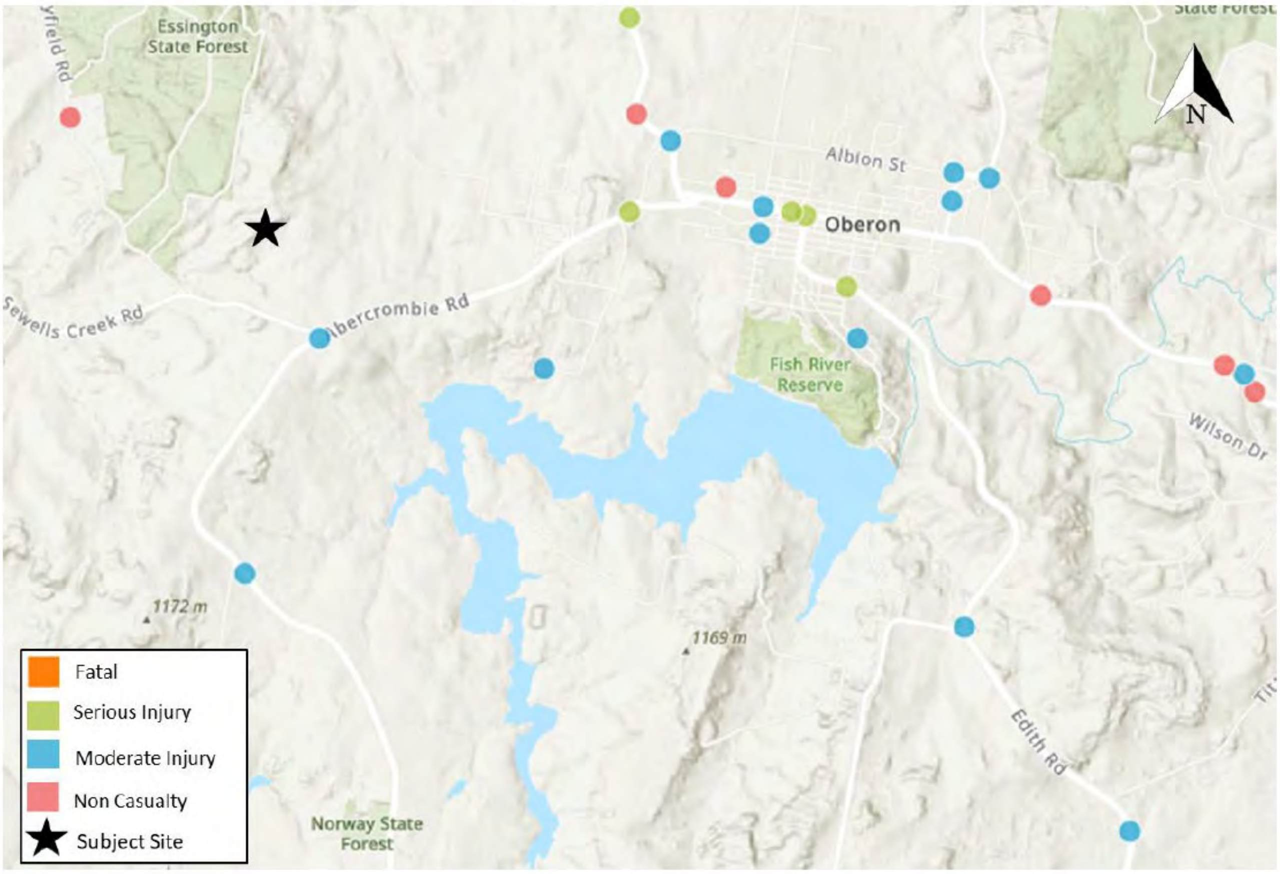
In the most recent 5-year crash history (2016–2020), one crash has occurred at the Abercrombie Road/Sewells Creek Road intersection (see **Figure 5.4**). The crash occurred in 2019 when a vehicle turning right into Sewells Creek Road collided with a through vehicle, resulting in a moderate injury.

There are no other recorded crashes in the vicinity of the Quarry, nor has any road safety deficiencies been identified (Stantec, 2022).

5.4.2.4 Traffic Projections

The Proposed Modification will increase two-way vehicle movements from 100 per day under the current approval, to 180 per day. On the basis of the Quarry hours of operation proposing to remain the same (7:00 am to 6:00 pm) (11 hours per day), this would equate to 16 to 17 vehicle movements per hour, an increase from the existing 9 to 10 vehicles per hour.

- Light vehicle traffic generation will increase from 12 to 20 vehicle movements per day to 16 to 26 vehicle movements per day.
- Peak total vehicle activity is forecast to increase from 20 to 29 vehicles.



Source: Modified after Stantec (2022) – Figure 2-3.

Figure 5.4 Crash History (2016–2020)

Baseline traffic projections for Abercrombie Road based on the current approval, are compared with forecasts for the Proposed Modification in **Table 5.17**.

Table 5.17 Baseline and Forecast Traffic Volumes – Abercrombie Road

Year	Existing Baseline (with Current Approval)			Forecast (with Proposed Modification)		
	Total	Light	Heavy	Total	Light	Heavy
2026	1253	1010	243	1323	1016	307
2031	1342	1087	255	1412	1093	319
2036	1438	1169	269	1508	1175	333
2041	1541	1258	283	1611	1264	347
2046	1653	1354	299	1723	1360	363

Source: Modified after Stantec (2022) – Table 4-1.

The Abercrombie Road forecast 2046 peak hour traffic volume is estimated to increase from 206 vehicles baseline to 214 vehicles with the Proposed Modification, which is likely to be split approximately 50/50 northbound and southbound, resulting in up to 107 vehicles in each direction (MAC, 2022). Sewells Creek Road is expected to remain low volume, with up to 100 two-way vehicles in the peak hour (MAC, 2022).

5.4.3 Traffic Management Measures

Notwithstanding the relatively minor change to local traffic proposed by the Project, and in order to ensure that the traffic and transport impacts of the Project are minimised, the following management and mitigation measures would be implemented:

- The Quarry's existing Driver Code of Conduct is proposed to remain in use and be updated to reflect any new conditions or restrictions.
- The Proponent will enforce the hours of operation for transport. Drivers who do not comply (arrive early/exit late) will be subject to further action.
- The existing levy on extracted material movement will also remain in effect and provide for ongoing road maintenance.
- The intersection of the Site Access Road and Sewells Creek Road will be regularly inspected and maintained in good working condition.
- The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.
- All vehicles will exit via the Quarry weighbridge, with overweight vehicles returned to the Stockpiling Area to have product removed. Reliance would be placed on drivers to advise the Proponent of the relevant load limits for non-Proponent owned vehicles.
- A covered load policy will be maintained to prevent loose materials falling onto the roadway or the creation of excessive dust.

The Project will result in no changes to the current site infrastructure already constructed or approved for construction. Therefore, it is anticipated that there will be no additional construction related traffic due to the Project beyond that currently approved.

5.4.4 Assessment Methodology

5.4.4.1 Intersections

Modelling of the Quarry Access Road/Sewells Creek Road and Sewells Creek Road/Abercrombie Road intersections was considered unnecessary due to the relatively low volumes of peak hour traffic which would show little or no variance in the modelling software when only minor changes are input compared to the baseline volumes.

5.4.4.2 Road Capacity

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections.

5.4.5 Assessment of Impacts

5.4.5.1 Road Capacity

Intersections

The previous upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases. This intersection will not be affected by the Proposed Modification.

The Sewells Creek Road/Abercrombie Road intersection is projected to see an increase from 14 to 19 vehicles turning right in 2046 peak hour with the Proposed Modification. The existing Basic Right (BAR) turn treatment is considered adequate for the Proposed Modification, and no further upgrade is required.

Midblock Traffic

With Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction, which is well under the capacity of the existing roads and will not require any upgrade. This is also true when considering heavy vehicle percentages for rural roads, where, up to 500 vehicles in the peak hour is considered to be good level of service (MAC, 2022).

5.4.5.2 Road Safety

Stantec (2022) notes that the increase in peak hour traffic volumes attributed to the Quarry from 20 under approved conditions, to 29 under the Proposed Modification is unlikely to have a tangible impact on the existing crash history and road safety on the public road network.

5.4.5.3 Construction Traffic

Traffic associated with minor site construction works are projected to be lower than the forecast operational traffic. Therefore, the impact of construction traffic is anticipated to be even lower than the aforementioned negligible impacts of operational traffic.

5.4.6 Key Summary

The key points of the Traffic Impact Statement are outlined below:

- The Proposed Modification will increase two-way vehicle movements from 100 per day under the current approval, to 180 per day. This would equate to 16 to 17 vehicle movements per hour, an increase from the existing 9 to 10 vehicles per hour.
- Despite the increase in traffic, the Proposed Modification is unlikely to have a tangible impact on the existing crash history and road safety of the area.
- The forecast peak hour traffic of the Proposed Modification is well under the capacity of the existing road traffic and thus no roads will require any upgrade.

5.5 Surface Water Resources

5.5.1 Introduction

The Quarry is currently operated in accordance with a Surface Water and Sediment Management Plan SWSMP (Umwelt, 2019) which provides for water use, management and monitoring of the approved operations. Noting the Proposed Modification is likely to result in a change in demand for water, and modifications to the Quarry Site layout which could affect the flow of water onto, over and off the Quarry Site, this section provides:

- a review of the hydrological setting, management issues and constraints,
- a summary of key design features, operational controls and management measures,
- an updated site water balance for approved and proposed operations (based on current and proposed production, dust suppression and water management practices), and
- an assessment of the likely impacts of the potential downstream impacts from surface water runoff.

5.5.2 Hydrological Setting

5.5.2.1 Drainage

The majority of the Quarry Site drains to the south and west into Captain Kings Creek which flows westwards from its headwaters located to the immediate east of the Quarry Site (see **Figure 5.3**). Captain Kings Creek flows in a westerly then northerly direction and discharges into Sewells Creek approximately 19km downstream. Sewells Creek discharges to the Campbells River upstream of Ben Chifley Dam, the main water supply for the city of Bathurst. The northern and eastern portions of the Quarry Site drain to the north into Middle Creek which flows to the northwest into Wisemans Creek which then discharges into the Campbells River upstream of Ben Chifley Dam (see **Figure 5.3**).

Where the construction of a new pad for the relocation of composting operations and supplementary stockpiling is proposed occurs at the headwaters of an ephemeral drainage line which flows into Captain Kings Creek to the southwest of the Quarry Site. This location was inspected by a representative of the Natural Resource Access Regulator (NRAR) in 2019 who confirmed the location did not represent waterfront land for the purposes of the WM Act.

5.5.2.2 Water Quality

There is no data available on the quality of water within Captain Kings or Middle Creeks. However, as the Quarry Site is located within the headwaters of both catchments, the water quality is expected to be good.

The criteria for any water discharged from the Quarry is provided by Condition L2.4 of EPL 21098 as follows.

- pH: 6.5 to 8.5 or within 0.5 units of existing quality.
- Total Suspended Solids (TSS): 50mg/L.
- Oils and Grease: not visible or contain more than 10mg/L grease and oil.

5.5.2.3 Flooding

The Quarry Site occurs at the headwaters of the Captain Kings Creek and Middle Creek sub-catchments of the Campbells River catchment and at an elevation where flooding is not a feature of the local or Quarry Site setting.

5.5.3 Management Issues and Constraints

5.5.3.1 Water Licensing

The Quarry Site lies within the Campbells River Water Source of the Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012 ("the Water Sharing Plan"). In accordance with Part 5, Division 2, Clause 21 of the Water Sharing Plan, Oberon Earthmoving is entitled to capture and store water sources pursuant to the harvestable rights order made under Section 53 of the *Water Management Act 2000* (WM Act). Section 53 of the WM Act permits landholders to harvest and use a portion of the total runoff from their land without requiring licence(s), provided that:

- the total capacity of the harvestable rights water storages are less than the capacity permitted under the right; and
- that all storages are constructed either off-line or on first or second order, non-spring fed streams.

Water captured within harvestable rights dams may be used for any purpose, including for extractive industry-related purposes.

Taking into account the relevant harvestable rights multiplier for the Oberon area (0.085ML/ha), the harvestable right capacity for the land to be held by Oberon Earthmoving would be approximately 11.9 ML. As nominated in the EIS for the original development application, the existing dams on the land holding (Lot 2 DP 1112479) account for a combined capacity of approximately 20 ML.

Dams exceeding the MHRDC for a land holding that were constructed before 1 January 1999 do not require a licence, although the capacity of these dams must be taken into consideration when considering the requirement to licence additional dams on the land holding. There are other exemptions from the requirement to obtain a licence for dams exceeding the MHRDC for a land holding, the most pertinent of which are dams constructed for the "capture, containment and recirculation of drainage and/or effluent", i.e. sediment basins.

On the basis that existing dams, constructed prior to 1999, with combined capacity greater than 11.9ML storage capacity occur on the land holding, only dams constructed for the purpose of managing sediment containing runoff from the Quarry Site may be constructed without licence. On completion of Quarry operations, these dams should be decommissioned and backfilled (or application to licence these under the WM Act made).

5.5.3.2 Waterfront Land

Waterfront land includes the bed and a distance inland of 40 m from a river, estuary or lake where a river is defined the *Water Management Act 2000* (WM Act) as:

a. any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and

b. any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and

c. anything declared by the regulations to be a river,

whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.

Correspondence received from NRAR in 2019 confirms that the proposed extension to the disturbance footprint of the Quarry would not impact on waterfront land, and therefore no Controlled Activity Approval (CAA) is required (in accordance with Section 91(2) of the WM Act).

5.5.3.3 Erosion and Sedimentation

As noted in the original EIS, the soils of the Oberon Soil Landscape are not noted as being especially erodible or of high erosion hazard (RWC, 2017). However, in the absence of appropriate controls the clearing of groundcover and stripping of surface soils associated with the Proposed Modification is likely to result in an elevated risk of erosion which could lead to discharges of sediment resulting in pollution of the ephemeral streams which discharge into Captain Kings Creek. This would be contrary to the objectives of Quarry SWSMP (Umwelt 2019), as well as the general objectives of Oberon Earthmoving to manage the Proposed Modification in a way which minimises impact on the environment, and Section 120 of the POEO Act.

5.5.4 Controls, Safeguards and Management Measures

5.5.4.1 Objectives

The principal objectives for management of surface runoff on and from the Quarry would be as follows.

- To ensure sufficient water is retained for use in dust suppression and processing.
- To divert run-off up-slope of disturbed areas (“clean water”) to natural drainage unaffected by the Quarry.
- To control run-off over areas of disturbance (‘dirty water’) and prevent discharge off the Quarry until settlement of suspended sediments has occurred.
- To manage the use, storage and, in the event of a spillage, control and clean-up of hydrocarbons.

Section 5.5.4.2 to **Section 5.5.4.5** describe the proposed water management controls that would be implemented within and around the main areas of disturbance on the Quarry Site.

5.5.4.2 Erosion and Sediment Controls

Figure 5.5 provides an illustration of the erosion and sediment control structures for the Quarry Site (identifying the additional or modified structures Proposed Modification). The following sub-sections describe the critical features and/or conceptual design specifications for these features. **Appendix 14** provides copies of the Blue Book SDs referenced throughout this sub-section.

Clean Water Diversion Drains

Upslope of any disturbance, a series of low flow earth banks would be progressively constructed to divert clean water away from the developing extraction area. As these would only be required for short periods ahead of extraction, these would be constructed in accordance with SD 5-5 of the Blue Book (see **Appendix 14**). At the discharge point of each diversion drain, a level spreader would be constructed (as recommended by SD 5-6 – see **Figure 5.6**). The level spreader provides a flat discharge zone from the drain with a minimum width of 4 m.

Dirty Water Collection Drains

A series of low flow earth banks would be progressively constructed downslope of the extraction area as it is progressively developed. Also constructed in accordance with SD 5-5 of the Blue Book (see **Appendix 14**), these drains would capture and divert the dirty water into a series of progressively constructed sediment basins. The design features of the drain would be the same as described for the up-slope clean water drains, although level spreaders would not be required as any discharge would be from the relevant sediment basin.

Sediment Basins

A series of sediment basins (SB-1 to SB-6) would be constructed to accept drainage from disturbed areas of the progressively developed extraction area. SB-1 is an upgrade of an existing sediment basin to account for an increased disturbance area. SB-2 to SB-6 would be constructed progressively ahead of disturbance within the relevant catchment.

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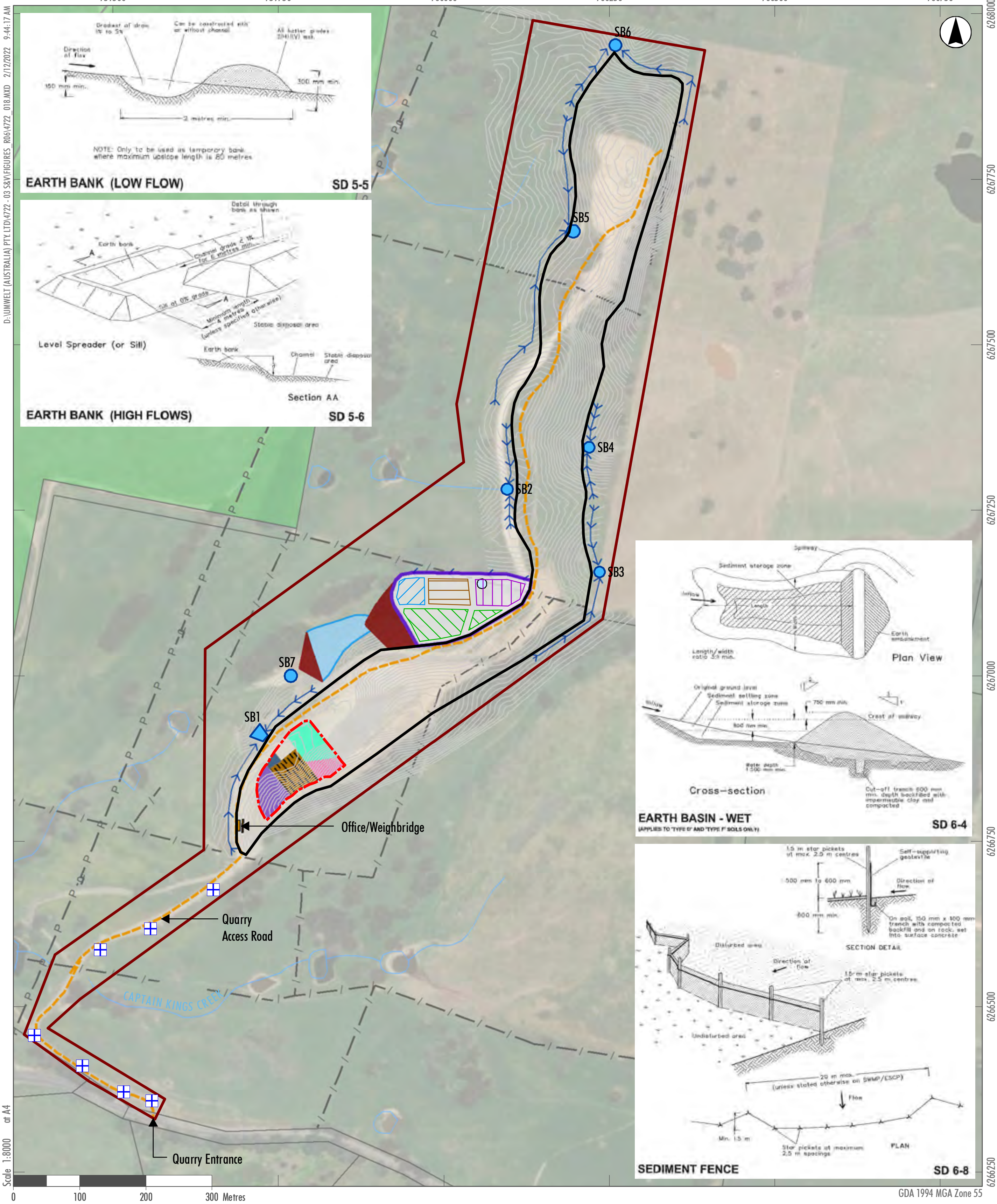

GDA 1994 MGA Zone 55

Legend

- Quarry Site Boundary
- Approved Extraction Area
- Initial Resource Recovery and Processing Area
- Office
- Weighbridge
- Collection Sump (900mm @ 1×10^{-9} m/s)
- Compost and Mulch Product Storage
- Windrow Composting
- Mulch Storage
- VENM, ENM and Treated Drilling Mud Storage
- Existing Roads
- Mire Drain
- Diversion Drains (SD 5-5)
- Sediment Fence (SD 6-8)
- Sediment Basin (SD 6-4)
- Fence
- Power Line and Staunchion
- Contours (1m)
- Watercourse / drainage line
- Batter Slope
- Composting Area
- Pollution Control Dam
- Collection Sump
- Compost and Mulch Products
- Mulch Storage
- Windrow Composting
- Water Tank 2.7ML

FIGURE 5.5

Surface Water Management

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

Note: 1. Indicative location for initial extraction in cell 2

2. The standard drawing in full, including construction notes, are provided in Application 14

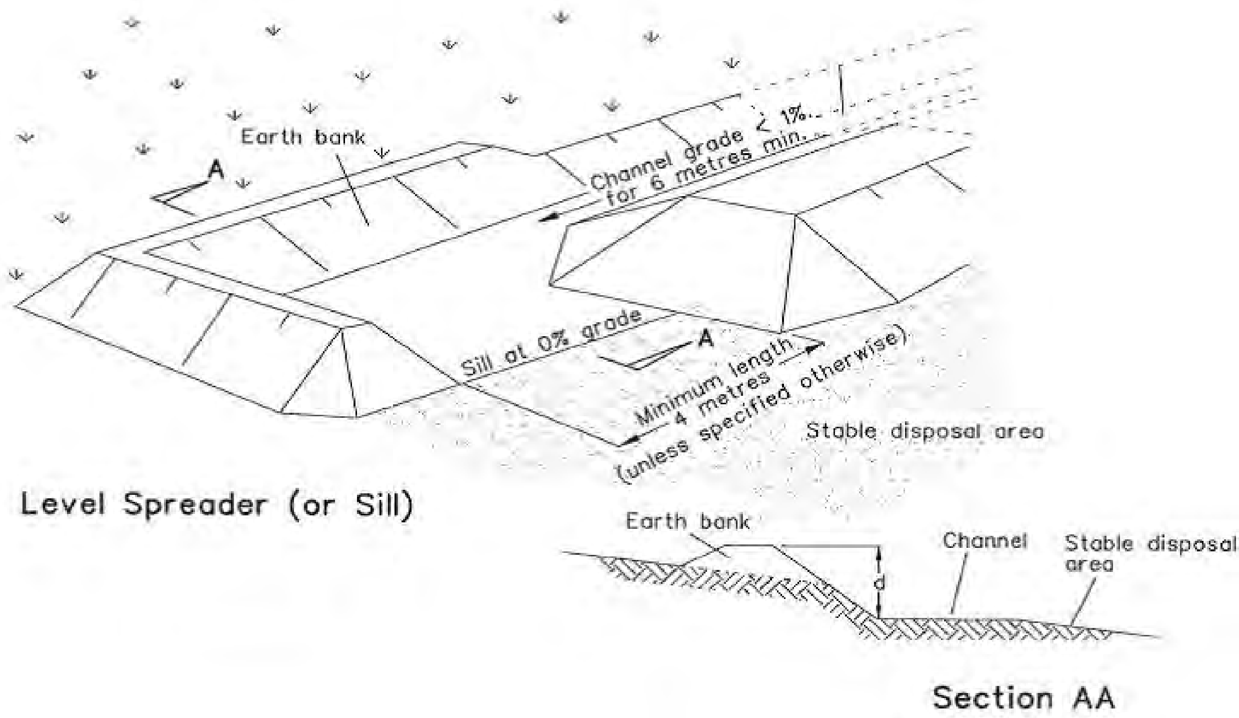

Figure 5.6 Level Spreader: Standard Drawing Specifications

Source: Modified after SD 5-6 of the Blue Book, Figure 4.8.

While local soils are not highly dispersive (RWC, 2017), there is a relatively high content of fines and as a consequence the sediment basins would be constructed as wet earth basins in accordance with SD 6-4 of the Blue Book (see **Figure 5.6** and **Appendix 14**). In determining the minimum storage capacity for each basin (see **Table 5.18**), the maximum disturbance area within the catchment for each has been assumed as well as the following parameters.

- Erodibility (K) Factor of 0.05[3].
- Soil Hydrologic Group D[4].
- Volumetric Runoff Coefficient (C_v) of 0.64.
- Design rainfall event 5-day 90th percentile rainfall conditions[5] (37.8mm)[6].

[3] Volume 2E of the Blue Book (DECC, 2008b) nominates default value of 0.05 when specific data is not available.

[4] While there may be significant areas of the extraction area where rehabilitation is more likely to display properties of Soil Hydrologic Groups C or even B, the use of Group D provides for a conservative assessment of possible runoff.

[5] Volume 2E of the Blue Book (DECC, 2008b) nominates 5-day 90th percentile conditions for non-sensitive receiving environments. While Captain Kings Creek and Middle Creek ultimately discharge into Ben Chifley Dam, which provide town water supply to Bathurst, this is too far downstream (<19km) to be considered direct discharge to a drinking water supply.

[6] While Bathurst is the closest meteorological station which provides the required 100 year data set to establish 5-day percentile rainfall events, Lithgow is considered a more equivalent location based on similarity of mean rainfall (between Lithgow and Oberon).

Table 5.18 Sediment Basins

Basin	Maximum Catchment (ha)	Minimum Water Settlement Zone (m^3)	Minimum Sediment Storage Zone (m^3)	Minimum Basin Capacity (m^3)
Existing Structures				
SB-3	1.5	363	36	399
SB-4	2.3	556	63	619
SB-5*	1.6	387	26	413
SB-6*	1.7	411	26	437
Modified and Additional Structures				
SB-1	1.0	242	121	363
SB-2	0.3	73	36	109
SB-7	2.15	520	260	780

*Note *: Constructed.*

Appendix 15 provides the calculation sheets used to determine the minimum capacity requirement for modified and additional sediment basins under 5-day 90th percentile rainfall conditions.

Sediment Fencing

Immediately downslope of stockpiles of erodible materials, temporary disturbance areas or areas of rehabilitation prior to the establishment of groundcover, sediment fencing would be installed in accordance with SD 6-8 of the Blue Book.

The sediment fencing would be inspected at least monthly, or following significant rainfall event, with accumulated sediment or vegetation removed and repairs made as required. Once an established cover of grass is achieved, or the stockpile removed, the sediment fencing would be removed and/or relocated to another site to avoid the potential that this might be washed from the Quarry Site at a later date and pollute downstream waters and aquatic habitats.

5.5.4.3 Organics and Composting Area Management

Once relocated, the area for the management of woody waste, mulch and composting activities would be operated based on the same principals nominated in the Quarry Waste Receival, Handling and Compost Management Plan (WRHCMP), i.e. as a nil discharge area of the Quarry Site.

A low bund wall (Containment Bund) of at least 0.5m in height above the most elevated point of the Composting Area would be constructed. This exceeds the 72 hour 1% Annual Exceedance Probability (AEP) rainfall for the location (3.10 mm/hr – as calculated by the Bureau of Meteorology's Design Rainfall Data System (2016)[7] of 223 mm (<0.25 m).

[7] http://www.bom.gov.au/water/designRainfalls/revised-ifd/ - accessed on 9 November 2022.

Runoff on the new pad would be directed to a Collection Sump with a capacity of approximately 2,000 kL. This volume would provide sufficient capacity for runoff generated by a 24 hour 1 in 100 ARI rainfall event (5.58 mm/hr) based on a catchment area of 0.6ha and conservative runoff coefficient of 0.7. The Collection Sump would be lined with an impermeable liner, e.g. HDPE sheeting, or at least 900 mm compacted clay liner with a permeability of less than 1 x 10^{-9} m/s. In the event of a rainfall event generating runoff in excess of 2,000 kL, this water would be directed to the downstream PCD via a rock-line spillway.

The PCD would be constructed with a compacted earth lining of at least 1 m (1,000 mm) achieving a permeability of 1 x 10^{-7} m/s or less. With parameters of approximately 50 m x 80 m x 4 m (average), the PCD woold have a maximum capacity of approximately 16,000 m^3 (16 ML). While used to store water captured within the extraction area and sediment basins during high rainfall events, an effective capacity of at least 3 ML will be maintained to accept and store any overflows from the Collection Sump.

Water for periodic wetting / cooling imported mulch, composting wind rows and mulch/compost products, as well as for general dust suppression on the new pad would be sourced from a water tank to be installed on the new pad (indicative location identified on **Figure 3.2**). With a nominal capacity of 2.7 ML (which is subject to change based on availability at the time), this would receive water either from the PCD or groundwater extracted under licence from Oberon Earthmoving's land holding.

5.5.4.4 Hydrocarbon Contamination

Only small quantities of oils and lubricants would be stored on the Quarry Site. Refuelling of equipment would be by a service truck brought to the Quarry Site as required with refuelling undertaken away from natural or artificial drainage lines.

In the event of a hydrocarbon leak or spill, Oberon Earthmoving would implement the following spill management procedure.

- Phase 1 – Source Control: isolate the source of spill or leak and stop the leak either by maintenance or placing the leaking item within or over the fuel/oil storage area.
- Phase 2 – Recovery: recover as much as possible at the source by pumping free hydrocarbon from the surface and excavating hydrocarbon-contaminated materials. Contaminated materials would be stockpiled on site under cover and on an impermeable surface, e.g. a high-density polyethylene sheet. This material would later be bio-remediated on site and/or transported to an approved waste facility.
- Phase 3 – Remediation: transport the contaminated material to a designated area within the Quarry Site (away from natural or created drainage) for on-site bio-remediation (land farming) or to a facility licensed to accept and treat hydrocarbon contaminated material.

5.5.4.5 Final Landform

Figure 3.2 presents the proposed final landform of the Quarry Site, illustrating the integration of retained extraction batters, moderate slopes of up to 30° and flatter area of less than 10°. All clean water diversions would be removed as there would be no significant natural flow towards the final landform.

The sediment basins and associated diversion drains would be progressively decommissioned as the disturbance either moves below surface or rehabilitation is completed within the affected catchment.
In order to prevent waterlogging within the retained void area, dams would be constructed across this part of the landform to retain any rainfall and runoff.

On cessation of composting, the material of the Containment Bund would be used to backfill the Containment Sump and the natural drainage to the north (towards the tributary of Captain Kings Creek) reinstated.

Given the natural evaporative rate exceeds rainfall, the fact that the final landform being above the local groundwater table, and the likely localised fracturing of the rock below the extraction area (as a result of blasting) it is expected that water will only accumulate for relatively short periods following significant rainfall.

5.5.5 Assessment of Impacts

5.5.5.1 Site Water Security

Water Use

The primary use of water on the Quarry Site would be for:

- dust suppression of roads, stockpiles and hardstand surfaces
- dust suppression associated with crushing and screening activities
- application of water to imported mulches, composting windrows and mulch/compost products, and
- washing of products to meet customer requirements.

The following outlines likely water usage considering production levels approaching maximum.

<u>Dust Suppression – Roads / Hardstand</u>

Based on an average water application rate of 20 kL per day during dry dust generating conditions (no rainfall), which occur 70% of the year in the local setting (see **Table 5.1**), the volume of water required for dust suppression would approximate 5 000 kL (5 ML).

<u>Dust Suppression – Crushing</u>

Water application at transfer points of crushing operations would approximately 5 L/t. Based on crushing of 30,000 tpa, this equates to 150 kL, i.e. <1 ML per year.

<u>Water Application – Composting</u>

The preparation of compost can require up to 50% water by weight of composted material. Therefore, at maximum composting rate (25,000 t per year), the annual water usage is expected to be up to 12.5 ML. Notably, the actual volume require will vary depending on the material to be composted, product requirements and weather conditions with 12.5 ML considered as an upper range estimate.

<u>Washing</u>

As noted in **Section 3.2**, the washing circuit is expected to require between 500 and 1,500 L of water per tonne of washed material, with the application rate varying depending on the product requirements, as well as the fines proportion of the rock and sand to be washed. For example a light washing of gravel, as considered in the original EIS (RWC, 2017) would require the addition of 500 L of water or less, whereas washing of fine aggregates or sand could require up to 1,500 L/t. Estimates for water use are based on an average water requirement of 1,000 L/t.

Based on the production of 50,000 t of washed products, and a water recycling rate of 80%, up to 15 ML of water would be required for washing. This represents approximately 10x the water requirements previously estimated for washing of Quarry gravels.

Total Annual Water Requirement

While likely to vary from year to year depending on meteorological and operational factors, the maximum on-site water requirement (excluding potable water) would be 33.5 ML.

Water Availability

The water required for dust suppression and washing would be sourced from the following sources:

1. Surface runoff captured within the Quarry sediment basins, extraction areas and hardstand surfaces and pumped to the PCD. The PCD would provide storage capacity for an additional 13 ML of water (noting that freeboard of 3 ML would be maintained to provide supplementary storage of any overflow from the relocated Composting Area).
2. Extraction of groundwater under licence (up to 50 ML from the Lachlan Fold Belt Groundwater Source of the Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan) which would be periodically pumped to a water tank to be installed on the new pad.

Conclusion

On the basis that groundwater of up to 50 ML may be extracted under licence with the PCD and Composting Area Water Tank to provide a repository for this water, Oberon Earthmoving demonstrates security of water supply for the proposed activities.

Notably, the requirement to rely upon this as a source of water is likely to be limited to extended dry periods as water accumulated in the extraction area and sediment basins would be transferred as required to the PCD for ongoing supply to dust suppression and washing activities.

5.5.5.2 Water Quality

Construction and installation of erosion and sediment controls as described in **Section 5.5.4.2** would ensure that all clean water is diverted away from areas of active disturbance and any additional rainfall and runoff within the areas of active disturbance is captured and used for dust suppression on the Quarry Site.

The storage and composting of mulch would be undertaken within an area of the Quarry Site segregated from receiving waters, with any runoff directed to, and retained within a (practically) impermeable sump. As a result, any leachate from these stockpiles which could contain elevated concentrations of organic or other pollutants would be captured and prevented from discharge. Furthermore, the lining of the Collection Sump on the relocated composting area, and PCD as a secondary control in the event of an overflow from the Composting Area, would ensure that the potential for discharge of water affected by mulch or compost is minimised.

Sand washing and concrete crushing would be undertaken below natural surface levels such that runoff from these areas is contained and only discharge to the PCD where sufficient freeboard is maintained to prevent discharge from this structure.

The potential for hydrocarbon contamination of runoff would be minimised through the operation of an oil/water separator within the nominated refuelling and maintenance areas, and careful management of refuelling elsewhere on the Quarry Site (with contingency measures implemented immediately in the event of spill or leak).

5.5.6 Monitoring and Corrective Actions

Prior to any discharge of water from the Quarry sediment basins, other than as a result of rainfall exceeding the 5-day 90th percentile design specifications of each sediment basin (see **Table 5.18**), a sample of the water would be taken and analysed by a NATA accredited laboratory to confirm compliance with pH, TSS and Oil and Grease parameters. On satisfaction of the nominated limits (see **Section 5.5.2.2**), water would be discharged.

Should the water quality fail to meet the nominated limits, discharge would be delayed until the water is treated to address the specific water quality issue. In the case of elevated TSS, an EPA accredited flocculent may be added to assist in settling out any fine or dispersive sediments. Based on the soil types of the Oberon soil landscape, it is possible pH may be slightly lower than the nominated limits, in which case a pH modifier such as lime or gypsum may be added to raise the pH.

5.5.7 Key Summary

The below outlines key points of this Surface Water Resources section:

- The maximum on-site water requirement (excluding potable water) would be 33.5 ML.
- On the basis that groundwater of up to 50 ML may be extracted under licence with the PCD and Composting Area Water Tank to provide a repository for this water, Oberon Earthmoving demonstrates security of water supply for the proposed activities.
- Any adverse environmental effects relating to surface water will be mitigated by the management measures featured above.

5.6 Groundwater Resources

5.6.1 Local Setting

The original EIS for the Quarry (RWC, 2017) established the local groundwater table as occurring below the maximum depth of extraction. Notably, extraction within Cell 1 of the Quarry has now approached the nominated maximum depth without encountering groundwater confirming this assessment.

5.6.2 Groundwater Management Issues

Groundwater is expected to occur below the proposed maximum depth of extraction and is therefore unlikely to be encountered as a result of the proposed quarry extension.

No Groundwater Dependent Ecosystems are mapped or expected on the Quarry Site. As discussed in RWC (2017), while Captain Kings Creek has been identified as having high potential for groundwater interaction, the lack of interaction between the extraction zone and local groundwater resources indicates the Quarry would have limited if any impact on groundwater expression to the creek.

On the basis that there is unlikely to be any direct impact of the Proposed Modification on groundwater or GDEs, the only identified groundwater-related management issue would be the potential contamination of local groundwater as a result of contaminants leaching from imported materials.

5.6.3 Design Features, Management Measures and Operational Controls

5.6.3.1 Groundwater Quantity

In the unlikely event that groundwater is encountered during extraction activities, work would be ceased immediately in that section of the Quarry and consultation with DPE-Water would be undertaken to identify the appropriate mitigation measures to ensure the operations continue to comply with all licencing requirements. Notably, Oberon Earthmoving holds a WAL for the Lachlan Fold Belt Groundwater Source (50 ML) and so can account for any inadvertent 'take' of groundwater should it occur.

5.6.3.2 Groundwater Quality

As discussed in **Section 5.5.4.3**, leachate from mulch and composts would be directed to an impermeable sump, preventing this from forming a component of recharge to the aquifers below.

No significant volume of hydrocarbons would be stored on the Quarry Site and **Section 5.5.4.4** documents the emergency spill procedures that would be implemented as required to minimise any contamination.

In the event that a hydrocarbon spill occurs, the contaminated material would be excavated and either treated by bioremediation or disposed of at a licenced waste facility.

5.6.4 Assessment of Impact

On the basis that the Proposed Modification does not introduce any additional sources of groundwater contamination and the continued implementation of controls to prevent impacts on groundwater from organic leachate or hydrocarbons, no further risk of impact is introduced by the Proposed Modification.

5.6.5 Key Summary

The key points of this Groundwater Resources section are featured below:

- Groundwater is expected to occur below the proposed maximum depth of extraction and is therefore unlikely to be encountered as a result of the proposed quarry extension.
- No Groundwater Dependent Ecosystems are mapped or expected on the Quarry Site. The Quarry would have limited if any impact on groundwater expression to Captains Kings Creek.
- The only identified groundwater-related management issue would be the potential contamination of local groundwater as a result of contaminants leaching from imported materials.
- On the basis that the Proposed Modification does not introduce any additional sources of groundwater contamination and the continued implementation of controls to prevent impacts on groundwater from organic leachate or hydrocarbons, no further risk of impact is introduced by the Proposed Modification.

5.7 Waste

5.7.1 Introduction

Two principal changes to the management of waste are proposed by the modification.

1. Waste concrete would be imported, stockpiled and crushed on the Quarry Site before being blended with quarried rock or sold directly as an aggregate product.
2. The locations of approved waste management activities (composting and clean fill management) would be modified.

5.7.2 Waste Management and Contingencies

VENM, ENM, Treated Drilling Mud and Organic Waste (Mulch) would be managed in accordance with the Quarry WRHCMP (refer to **Appendix 3**).

The following provides key management controls and contingency measures for the receival, storage and management of waste concrete.

- Concrete would only be accepted where the source of the material can be confirmed.
- Concrete would only be accepted where it is confirmed as not containing asbestos.
- Oberon Earthmoving would require suppliers to complete a chain of custody equivalent to *Table 5.5* of the Quarry WRHCMP.
- Each load of concrete would be inspected by the Quarry manager (or delegate) to verify the material supplied.
    - If any non-complying material is observed or suspected in the truck prior to tipping, the load would be held and the material supplier contacted. If the observed or suspected material cannot be verified at this time, reject the load.
    - If any non-complying material is identified after the load is tipped, the material would be isolated from other material using appropriate controls and the material supplier contacted. The material would be reloaded and returned to the material supplier.
- Load sheets (or equivalent would be provided by the supplier to Oberon Earthmoving for record keeping and to control the total volume of material received.
- Concrete storage and crushing would be undertaken in a contained area of the Quarry such that no uncontrolled runoff flows to natura drainage. Prior to discharge of water from the storage area to Quarry sediment basins, the pH of the water would be tested and confirmed as meeting Quarry discharge limits.

5.7.3 Assessment of Impact

5.7.3.1 Potential Pollution

Waste generated by on-site extraction and other activities would be managed appropriately and assuming adherence to the management and contingency measures nominated in the Quarry WRHCMP and **Section 5.7.2**, should not pose significant risk of pollution to the surrounding environment.

It is recommended that the Quarry WRHCMP and Pollution Incident Management Response Plan are updated to include management of waste concrete.

5.7.3.2 Biosecurity

No additional materials presenting a biosecurity risk would be imported to the Quarry and as such the Proposed Modification does not increase the risk posed by the Quarry (which was assessed as negligible to low risk as part of the original EIS (RWC, 2017)).

5.7.4 Key Summary

The below outlines the key points of this waste section:

- Two principal changes to the management of waste are proposed by the modification.
  - Waste concrete would be imported, stockpiled and crushed on the Quarry Site before being blended with quarried rock or sold directly as an aggregate product.
  - The locations of approved waste management activities (composting and clean fill management) would be modified.
- It is recommended that the Quarry WRHCMP and Pollution Incident Management Response Plan are updated to include management of waste concrete.
- Management measures would ensure any adverse environmental impacts are mitigated.

5.8 Biodiversity

5.8.1 Introduction

A Biodiversity Assessment has been undertaken by AREA Environmental & Heritage Consultants (AREA) to assess the impacts of the Proposed Modification under the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Biosecurity Act 2015*.

The Biodiversity Assessment Report (BAR) (AREA, 2022a) has considered the additional disturbance and clearing that is required for the Proposed Modification and the detailed assessment is provided in **Appendix 12**. AREA (2022a) is supplemented by a letter report (also by AREA) reviewing the application of the State Environment Planning Policy Koala Habitat Protection 2020 (Koala SEPP) to the Proposed Modification AREA (2022b).

5.8.2 Existing Environment

The Quarry Site is located within land that is zoned for primary production and has been extensively grazed and cleared. There are fragmented patches of native vegetation within Lot 2 DP1112479 and the Essington State Forest, a monocultural softwood pine forest plantation, lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

The Proposed Modification is located within the South Eastern Highlands (Interim Biogeographic Regionalisation for Australia (IBRA) 7) and the Oberon Subregion. The South Eastern Highlands Bioregion lies just inland from the coastal bioregions of the South East Corner and the Sydney Basin, bounded by the Australian Alps and South Western Slopes bioregions to the south and west. The bioregion includes most of the ACT and extends south into Victoria.

The Oberon Subregion consists of fine-grained Silurian and Devonian slates, shales, and sandstones with Ordovician acid volcanics and typical soils consist of red and yellow texture contrast soils on slopes, well-structured deep red loams on basalt. The subregion has moderately fertile soils and vegetation is typically narrow-leaved peppermint, mountain gum and some snow gum on high areas and Apple box, yellow box, ribbon gum and Blakely's red gum in the west.

The Proposed Modification Site occurs entirely within the Rockley Plains NSW Landscape (Mitchell, 2002). Vegetation of this NSW Landscape is typically categorised by mixed eucalyptus forest and woodlands including peppermints (*Eucalyptus sp.*), stringybark (*Eucalyptus sp*.), candlebark (*Eucalyptus rubida*), brittle gum (*Eucalyptus mannifera*) and snow gum (*Eucalyptus pauciflora*).

5.8.3 Assessment Criteria

The minimum lot size for the Proposed Modification Site is 100 hectares. The total impact to native vegetation from the Proposed Modification is less than one hectare, therefore in accordance with Section 7.2 of the *Biodiversity Conservation Regulation 2017* the proposal does not trigger assessment by the Biodiversity Assessment Method under the area threshold.

Also, there will be no impact to land mapped on the Biodiversity Values Map as defined by clause 7.3(3) of the *Biodiversity Conservation Regulation 2017* or an area of outstanding biodiversity value. This is further discussed in **Section 5.8.6**.

5.8.4 Assessment Methodology

This BAR was completed by appropriately qualified and experienced ecologists as provided in **Appendix 12**.

5.8.4.1 Desktop Assessment

This BAR included a desktop assessment of threatened species databases and considered state and Commonwealth environmental classifications. The database searches included a review of the following:

- BioNet Atlas of NSW Wildlife Database.
- NSW Department of Primary Industries (DPI) Council and Developer Toolkit.
- Department of Agriculture, Water and the Environment's Protected Matters Search Tool.
- Critical habitat registers available on the:
  - NSW Environment, Energy and Science (EES) website
  - DPI NSW (Fisheries)
  - Department of Agriculture, Water and the Environment's website.
- EES vegetation information system (VIS) database.
- Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE).
- Department of Agriculture, Water and the Environment's directory of important wetlands.
- Department of Planning, Infrastructure and Environment's SEPP (Coastal management) 2018 spatial data.
- DPI's database for aquatic Threatened Ecological Communities.
- Native Vegetation Regulatory Map.
- Biodiversity Values Map.

5.8.4.2 Ecological Survey

A field assessment occurred on 28 July 2020 and was conducted by Managing Director, Phillip Cameron and Environmental Research Assistant, Alex Cameron of AREA. Field surveys ground-truthed the results of the background research and assessed habitat values. As such, any threatened species, populations, or communities that are considered likely to occur within the development footprint were targeted during the field survey to determine presence or likely occurrence.

Survey included identification and mapping of plant community types, threatened species searches, habitat identification and weed/pest identification. The day was spent completing vegetation plots, mapping vegetation, walking search transects and inspecting all habitat trees in the development footprint.

All relevant threatened species identified to have a potential to occur within the Proposed Modification Site, were taken into consideration when assessing the impact of the Proposed Modification. Threatened fauna species searches involved searching for signs of resident microbat populations, looking for tell-tale marks of koala on trees and observing any birds and reptiles. The development footprint was also searched for fauna habitat values.

No aquatic surveys were conducted as part of the assessment as no aquatic environs occur in the study area.

5.8.5 Biodiversity Management and Mitigation Measures

Removal of vegetation will be avoided where reasonably practicable and is limited to isolated paddock trees. Larger areas of intact vegetation will not be impacted. Landscape and visual screen planting will assist in offsetting the loss of vegetation.

Where impact to the environment cannot be avoided, safeguards will be implemented to mitigate these impacts during construction and operation. Safeguards recommended to be implemented include:

- Native vegetation removal will be minimised through detailed design. Exclusion zones will be set up at the limit of clearing.
- Native vegetation will be re-established in areas disturbed by the proposal and not occupied by operational needs once the proposal has been completed.
- Pre-clearing inspections will be undertaken prior to the removal of vegetation. Where hollow-bearing trees, logs or stags which could contain native fauna are to be removed, clearing will be undertaken under the supervision of an ecologist or other qualified expert.
- Clearing will be undertaken preferentially in winter outside of many fauna species breeding season that are likely to use hollows.
- Aquatic impacts will be minimised through detailed project design. Follow NSW DPI Publication - Controlled Activities on Waterfront Land:
    - Guidelines for instream works on waterfront land
    - Guidelines for vegetation management plans on waterfront land
    - Guidelines for water crossings on waterfront land.
- Connectivity impacts will be minimised through detail design. Landscape and visual screen planting will assist with joining previously fragmented patches of vegetation.
- Fauna will be managed in accordance with attached guidelines and procedures. The fauna handling and rescue procedure is to be referred to if required.
- Weed species in the development footprint will be managed, and disposed of accordingly, with attention to the significant weeds (Weeds of National Significance and High Threat Exotic species).
- Pest species are unlikely to be encountered during the proposal. If pest invasion occurs during the proposal, the animal/s should be removed if possible.
- Pathogens such as *Phytophthora cinnamomi* will be managed by implementing precaution such as washing down equipment prior to commencing the proposal.

- Handling of frogs encountered during proposal will be done only if necessary, and always in accordance with safe frog handling procedures to prevent the spread of Chytridiomycosis (Amphibian Chytrid Fungus Disease). See fact sheets such as available at: https://www.environment.gov.au/system/files/resources/279bf387-09e0-433f-8973-3e18158febb6/files/c-disease_1.pdf

5.8.6 Assessment of Impacts

5.8.6.1 Native Vegetation

The field survey conducted found the native vegetation in the Quarry Site is a dry sclerophyll forest with a mostly absent shrub layer and dense grassy, highly weedy groundcover, which has been historically cleared for primary production and quarry operations.

Native vegetation recorded in the study area included Broad-leaved Peppermint Eucalyptus dives, Mountain Gum, and Blakely's Red Gum Eucalyptus. The presence of native ground stratus species, rough spear grass (*Austrostipa scabra*), was detected, but an estimate of approximately 90% of groundcover species were not native.

The native vegetation in the Quarry Site has been ground truthed and mapped as PCT730 Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion. PCT730 is the best fit for the vegetation in the study area due the dominance of the two previously mentioned Eucalypt species. As shown in **Table 5.19**, the total area to be impacted as a result of the Proposed Modification will be 2.85 ha including vegetation which includes impacted vegetation outside extraction limit that has already been cleared.

Table 5.19 Vegetation Impacted by the Proposed Modification

PCT ID	PCT Name	Hectares in the development footprint	Location of Vegetation in Development Footprint
PCT730	Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion	0.11	Proposed Additional Stockpiling and Processing Area
PCT730	Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion	0.31	Already impacted vegetation outside extraction limit
No PCT	Low conservation value grassland	2.43	

Remaining vegetation in the Proposed Modification site has no shrubs and has been completely cleared of trees. It is highly disturbed and degraded from clearing, grazing and quarry operations. It was identified that greater than 90% of groundcover within the Quarry Site was found to be exotic weed and grass species and the vegetation was assessed as low conservation value grassland.

5.8.6.2 Flora

The likelihood of occurrence in the Proposed Modification Site was considered for 12 listed flora species identified by the database searches conducted prior to the field survey. The assessment found no species were considered likely to occur in the development footprint and or likely to be impacted. Further, no flora species required a test (BC Act) or assessment (EPBC Act) of significance.

Threatened flora species listed under state and Commonwealth legislation are predicted and/or known to occur in the development footprint, however, no threatened species were detected during survey.

The removal of native vegetation in the development footprint may increase the edge effects on adjacent native vegetation. However, the area is already highly disturbed and impacted by edge effects from the existing quarry operations and historic grazing and clearing. Mitigation measures such as pest and weed management and dust suppression are provided in **Section 5.8.5** which will reduce the impact of edge effects.

5.8.6.3 Habitat

No areas defined as Critical Habitat (Area of Outstanding Biodiversity Value) by the NSW or Commonwealth government were found to be mapped within, or next to, the development footprint.

PCT730, as identified in **Section 5.8.6.1**, can provide habitat for a wide range of terrestrial fauna, including birds, microbats, reptiles, rodents, and small marsupials. However, the vegetation likely to be impacted from the Proposed Modification, is highly disturbed and there are few fallen logs present in the development footprint where the vegetation has been cleared outside the previously approved extraction and pushed up.

Five trees, three of which have hollows will potentially be impacted by the Proposed Modification. These tree hollows can provide habitat value for microbats, birds and arboreal mammals and will be retained and/or mitigated where possible. Habitat values such as shade, shelter and food provided by the vegetation to be removed represents some decline in habitat features.

Aquatic habitat close to the development footprint (farm dams) is highly artificial and lacks complex structural features such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation and tree stumps. Captain Kings Creek is an intermittent waterway. It lies south of the development footprint and would not be impacted.

All native vegetation mapped in the Proposed Modification Site has some role in habitat connectivity. However, connectivity will not be reduced by the proposal as the vegetation is already highly fragmented and will be no less connected by the proposal.

Landscape and visual screen planting will improve connectivity by creating more vegetated areas and connecting currently fragmented patches of native vegetation in the northern extraction area. Overall, connectivity would not be reduced, nor fragmentation increased by the proposal.

5.8.6.4 Koala Habitat Impact Assessment

The NSW and Commonwealth database searches identified that Koala are predicted to occur in the Proposed Modification Site. Two Koala records exist within 10 kilometres of the Proposed Modification Site but both records are more than 20 years old. No evidence of Koala presence in the development footprint was recorded during this assessment. The desktop assessment also determined no historical records within 5 km of the Quarry Site.

The SEPP (Koala Habitat Protection) 2021 does not apply land being zoned RU1 Primary Production and located outside the Sydney Metropolitan Area, Blue Mountains, and Central Coast areas. Where a proposal occurs in RU1 land located outside the areas listed above, SEPP (Koala Habitat Protection) 2020 applies, which is the case for this proposal.

Further, the SEPP (Koala Habitat Protection) 2020 applies to the proposal because:

- the Lot is larger than one hectare
- the Oberon LGA is listed in Schedule 1 of the (SEPP) (Koala Habitat Protection) 2020.

Field assessment determined potential and core koala habitat do not occur in the Quarry Site (AREA, 2022b). No tree species present in the development footprint were listed in Schedule 2 of the SEPP (Koala Habitat Protection) 2020. No Koalas or evidence of Koalas was noted during field assessment.

Therefore, no further management plans would be required, and consent would not be prevented under the SEPP (Koala Habitat Protection) 2020.

5.8.6.5 Fauna

No threatened fauna was observed in the Quarry Site during the field assessment, however the desktop assessment noted that threatened species listed under State and Commonwealth legislation have the potential to impacted by the Proposed Modification. Based on the results of tests and assessments of significance, the proposal is not likely to have a significant impact on threatened fauna species because habitat loss is minimal, and the Proposed Modification Site is already highly disturbed and degraded from existing clearing, farming, and quarry operations.

A total of 52 known and predicted threatened fauna species were individually considered and assessed. Most predicted threatened fauna species were determined not to require a test or assessment of significance as assessment concluded the species was:

- Not present or
- Unlikely to be present or
- Unlikely to use the suitable habitat in the development footprint.

The tests and assessments of significance completed and included in the BAR (refer to **Appendix 12**) have identified that no species of fauna are likely to have a significant impact as a result of the Proposed Modification.

Injury and mortality of fauna could occur during construction and quarry activities. Specific impacts to be addressed include:

- risk to nesting birds in trees to be felled lopped or driven past during removal and disturbance of vegetation and habitat clearing
- risk to hollow dependent species if present in trees when felled

- construction and operational traffic
- machinery and plant movements.

A Fauna Handling and Rescue Procedure has been included as an appendix to the BAR (provided in **Appendix 12**) to be followed in the event of an and unexpected find or fauna injury or mortality.

5.8.6.6 Threatened Ecological Communities

Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions required further consideration as an associated PCT is present in the Proposed Modification Site and it is known to occur in the Oberon region. The assessment concluded the vegetation in the development footprint is not consistent with Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions.

The Quarry Site is already highly disturbed and degraded from existing clearing, farming, and quarry operations. This TEC was identified to be not present in the Quarry Site, and therefore no further assessment is required.

5.8.6.7 Aquatic Environments

One Strahler First Order drainage line commences in the proposed Additional Stockpiling and Processing Area of the Proposed Modification Site. This drainage line has no structure or form and flows into a farm dam which contains no aquatic fauna or habitat. Overflow from this drainage line is a tributary to Captain Kings Creek and is a part of the Macquarie River catchment.

The Proposed Modification will directly impact the above-mentioned drainage line. The proposed activities associated with the quarry modification would generate contaminated runoff which creates a risk of pollution to downstream water (either as surface flow or leachate) if not appropriately managed. However, the assessment identified none of the drainage lines in the development footprint for this proposal, including the drainage line as mentioned above, are mapped as Key Fish Habitat under the *Fisheries Management Act 1994* and it is predicted the Proposed Modification will not impact any Key Fish Habitat (KFH).

No wetlands of international or national importance are located within relevant distance to the development footprint.

Implementation of the modified operations will need to ensure excessive sediment, nutrients or other contaminants are not allowed to contaminate down stream flows. Movement of water through the site during the implementation of this proposal should be controlled using sediment traps and drainage structures. The management measures proposed to address this aspect are presented in **Section 5.6**.

An assessment against the guidelines for Groundwater Dependent Ecosystems was also conducted to consider impacts to Aquatic Environments and identified that changes to the nearby waterways during the implementation of this proposal are unlikely to significantly impact Groundwater Dependent Ecosystems. Extraction activities are not anticipated to impact on groundwater flows and depth and therefore impacts on groundwater dependent ecosystems is unlikely.

5.8.6.8 Weeds and Pests

An increase in the movement of people, vehicles, machinery, vegetation waste and soil as a result of the Proposed Modification is unlikely to alter the current exotic grass burden at the Quarry Site and is unlikely to increase the prevalence of these weeds elsewhere, due to the existing levels of disturbance and weed infestation.

However, disturbed areas, such as those in which earthwork are to be carried out, will be susceptible to weed establishment. Management measures such as those presented in **Section 5.8.5** will be required to minimise the risk of introduction and spread of weeds. Site rehabilitation plans should consider engagement of a weed contractor to eradicate and control Asparagus fern *Asparagus virgatus* and other locally known weeds in the development footprint which may be exacerbated by further disturbance.

In NSW, there are infectious pathogens with potential to impact on biodiversity and any activities involving the movement of soil and equipment over large areas are a potential risk for spread and infection. Three pathogens were identified as a negligible risk to the Proposed Modification Site due to the low rainfall of the area. These are listed as key threatening processes under the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (EPBC Act and BC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act).
- Infection by Psittacine Circoviral (beak and feather) (EPBC Act and BC Act).

Mitigation measures for these diseases have been provided in **Section 5.8.5**.

5.8.6.9 Construction Impacts

The construction activities associated with the Proposed Modification have the potential to generate contaminated runoff which creates a risk of pollution to downstream water (either as surface flow or leachate) if not appropriately managed. Implementation of the Proposed Modification will include the management measures to ensure excessive sediment, nutrients or other elements are not allowed to contaminate down stream flows. Movement of water through the site during the implementation of the Proposed Modification will be controlled using sediment traps and drainage structures. These measures are aimed to minimise cumulative impacts to the local waterways and catchments.

5.8.7 Key Summary

The key points of the Biodiversity Assessment are outlined below:

- The total impact to native vegetation from the Proposed Modification is less than one hectare and therefore does not trigger assessment by the Biodiversity Assessment Method under the area threshold.
- The Proposed Modification provides little impact to the biodiversity of the area.
- Where impact to the biodiversity may occur, the management measures mentioned will mitigate any adverse environmental impacts.

5.9 Cultural Heritage

5.9.1 Introduction

An Aboriginal Due Diligence Assessment has been completed by AREA in accordance with *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010). The outcomes of the Due Diligence Assessment (AREA, 2022c) are discussed in the following sections with the detailed assessment provided in **Appendix 13**.

5.9.2 Existing Environment

The study area is primarily located within cleared and grazed land although there are also occurrences of remnant natural vegetation that flank the upper slopes of the area.

The native vegetation of the study area is described in **Section 5.8.4.2**. It is noted that the dry sclerophyll forest with a mostly absent shrub layer and dense grassy, highly weedy groundcover has been historically cleared for primary production and quarry operations. The assessment of native vegetation in **Section 5.8.6** identified that greater than 90% of groundcover within the Proposed Modification Site was found to be exotic weed and grass species and the vegetation was assessed as low conservation value grassland.

Previous assessments conducted at the location of the Proposed Modification (Environmental Assessments Pty Limited, 2016) note that the broader environs surrounding the Proposed Modification Site would have been a highly exploitable resource area for local Aboriginal people with the localised creeks, rivers, and swamps with bountiful supplies of fishes, tortoises, macropods, molluscs (bivalves), waterbirds, monitors and likely flying foxes, possums and snakes etc.

Previous assessments also identified that plant foods such as the reeds *Typha orientalis* (Bulrush) and tuberous climbers such as *Dioscorea transversa* (Native Yam) and the *Eustrephus latifolius* (Wombat Berry) would have also been in abundant supply especially in ecotonal areas of localised creeks and open forests and woodlands (Environmental Assessments Pty Limited, 2016).

5.9.3 Assessment Methodology

5.9.3.1 Database Searches

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 11 August 2020 (Client ID: 526588). The AHIMS search provides archaeological context for the area and identifies whether any previously recorded Aboriginal sites are located within or near the study area. A total of five sites were recorded within the search area and are all recorded as the site type 'Artefact'.

Other searches were conducted of the following:

- Oberon LEP 2013
- Native title Vision
- State Heritage Register.

The database searches identified that no items relative to Aboriginal heritage within the Quarry Site are listed on the LEP or State Heritage Register and no native title claims are applicable.

5.9.3.2 Previous Archaeological Assessments

A review was conducted on previous archaeological assessments that were applicable to the study area. The assessment found that Environmental Assessments Pty Ltd were engaged by Oberon Earthmoving to conduct an Aboriginal Heritage Due Diligence Assessment for the proposed extension to the existing Middle Creeks Quarries, which is the same area as the current study area.

During this 2016 assessment, an inspection of the study area was conducted in conjunction with representatives from the Pejar Local Aboriginal Land Council. Two sites were identified (AHIMS ID 44-6-0122 and AHIMS ID 44-6-0121). Both sites are outside the current study area.

5.9.3.3 Predictive Modelling

Areas of archaeological potential are regarded as any sensitive landform with a reasonable level of intactness (i.e., little to no disturbance or minor ground surface disturbance only and in areas not on self-mulching soils). The definition of disturbance used here follows that of the *NPW Regulation 2009* (Clause 80B, Subclause 4). Sensitive landforms follow the definitions supplied in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010).

The predictive model assessed the location of Captain Kings Creek that flows within 520 m south of the study area and concluded that the study area does not contain any sensitive landforms as defined by the Due Diligence code of practice. Based on the background research, desktop assessment and previous archaeological assessments the following predictions were made:

- There is a low risk of previously-unrecorded, intact sites within the study area as the proposal is mostly within land that has been significantly impacted by land clearing and intensive quarrying. However, it is possible that there are intact sites in discrete locations where impacts are low.

- The most common recorded site type within 400 m of the study area, artefact, may occur within the study area in areas that are intact and less disturbed.

5.9.3.4 Fieldwork Survey

The fieldwork component of this assessment was undertaken on 8 July 2020 by Alex Cameron, Environmental Research Assistant of AREA and Phil Cameron, Principal Consultant, of AREA. The purpose of the field assessment was to identify sections of the subject site with archaeological potential and physically inspect them.

The entire study area was inspected by pedestrian survey. Particular attention was paid to exposed ground surfaces to increase the chances of locating any stone artefact scatters. All mature trees were inspected in order to identify culturally scars. Ground surface visibility and existing levels of disturbance were noted.

Recordings were made of ground surface visibility and existing levels of disturbance. Recording included photographs, mapping, written records, and GPS coordinates.

5.9.4 Aboriginal Cultural Heritage Management Measures

The following protocol has been recommended if any objects of suspected Aboriginal heritage origin be encountered during the proposed works. The protocol recommends work in the area of the find should cease and the following steps should be implemented.

The protocol to be followed in the event previously unrecorded or unanticipated Aboriginal object(s) are encountered during the proposed works is as follows:

- All ground surface disturbance in the area of the finds should cease immediately the finds are uncovered.
- If the finds are of human remains, contact the local police.
- Seek verification of the finds from a suitably qualified person, such as a heritage consultant.
- If the finds are verified or very likely to be Aboriginal in origin notify NSW Heritage, Department of Premier and Cabinet and the relevant local Aboriginal community representatives.
- All finds should be professionally recorded and registered on appropriate databases.
- A management strategy will be required according to best practice and consultation with the local Aboriginal community. All management will require approval from the relevant determining authority.

5.9.5 Assessment of Impacts

The results of the field work were consistent with the predictive model developed as part of the assessment methodology as presented here in **Section 5.9.3** and provided in **Appendix 13**. The assessment noted that ground surface visibility (GSV) was low across the study area making it difficult to identify stone artefacts. There is an ever-present possibility of stone artefacts remaining undetected where GSV is not total.

The assessment concluded that no sites of cultural heritage are recorded within the study area or are likely to occur within it. However, the management measure as outlined in **Section 5.9.4** will be implemented if an unexpected find is identified.

5.9.6 Key Summary

The key points of the Aboriginal Due Diligence Assessment are outlined below:

- No sites of cultural heritage are recorded within the Project area or are likely to occur within it. However, it was noted ground surface visibility was low.
- A protocol is to be followed in the event previously unrecorded or unanticipated Aboriginal object(s) are encountered during the proposed works.
- The management measures outlined in this section will mitigate any adverse environmental or social impacts of cultural heritage that may occur.

5.10 Rehabilitation and Land Use

The aims, objectives and methods of final landform construction and rehabilitation would remain consistent with those nominated in **Section 2.11**, noting the minor change to the final landform described in **Section 3.7** and **Figure 3.2**.

The following considers the implications of the nominated changes to the final landform on the established rehabilitation and land use objectives.

Final Landform

The final landform presented in **Figure 3.2** and described in **Section 3.7** represents a sympathetic extension of the landform already nominated for the Quarry and approved. The proposed final landform does not rely on the importation of an additional materials, resources or specialist equipment.

Final Land Use

The Proposed Modification does not propose to modify the intended final land use of the Quarry (management for the conservation of native vegetation).

5.11 Socio-Economic

5.11.1 Introduction

The following sections discuss the existing socio-economic setting, the existing social and economic contributions of the Quarry, the management and mitigation measures and residual impacts following the implementation of these management and mitigation measures. Due to the relatively small nature of the Proposed Modification, a Social Impact Assessment (DPE, 2022) is not required. Nonetheless, important and relevant potential socio-economic impacts and proposed mitigation measures are addressed in this section.

5.11.2 Local Setting

Oberon Local Government Area (LGA) is located west of the Blue Mountains in the Central West of New South Wales, approximately 150 km west of Sydney. Oberon LGA is bounded by the Lithgow, Bathurst, Upper Lachlan, Blue Mountains and Wollondilly LGAs.

Oberon LGA is predominantly rural with the major centre being Oberon in which approximately 50% of the LGA's 5,580 inhabitants reside. The remaining inhabitants are spread amongst a number of smaller villages and localities across the LGA. Between 2016 and 2021, the population of the LGA increased by approximately 10% (5,040 to 5,580) suggesting an improvement in employment generating factors, although median income has increased relatively in that time ($525 to $759, approximately 45%).

The main industry of employment in Oberon is wood manufacturing (6.3%) reflecting the Borg Pty Ltd Wood Product Manufacturing Plant as the principal employer in Oberon. Other key industries of employment were sawmilling (3.8%), farming (cattle and sheep) (6.2%) and local government administration (2.8%). With a number of NSW State Forests and private forestry operations located within the Oberon LGA, forestry, milling and wood manufacture represent a second major industry within the LGA and would contribute positively to the development of a circular economy incorporating the local reuse of materials.

While not a major feature of the Oberon LGA, there are several operating quarries within the LGA and identified metalliferous resources, notably copper near Burraga.

5.11.3 Potential Impacts of the Proposed Modification on the Socio-Economic Setting

Given the limited scale of the Proposed Modification, the fact that the Quarry is currently operating and very minor reliance of the proposed operations on local services and infrastructure, the potential for impact on the local socio-economic climate is limited. The main potential impact would be on local amenity, i.e. the tangible or intangible features of a setting that contribute to its appeal or desirability.

5.11.4 Controls, Safeguards and Management Measures

In addition to the mitigation measures and management procedures relating to amenity aspects such as noise, air quality, visibility, transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised.

Social and Community

- Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.
- Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
- Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
- Advertise and maintain a community complaints telephone line.

Economic Contribution and Development

- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.
- Continue to implement the contributions agreement with Council to fund maintenance of affected roads.

Agricultural Lands

- Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
- Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

General

- Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.

5.11.5 Assessment of Impacts

In order to assess the overall impact of the Proposed Modification on the socio-economic environment, the various adverse and beneficial impacts are considered as follows.

Adverse Impacts

- The impacts on local noise, air quality and traffic could each have a minor impact on the neighbouring properties of the Quarry and users of Sewells Creek and Abercrombie Roads.

Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

- The reduction in aesthetic appeal of the local setting nominated in the 2017 EIS (RWC, 20167) remains a potential impact.

Notably, the Quarry is now an established feature of the local setting and on the basis that vegetation screens have been planted, amenity bunds are maintained and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

Beneficial Impacts

- The Proposed Modification would ensure full-employment for Quarry personnel and truck drivers is secured.
- As it is the intention of Oberon Earthmoving to continue to source the majority of the Quarry workforce from the local area, this would have a positive impact on economic activities within the Oberon LGA and Central West of NSW.
- The Proposed Modification will result in ongoing operational expenditure that will have flow-on economic benefits for the region and will provide continued employment for existing staff and additional employment for truck drivers required for the Quarry.
- The Proposed Modification would also contribute to the national and State economies through the payment of taxes and royalties and the purchase of goods and services from outside the local area.
- The availability of the important construction materials that would be produced by the Quarry, demand for which is likely to increase, would be increased.
- The final landform provides for the conservation of native vegetation. By encouraging the presence of native flora and fauna, the Quarry Site would assist in maintaining the local aesthetic of an area which is to be the subject of significant development over the coming years.

The impact of the Proposed Modification on current and future land uses has been considered as part of this assessment. Importantly, assessment of impacts against established environmental criteria and reasonable community expectation indicates compliance or achievement of these. As such, and assuming the implementation of the various design features, operational controls and management measures described throughout this section (or equivalent), the Proposed Modification could be operated without adversely impact on the current land use(s) of surrounding properties.

Considering the potential direct and indirect socio-economic benefits against those deemed to be adverse, it is assessed that there would be a net socio-economic benefit resultant from the approval of the Proposed Modification.

5.11.6 Key Summary

Below outlines the key points of this socio-economic section:

- The potential for impact on the local socio-economic climate is limited, based on the limited scale of the Proposed Modification, the fact that the Quarry is currently operating and very minor reliance of the proposed operations on local services and infrastructure.
- Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised.
- Considering the potential direct and indirect socio-economic benefits against those deemed to be adverse, it is assessed that there would be a net socio-economic benefit resultant from the approval of the Proposed Modification.

6.0 Justification and Conclusion

6.1 Introduction

The potential environmental impacts of the Proposed Modification have been identified through a process involving:

- assessment of the site characteristics
- consultation with government agencies
- consultation with surrounding landowners
- expert technical assessments.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the Proposed Modification on the existing environment and community. The results of these assessments are detailed in **Section 6.0** and the appendices of this SEE.

The environmental and social impacts of the Proposed Modification have been minimised through refining the project design and operational procedures in consideration of environmental constraints and implementation of appropriate control measures.

With the existing and proposed measures to avoid, minimise or manage impacts associated with the Proposed Modification, it is anticipated that the Quarry can continue to operate within acceptable environmental standards without significantly adversely impacting the environment or local community.

6.2 Suitability of the Site

The Quarry is located within a transitional environment surrounded by agricultural activities, forestry and low-density residential development. The site is considered suitable for the Proposed Modification for the following reasons.

- The site contains extensive gravel resources, waste importation and processing facilities and composting facilities, and is located within proximity to markets for these resources and products.
- The site has been used for the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and ENM since approval was granted in 2018.
- The Proposed Modification is located on land largely disturbed by previous agricultural activities and involves only minor additional disturbance to native vegetation communities and fauna habitat.
- The Proposed Modification is compatible with surrounding land uses and can co-exist with these existing uses.
- Topography, planted and remnant vegetation, and constructed bunds provide some visual shielding from the surrounding area.
- Suitable safe access to Sewells Creek Road is provided from the Quarry without impacting adversely on the local road network.

6.3 Benefits of the Proposed Modification

The key benefits of the Proposed Modification include:

- maximising efficient operations at the existing Quarry, thereby delaying or eliminating the need for further quarry development on another less suitable greenfield site
- providing for an increased production rate, further processing of waste, aggregates and compost material without any increase in the approved disturbance footprint
- the environmental impact of the Proposed Modification can be managed within acceptable environmental standards
- the Proposed Modification will provide continued employment for existing staff and additional employment for truck drivers required for the Quarry, and
- the Proposed Modification will result in ongoing operational expenditure that will have flow-on economic benefits for the region.

6.4 Ecologically Sustainable Development

6.4.1 Introduction

Ecologically Sustainable Development (ESD) is a concept which can be defined as development which uses, conserves, and enhances the community's resources in such a way that ecological processes are maintained and our existing and future quality of life can be improved. An alternative definition is 'a development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations'.

Production of road building/construction products and composting products would contribute to the material and socioeconomic well-being of the region. However, quarries and composting establishments and their related processing operations do involve some degree of environmental disturbance. In the context of ESD, the issue of whether environmental impacts are irreversible or affect long term ecological sustainability is important. For this reason, it is the overall objective of the ESD process to ensure compatibility between quarrying and the environment.

It is intended in this section to address how the Proposed Modification has been planned and would operate in a manner that is consistent with the following four inter-related principles, as defined under Schedule 2(6) of the EP&A Reg, as:

- the precautionary principle
- the principle of social equity
- the principle of the conservation of biodiversity and ecological integrity
- the principle for the improved valuation and pricing of environmental resources.

6.4.2 The Precautionary Principle

This principle states that 'where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

In the application of the precautionary principle, public and private decisions should be guided by:

- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
- an assessment of the risk-weighted consequences of various options." (DoE, 1992).

To satisfy this principle of ESD, emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it. The environmental setting is considered in **Section 5.1** along with the potential impacts that could be associated with the Proposed Modification (**Section 5.2** to **Section 5.11**). Various operational controls, safeguards and management measures are then presented based on this knowledge of the existing environment and an appreciation of the potential impacts. This demonstrates that the assessment of potential impacts on the environment has focused on those aspects considered to pose the greatest risk of irreversible or unacceptable impact.

After a full evaluation of the potential environmental impacts of the Proposed Modification, there are no activities or features for which achievement of an acceptable level of environmental performance is not possible.

With the exception of the depletion of the quarry resource, it is considered that there are no features of the local environment that would be irreversibly or unacceptably damaged. Features of the local environment such as water quality, biodiversity, heritage, noise and air quality would be managed throughout the life of the Proposed Modification such that they will be comparable before and after Quarry operations.

It would remain a guiding principle for Oberon Earthmoving to be pro-active and anticipate problems rather than allow problems to develop.

6.4.3 Intra- and Inter-Generational Equity

The objective of this ESD principle is that "the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations" (DoE, 1992). This principle is based on social equity for the current generation (intra-generational) and future generations (inter-generational).

Intra-generational equity requires that the economic and social benefits of the development be distributed appropriately among all members of the community. The Proposed Modification, and particularly the safeguards proposed with respect to air emissions (including odour), noise and traffic has been designed to ensure that no part of the community would be unacceptably disadvantaged. As discussed in **Section 6.3**, the economic benefits of the continued operation of the Quarry would be felt by the wider community through:

- provision of local employment and flow-on benefits to local goods and service providers
- supply of product important for the maintenance of necessary infrastructure and development of new infrastructure.

The non-material well-being or 'quality of life' of existing and future residents in the vicinity of the Quarry would continue to be maintained throughout and beyond the life of the Quarry through:

- implementation of safeguard measures and operational controls to mitigate any environmental impacts
- the planned progressive rehabilitation of the Quarry.

6.4.4 Conservation of Biological Diversity and Ecological Integrity

Biological diversity or biodiversity describes life forms and is usually considered at three levels:

- genetic diversity
- species diversity
- ecosystem diversity.

Ecosystem integrity describes the condition of an ecosystem that is relatively unaltered from its natural state.

The additional disturbance required by the Proposed Modification is located on land previously disturbed by agricultural clearing and operation and a BAR completed by AREA (2022a) confirms this includes only small patches of remnant native vegetation. Assessment of these remnant patches confirms the impact on local biodiversity, including Koala habitat, would be minimal. Based on the implementation of the proposed impact avoidance, minimisation and mitigation measures of the existing Quarry, and considering the area to be disturbed would not result in any additional impacts to any threatened species or vegetation community, it is concluded that the Proposed Modification would not increase the risk of local extinction of any species.

6.4.5 Improved Valuation and Pricing of Environmental Resources

This principle involves consideration of the materials proposed to be extracted, accepted and produced, and the surrounding environmental resources (e.g. air, water, land and living things) which may be affected. The valuation and pricing of quarry and compost products comprises the cost of extraction and composting, screening, importation, backfilling and rehabilitation costs, delivery costs and the final cost to Oberon Council rate payers.

The value placed by Oberon Earthmoving on the environmental resources, other than the extracted and imported resources, is evident through the existing management measures employed at the Quarry.

6.5 Environmental Planning and Assessment Act 1979 Considerations

6.5.1 Section 4.15 – Evaluation

Under section 4.56(1A) of the EP&A Act, in determining an application for the modification of a development consent, the consent authority must take into consideration such matters referred to in section 4.15(1) as they are of relevance to the development which is the subject of the application. These mandatory matters for consideration, and the sections where they are addressed in this Modification Report, are outlined in **Table 6.1**.

In determining an application for the modification of a development consent, the consent authority must take into consideration such of the matters referred to in Section 4.15(1) of the EP&A Act (as relevant to the development). These matters for consideration by the consent authority and the sections where they are addressed in this SEE are provided in **Table 6.1**.

Table 6.1 Section 4.15 Matters for Consideration

Matters for Consideration	Relevant SEE Section
the provisions of - (i) any environmental planning instrument	**Section 4.0**
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	Not applicable.
(iii) any development control plan,	**Section 4.1.3.4**.
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	Not applicable.
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	No additional mandatory considerations applicable to the Proposed Modification.
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	**Section 5.0**.
(c) the suitability of the site for the development,	**Section 6.2**.
(d) any submissions made in accordance with this Act or the regulations	This is a matter for consideration by the consent authority, in the event the application is publicly exhibited.
(e) the public interest	**Section 6.0**.

6.5.2 Objects of the EP&A Act

Table 6.2 provides a short description of how the Proposed Modification and this SEE have addressed and satisfy the objects of the EP&A Act.

Table 6.2 Objects of the EP&A Act

Object	SEE Coverage
a. to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	Socio-economic effects are assessed in **Section 5.10**, with the Proposed Modification likely to provide for an ongoing socio-economic benefit to the Oberon LGA. The Proposed Modification would incorporate measures to avoid or mitigate potential impacts from air emissions (**Section 5.2.5**), noise (**Section 5.3.5**), traffic (**Section 5.4.3**), water (**Section 5.5.4 / Section 5.6.3**), waste (**Section 5.7.2**), biodiversity (**Section 5.8.5**) and cultural heritage (**Section 5.9.4**).
b. to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecologically sustainable development have been considered in **Section 6.5**.
c. to promote the orderly and economic use and development of land,	The Proposed Modification would involve the continued operation and would maintain the supply of construction materials to the region. The Proposed Modification would continue to be a significant contributor to the local and regional economy and community for the proposed 10 – 15-year life.
d. to promote the delivery and maintenance of affordable housing,	The Proposed Modification would not limit the provision of affordable housing in the Oberon LGA.
e. to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The additional disturbance associated with the Proposed Modification occurs on land previously disturbed for agricultural clearing and which contains only small patches of remnant native vegetation. It is assessed as unlikely to have any impacts on any threatened population, species or community and would not increase the risk of local extinction of any species.
f. to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposed Modification would have no impact on built or cultural heritage, including Aboriginal cultural heritage.
g. to promote good design and amenity of the built environment,	The Proposed Modification would have no impact on the built environment.
h. to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The Proposed Modification does not require construction of buildings.
i. to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The SEE includes a review of the relevant State, regional and local environmental planning regulations, plans and strategies including how these have been addressed (**Section 4.0**).
j. to provide increased opportunity for community participation in environmental planning and assessment.	Oberon Council, various government agencies and local landholders were consulted during the planning of the Proposed Modification and preparation of the SEE.

Object	SEE Coverage
k. to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	Socio-economic effects are assessed in **Section 5.11** with the Proposed Modification likely to provide for an ongoing socio-economic benefit to the Oberon LGA. The Proposed Modification would incorporate measures to avoid or mitigate potential impacts from air emissions (**Section 5.2.5**), noise (**Section 5.3.5**), traffic (**Section 5.4.3**), water (**Section 5.5.4 / Section 5.6.3**), waste (**Section 5.7.2**), biodiversity (**Section 5.8.5**) and cultural heritage (**Section 5.9.4**).

6.6 Conclusion

Based on the comparative analysis, the Quarry would remain essentially and materially the same as originally approved (refer to **Section 4.1.3.2**) and is considered unlikely to result in significantly greater impacts than those already approved (refer to **Section 5.0**).

The Proposed Modification to the Middle Creek Quarry has, to the extent feasible, been designed to address the issues of concern identified by the relevant levels of government and legislation.

- The modified Quarry provides for the extraction, processing and transportation of important construction material whilst minimising the residual impacts on the biophysical environment.
- The modified operations provide for additional activities, concrete crushing and sand washing, which improve the economic feasibility of the Quarry, provide for important resource recovery and improved resource utilisation.
- The Quarry products would facilitate the efficient operation of businesses and projects in the wider area surrounding the Quarry, including road building and maintenance, and infrastructure construction.
- The contribution of the modified Quarry to the local and regional economy would be increased by virtue of the increased employment and expenditure.
- The post-quarry landform would integrate the re-establishment of vegetation conducive to a land use consistent with the surrounding land uses.

In light of the conclusions included throughout the SEE, it is assessed that the Proposed Modification could be undertaken in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

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APPENDIX 9

Air Quality Impact Assessment

Middle Creek Quarries

Air Quality Impact Assessment

F0 | V0

18 November 2022

Oberon Earthmoving Pty Ltd

Middle Creek Quarries

Project No: IA226200
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Author: Luke Spencer
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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 4, 12 Stewart Avenue
Newcastle West NSW 2302 Australia
PO Box 2147 Dangar NSW 2309 Australia
T +61 2 4979 2600
F +61 2 4979 2666
www.jacobs.com

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F0v0	18/11/2022	Final following internal and client review	LS	BC	BC	BC

Contents

Executive Summary

Background

Oberon Earthmoving Pty Ltd (Oberon Earthmoving) is seeking an approval to modify operations at Midd le Creek Quarries on Lot 2 DP 1112479 , 50 Sewells Creek Road, Oberon. The extraction and transport of up to 150,000 tonnes per annum (tpa) of material presently takes place at the Quarry in accordance with development consent DA 10. 2016.38.1 . The proposed modification involves increasing the maximum extraction rate at the site up to 315,000 tpa and associated increases in production, and storage and haulage.

This report provide s an assessment of the potential air quality and greenhouse gas impacts of the proposal . In summary, the air quality assessment involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling the potential impact of the Project on local air quality. The modelling was carried out in accordance with the assessment procedures prescribed by the EPA.

The key air quality issue was identified as dust during operations. This was the focus of the assessment, along with impacts from diesel exhaust emissions, NO_2 emissions from blasting, impacts from associated road transport activities and the effects of crystalline silica.

Key features of the existing environment

As part of the assessment, key features of the existing environment were identified including surrounding sensitive receptor s, local meteorology and background air quality . Aerial imagery was used to identify the location of surrounding receptor s. Meteorological and ambient air quality data collected at monitors operated by DPE and BoM (Meteorology only) in the surrounding area were reviewed to characterise existing local conditions. The following conclusions were made in relation to the existing environment:

- Meteorological conditions do not vary significantly from year to year, and conditions in 2021 were identified as most representative of the long term, local conditions.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal setting.

Assessment of impacts

Air quality emission rates for key dust-generating activities associated with the proposed modification were estimated from local and international guidance. Modelling was then carried out with these emission rate to predict potential changes to local air quality. The assessment determined that air quality impacts associated with the proposal would meet the relevant requirements of the EPA's Approved Methods. Specifically, it was predicted that:

- Modified Operational dust emissions due are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on modelling which showed compliance with the EPA assessment criteria.
- No exceedances of the EPA's NO_2 criteria from diesel exhaust emissions or from blasting.
- Emissions from truck diesel exhausts travelling on public roads are not expected to result in any adverse air quality impacts based on modelling which showed that maximum kerbside concentrations would not exceed EPA criteria.
- Monitoring from a similar site and results from modelling suggest that the proposal is not expected to cause, adverse air quality impacts with respect to crystalline silica.

Conclusion and recommended safeguards

While this assessment has shown the proposal is not expected to cause any adverse air quality impacts, a range of mitigation and management measures are recommended. These include the continuation of existing measures outlined in the 'Air Quality Management Plan, Middle Creek Quarries' (AQMP) (Umwelt, 2019), as well as additional measures regarding blasting and diesel exhaust emissions.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts for the Middle Creek Quarry Modification proposal in accordance with the scope of services set out in the contract between Jacobs and Oberon Earthmoving Pty Ltd (Oberon Earthmoving), as well as Umwelt (Australia) Pty Ltd (Umwelt). That scope of services, as described in this report, was developed with Oberon Earthmoving and Umwelt.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Oberon Earthmoving and Umwelt and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Oberon Earthmoving and Umwelt (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Oberon Earthmoving and Umwelt, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and Oberon Earthmoving and Umwelt. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

Oberon Earthmoving Pty Ltd (Oberon Earthmoving) seeks to modify the operations at Middle Creek Quarry (the Quarry). The Quarry is located on Lot 2 DP 1112479 at 50 Sewells Creek Road, approximately 4 km west of Oberon, within the Oberon Shire Council local government area (LGA) (see Figure 1.1). The Quarry is classed as a Designated Development and operates under development consent DA 10.2016.38.1, permitting the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and Virgin and Excavated Natural Material (VENM and ENM). Under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the modification of the development consent includes the following:

- Extended resource recovery activities including:
  - Sand washing; and
  - Concrete for crushing.
- Construction of additional stockpiling areas; and
- Increased number of truck movements.

The development is also classified as Regional Development under the *State Environmental Planning Policy (State and Regional Development) 2011*. As a result, the development application will be determined by the independent Western Region Planning Panel (WRPP).

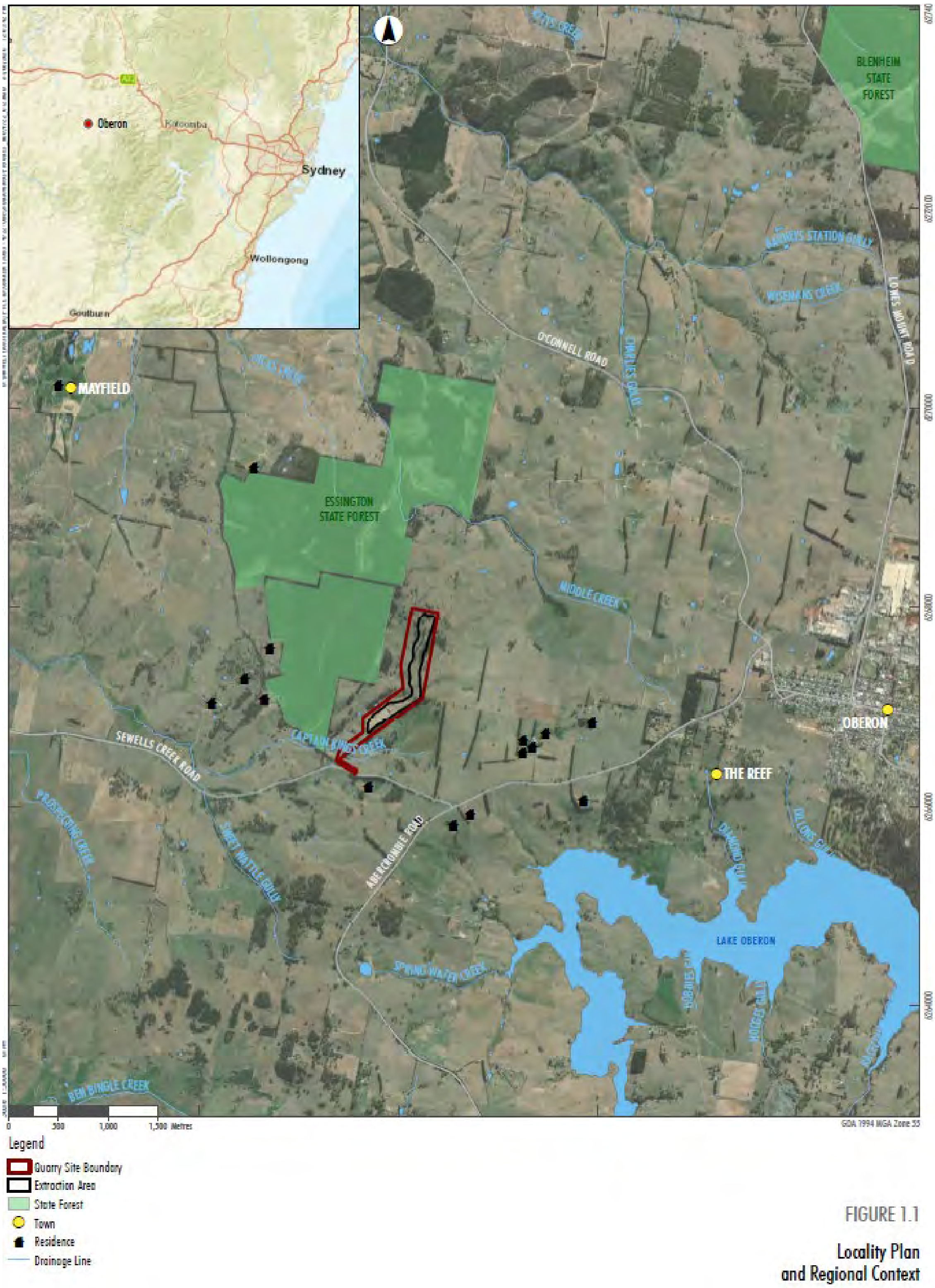


Figure 1.1. Quarry setting (Umwelt, 2022)

Oberon Earthmoving has engaged Umwelt (Australia) Pty Limited (Umwelt) to complete an application to modify DA 10.2016.38.1 for these works. Umwelt has engaged Jacobs Group (Australia) Pty Ltd (Jacobs) to undertake an Air Quality Impact Assessment (AQIA) to support the modification application. The AQIA has been prepared to address the following requirements issued for a similar recent quarry development.

Table 1.1. AQIA Assessment objectives.

Assessment objective
Air – including an assessment of the likely air quality impacts of the development in accordance with the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW'. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage.

In meeting these requirements, the objectives of this assessment were to:

- Describe the proposal modification, proposed activities and potential air quality issues (Section 2);
- Establish suitable air quality assessment criteria (Section 0);
- Describe the existing environment including surrounding receivers, terrain, meteorology and ambient air quality conditions (Section 4);
- Explain the methods used to predict potential air quality impacts, including the estimated emissions to air associated with the proposal modification (Section 5);
- Present and discuss predicted potential impacts (Section 6); and
- Recommend mitigation and management measures (Section 7).

2. Proposal details

2.1 Modification overview

The extraction and transport of up to 150,000 tonnes per annum (tpa) of material presently takes place at the Quarry in accordance with development consent DA 10. 2016.38.1. The proposal involves increasing the maximum extraction rate at the site up to 315,000 tpa and associated increases in production, and storage and haulage. Key details of the proposal, including how operations would change from existing activities are listed in **Table 2.1**.

Table 2.1. Key details of existing and proposed operations

Parameter	Existing approved operations under DA 10. 2016.38.1	Proposed operations
Site location	Lot 2 DP 1112479	No change
Resource Recovery	Importation of VENM, ENM, Treated Drilling Muds for land application or processing and sale	As per existing, as well as the importation of waste concrete for crushing and sale (up to 35,000 tpa)
Production rate	Up to 250,000 tpa	Up to 315,000 tpa (increase of 26%)
Disturbance area	Extraction Area (including all processing and stockpiling operation): 15 ha Erosion and Sediment Control features: <0.25 ha Site Access Road: <1 ha	Extraction Area (including select processing and stockpiling operation): 15 ha Erosion and Sediment Control features: <0.25 ha Site Access Road: <1 ha Out of Pit Processing and Stockpile Area: 1 ha Additional Water Management Features: to be confirmed
Extraction area	As identified in **Figure 2.1**	No change
Extraction design	• Operational Face Height: ▪ <15 m: friable rock. ▪ <20 m: harder rock. • Operational Bench Width: 20 m to 100 m (longitudinal i.e. north-south). • Terminal Bench Width: 3 m to 5 m (approximate).	No change
Extraction methods	Drill and blast	No change
Overburden Management	Sale as select fill Void backfill (rehabilitation)	Construction of an additional stockpile and processing area
Composting	Aerobic windrow composting of mulch within the completed extraction area	No change to process. Relocation to Out of Pit Processing and Stockpile Area
Processing operations	Campaign crushing and screening	Addition of a washing circuit
Truck movements	Maximum of 100 truck movements per day (Monday to Friday) Maximum 60 truck movements per day (Saturday)	Maximum of 180 truck movements per day (Monday to Friday) Maximum 90 truck movements per day (Saturday)
Hours of operation	Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 2.00 pm No work on Sundays or Public Holidays	No change
Rehabilitation activities	Retained void with stable final slopes	No change to residual voids Out of Pit Processing and Stockpile Area to be profiled to blend with surrounding slopes

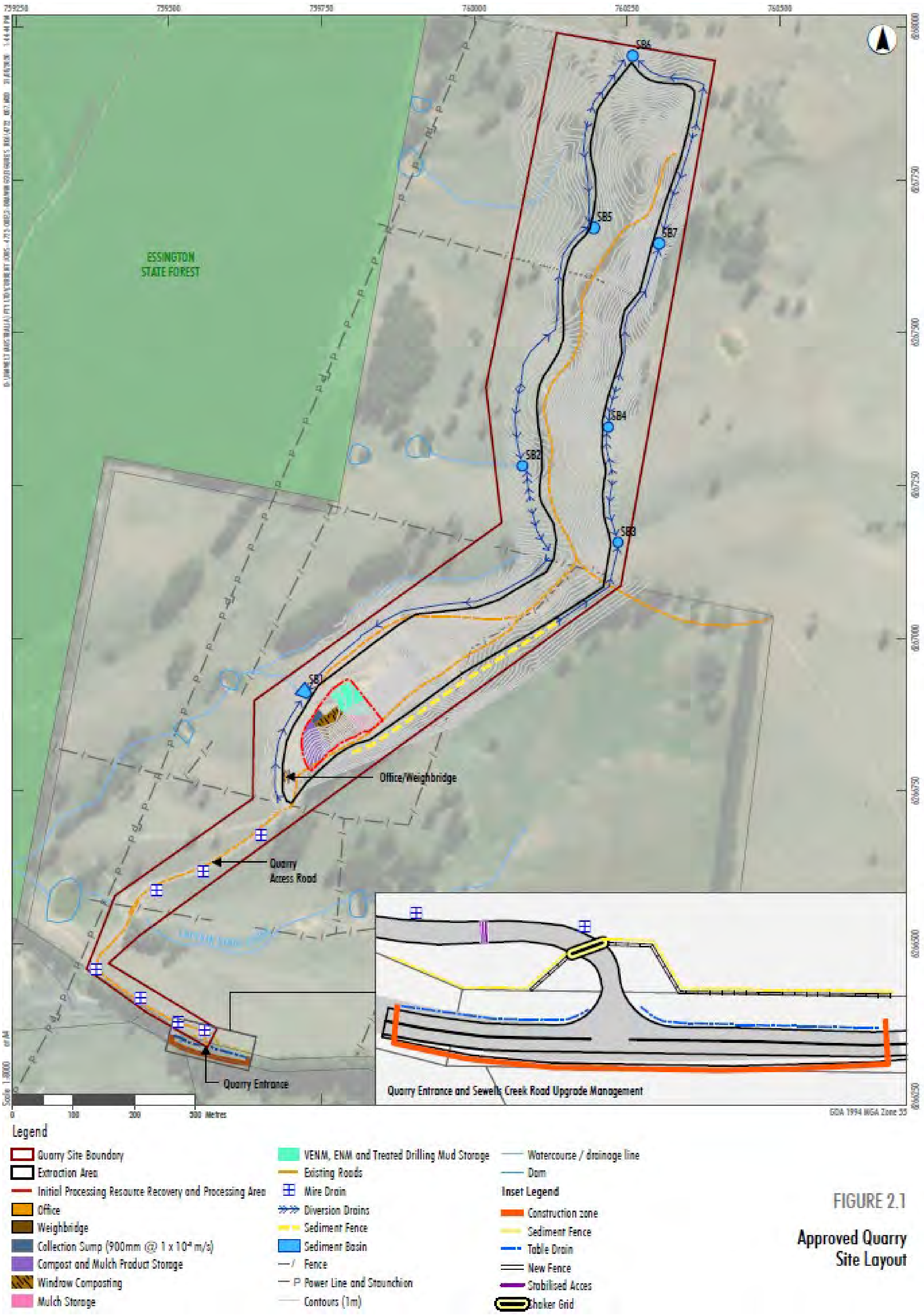


Figure 2.1. Approved quarry site layout (Umwelt, 2022)

2.2 Key air quality-related matters

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Changes in potential dust impacts at nearby residential receivers due to modified operations at the quarry presents the key air quality-related risk.

Dust is often referred to as particulate matter and in the forms of:

- Total Suspended Particles (TSP);
- Deposited dust;
- Particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}); and
- Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

Plant and equipment exhausts also have the potential to generate emissions that include carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter, and to a lesser extent sulphur dioxide (SO_2). Post-blast fume has the potential to generate NO_x emissions which, in turn, can oxidise to the more harmful and odorous nitrogen dioxide (NO_2). Rock crushing also has the potential to cause emissions of crystalline silica.

The area around the Project site contains various emission sources that will influence the local air quality. Consequently, the potential cumulative impacts are an important issue to address.

The key issues for construction will be:

- Emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and deposited dust) including those from machinery exhausts.

The key issues for operation will be:

- Emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and deposited dust);
- Post-blast fume (NO_2);
- Diesel exhaust (PM_{10}, $PM_{2.5}$ and NO_2); and
- Crystalline silica due to the crushing of rock.

These issues are the focus of this assessment.

Composting is already an approved activity at the site. As listed in **Table 2.1** there is no proposed changes to composting operations except the relocation of the activity to an out of pit processing and stockpile area. This change is minimal (movement of around 100 to 200 metres to the north of the existing processing and storage location). Noting that this aspect remains largely unchanged, expected impacts from composting are similarly expected to remain largely unchanged. As such, these effects (barring dust generated from wind erosion of the new out of pit processing and storage area) have not been considered as part of this assessment and should continue being managed as outlined in the ‘Air Quality Management Plan, Middle Creek Quarries’ (AQMP) (Umwelt, 2019).

3. Policy setting and assessment criteria

3.1 Overview

There are several statutes and guidelines that apply to the regulation of emissions to air from developments in NSW including:

- *NSW Protection of the Environment Operations Act 1997* (POEO Act NSW);
- *NSW Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO Clean Air Regulation);
- 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW', (NSW Environment Protection Authority [EPA], 2022);
- 'NSW Voluntary Land Acquisition and Mitigation Policy', (NSW Government, 2018); and
- 'Approved Methods for Sampling and Analysis of Air Pollutants in NSW', (NSW Department of Environment and Conservation [DEC], 2005).

Requirements relevant to the proposal from each of these documents are outlined below.

3.1.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act NSW) is the primary piece of legislation for the regulation of potential pollution impacts associated with Scheduled operations or activities in NSW. Scheduled activities are those defined in Schedule 1 of the POEO Act. The site is and will remain a Scheduled activity, operating in accordance with the requirements of Environment Protection Licence (EPL) No.21098. EPL 21098 includes the following conditions listed below in **Table 3.1** regarding the management of air quality-related issues at the site.

Table 3.1. EPL21098 air quality requirements

EPL Condition	Requirement
L6.5	Blasting operations at the premises may only take place between 10am-4pm Monday to Friday
L7 Potentially offensive odour	L7.1 No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the *Protection of the Environment Operations Act 1997*
O3 Dust	O3.1 Activities occurring at the premises must be carried out in a manner that will minimise emissions of dust from the premises. O3.2 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises. O3.3 Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading. O3.4 All dust control equipment must be operable at all times with exception of shutdowns required for maintenance.

These requirements will remain applicable for the site.

3.1.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The NSW *Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO Clean Air Regulation) contains provisions for the regulation of emissions to air from wood heaters, open burning, motor vehicles, fuels and industry. The proposal does involve any activities listed Schedule 3 of the POEO Clean Air Regulation. As such the applicability of the POEO Clean Air Regulation to the proposal is expected to be limited.

3.1.3 Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and NSW Voluntary Land Acquisition and Mitigation Policy

Air quality is typically quantified by the concentrations of substances in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of one or more substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the substances most relevant to the Project have been identified, from **Section 2.2**, as particulate matter in its various forms.

The EPA has developed criteria for a range of air quality indicators including particulate matter that are used for the assessment of specific projects. These criteria are outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2022), hereafter referred to as the Approved Methods. Most of the EPA criteria referred to in this report have been drawn from national standards for air quality set by the National Environment Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 1998).

The Project has been assessed in terms of its ability to comply with the air quality criteria set by the EPA as part of the Approved Methods. These criteria are outlined in **Table 3.2** and apply to existing and potentially sensitive receptors, where the Approved Methods defines a sensitive receptor as *"a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area"*. This definition has also been interpreted as places of near-continuous occupation.

Table 3.2. EPA air quality assessment criteria

Substance	Averaging time	Criterion	Source
Particulate matter (PM_{10})	24-hour	50 µg/m^3	EPA (2022) / DoE (2016)
	Annual	25 µg/m^3	EPA (2022) / DoE (2016)
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	EPA (2022) / DoE (2016)
	Annual	8 µg/m^3	EPA (2022) / DoE (2016)
Particulate matter (TSP)	Annual	90 µg/m^3	EPA (2022) / NHMRC (1996)
Deposited dust	Annual (maximum increase)	2 g/m^2/month	EPA (2022) / NERDDC (1998)
	Annual (maximum total)	4 g/m^2/month	EPA (2022) / NERDDC (1998)
Nitrogen dioxide (NO_2)	1-hour	164 µg/m^3	EPA (2022) / DoE (2021)
	Annual	31 µg/m^3	EPA (2022) / DoE (2021)
Carbon monoxide (CO)	1-hour	30 mg/m^3	EPA (2022) / DoE (2016)
	8-hour	10 mg/m^3	EPA (2022) / DoE (2016)

On 25 February 2016, an amendment to the Ambient Air Quality NEPM entered into force and introduced the new national air quality standards for PM_{10} and $PM_{2.5}$, as noted above. The EPA subsequently revised its PM_{10} and $PM_{2.5}$ assessment criteria as part of an update to the Approved Methods. These revised criteria are reflected in **Table 3.2** and took effect from 20 January 2017 onwards. There is currently no State legislation regarding the aim to move to more stringent $PM_{2.5}$ criteria by 2025. **Table 3.1** also reflects the April 2021 update to the NEPM, where the standards for ozone (O_3), sulfur dioxide (SO_2) and NO_2 were updated in-line with the latest scientific research around health impacts.

The 'NSW Voluntary Land Acquisition and Mitigation Policy', (NSW Government, 2018) (VLAMP) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. The VLAMP brings the air quality criteria in line with the NEPM standards and EPA assessment criteria. Noting that the proposal is not currently and is expected to remain below the triggers for State Significant Development as outlined in Schedule 1, Clause 7 (Extractive Industries) of the *State Environmental Planning Policy (Planning Systems) 2021*, the VLAMP and its provisions are not expected to be applicable for the site. As such, the VLAMP hasn't been considered further in the assessment.

3.1.4 Approved Methods for Sampling and Analysis of Air Pollutants in NSW

The Approved Methods for Sampling and Analysis of Air Pollutants in NSW, (DEC, 2005) provides guidance for the monitoring and analysis of air pollutants in NSW. This standard applies to the air quality monitors used to establish local background air quality conditions (see Section 4.4).

4. Existing environment

4.1 Surrounding receivers

Identified nearby sensitive receivers in the air quality study area around the site are displayed below in **Figure 4.1**.

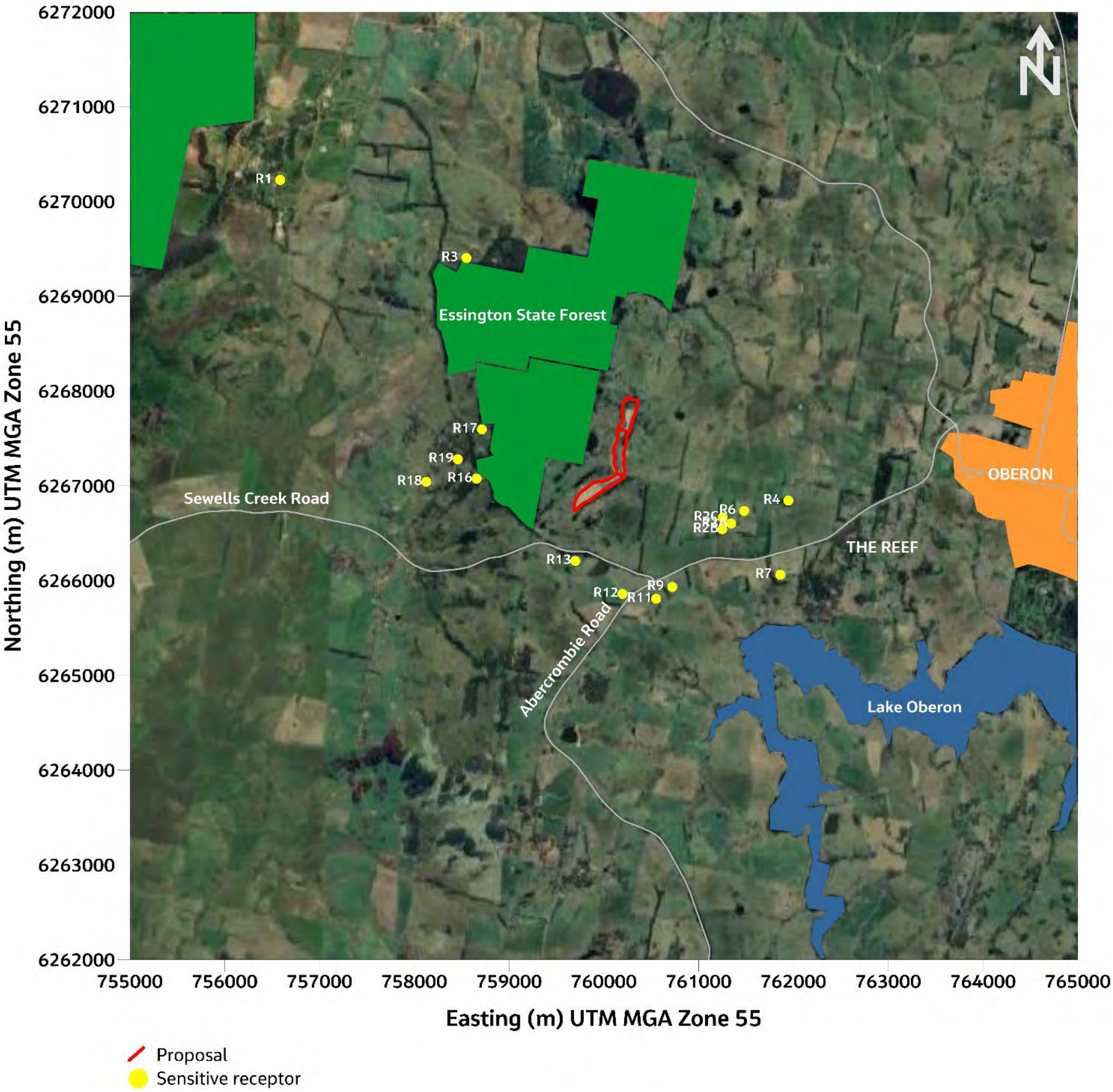


Figure 4.1. Surrounding sensitive receptors

Details of these locations are listed in **Table 4.1** below. The receiver identification numbers listed are consistent with those used in the overall modification application .

Table 4.1. Surrounding residential receivers

Receiver ID	Approximate co -ordinates UTM MGA 55		Approximate elevation (m)	Approximate distance from the site (km)	Approximate orientation from the site	Affiliated with site or permanently disused?
	Easting (m)	Northing (m)				
R1	756586	6270224	1011	4.1	Northwest	No
R2A	761345	6266600	1125	1.2	East southeast	No
R2B	761248	6266538	1131	1.2	East southeast	No
R2C	761255	6266664	1123	1.1	East southeast	No
R3	758547	6269398	1040	2.2	Northwest	No
R4	761947	6266839	112 4	1.7	East	No
R6	761479	6266733	1119	1.3	East	No
R7	761860	6266057	1144	1.9	Southeast	No
R9	760720	6265932	1155	1.2	South southeast	No
R11	760552	6265804	1147	1.1	South southeast	No
R12	760196	6265857	1152	0.8	South southeast	No
R13	759699	6266209	112 6	0.2	South	No
R16	758658	6267073	110 3	1.1	West	No
R17	758711	6267593	1080	1.2	West	No
R18	758124	6267042	1051	1.6	West	No
R19	758456	6267277	1066	1.3	West	No

As listed the nearest sensitive receiver (R13) is located around 200 metres from the quarry site boundary. R13 is located along Sewells Creek Road near the site entrance (i.e. the sealed main quarry road) but is around 500 metres from the materials handlin g areas.

4.2 Terrain

A three-dimensional schematic of terrain features around the proposal is shown below in **Figure 4.2**.

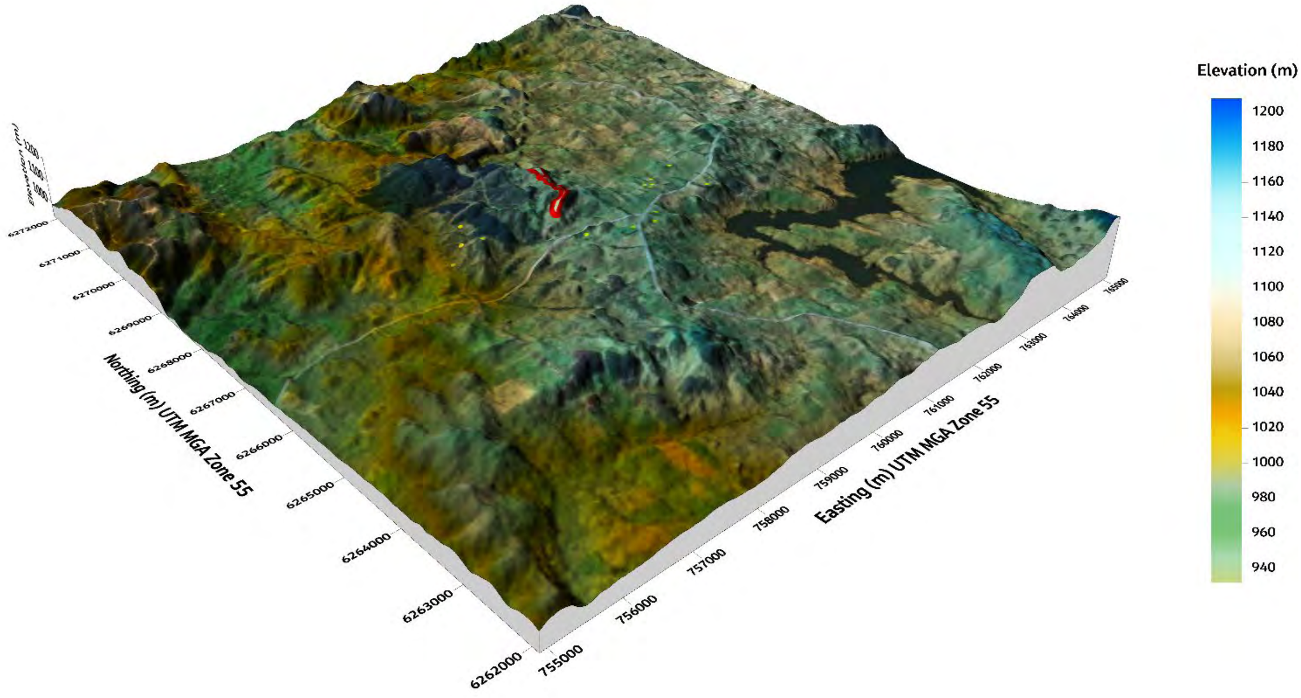


Figure 4.2. Three-dimensional schematic of proposal setting

As displayed, elevations within the air quality study area range from around 940 to 1200 metres above sea level. Elevations at the site range are around 1,150 metres above sea level. As listed above in **Table 4.1**, most identified nearby receivers are at locations with approximately the same elevation as the proposal site. Receivers R1, R3, R18 and R19 are all at elevations around 100 metres or more below the site.

4.3 Meteorology

Meteorological conditions are important for determining the transport of emissions, and the potential influences on air quality. In addition, meteorological data are often used with concurrent air quality data to determine potential contributions from sources of interest. This section provides an analysis of meteorological data collected near the Project and identifies the datasets that may be representative of the long term, local conditions.

The EPA prescribes the minimum requirements for meteorological data that are to be used for air quality assessments. These requirements are outlined in the Approved Methods and include minimum data capture rates, siting and operation, and data preparation. Two types of meteorological stations are described by the EPA:

- "Site specific"; and
- "Site representative".

Data from site-specific meteorological stations are preferred for air quality assessments however site representative data is also acceptable provided that analysis indicate that the data adequately describes the expected meteorological conditions at the site of interest.

There are no known meteorological stations around the site, however the Bureau of Meteorology (BoM) and NSW Department of Planning and Environment (DPE) operate automatic weather stations throughout NSW. As listed below in **Table 4.2**, the nearest stations to the site are both in Bathurst. Both are 35 kilometres distance from the site and are unlikely to collect data that accurately represent conditions around the site, primarily due to terrain effects. Meteorological modelling has therefore been used to derive local conditions.

Table 4.2. Details of representative meteorological station

Station	Operated by	Approximate co-ordinates UTM MGA 55		Elevation (m)	Approx. distance (km) from the site	Approx. direction from the site
		Easting (m)	Northing (m)			
Bathurst Airport (Station no. 063291)	BoM	746802	6299899	745	35	North northwest
Bathurst Sewage Treatment Plant (STP)	DPE	739441	6301208	651	39	Northwest

Consistent with the NSW EPA's Approved Methods, meteorological data from the five most recent calendar years (2017, 2018, 2019, 2020 and 2021) were analysed to identify overall and year-to-year trends, and to identify a representative year for use in the dispersion modelling. This review is presented below in **Table 4.3**.

Table 4.3. Meteorological review

Parameter	BoM Bathurst Airport						DPE Bathurst					
	2017	2018	2019	2020	2021	5 year average	2017	2018	2019	2020	2021	5 year average
Data completeness (%)	99.9	99.9	100	100	100	**99.9**	99.7	99.9	99.6	99.6	96.0	**99.0**
Mean wind speed (m/s)	3.4	3.4	3.4	3.4	3.2	**3.3**	1.7	1.6	1.6	1.8	1.8	**1.7**
99th percentile wind speed (m/s)	9.7	9.8	10.1	9.3	9.0	**9.6**	6.4	6.9	6	7.0	6.6	**6.6**
Percentage of calms (%)	5.8	7.4	7.0	6.3	8.8	**7.1**	25.4	26.7	27.4	24.5	21.4	**25.1**
Percentage of winds >6 m/s (%)	13.2	13.0	13.9	12.5	10.8	**12.7**	1.4	1.9	1.0	2.4	1.8	**1.7**
Wind direction distribution (%)												
North	7	7	6	9	8	**7**	7	8	7	8	8	**8**
Northeast	17	18	17	19	19	**18**	12	12	13	14	13	**13**
East	15	15	13	15	12	**14**	10	8	8	10	10	**9**
Southeast	11	12	11	11	12	**11**	15	17	14	14	15	**15**
South	12	11	11	9	10	**11**	9	11	10	8	9	**9**
Southwest	15	15	17	15	16	**16**	10	11	13	10	11	**11**
West	13	13	15	13	12	**13**	11	12	14	13	12	**12**
Northwest	11	10	10	10	10	**10**	26	21	21	23	23	**23**
Wind speed distribution (%)												
0 to 0.5 m/s	6	7	7	6	9	**7**	26	27	27	25	22	**25**
0.5 to 2 m/s	24	24	24	23	24	**24**	41	41	41	40	42	**41**
2 to 4 m/s	35	35	36	36	35	**35**	24	23	23	24	25	**24**
4 to 6 m/s	21	21	19	22	21	**21**	8	7	8	9	9	**8**
6 to 8 m/s	10	10	9	10	8	**9**	1	2	1	2	2	**2**
8 to 10 m/s	3	3	4	2	2	**3**	0	0	0	0	0	**0**
> 10 m/s	1	1	1	1	0	**1**	0	0	0	0	0	**0**

Parameter	BoM Bathurst Airport						DPE Bathurst					
	2017	2018	2019	2020	2021	5 year average	2017	2018	2019	2020	2021	5 year average

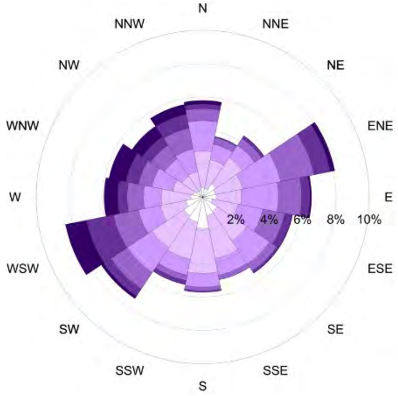
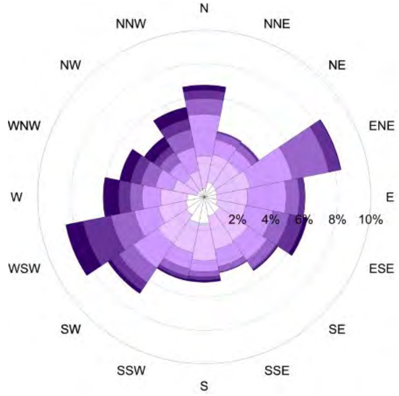
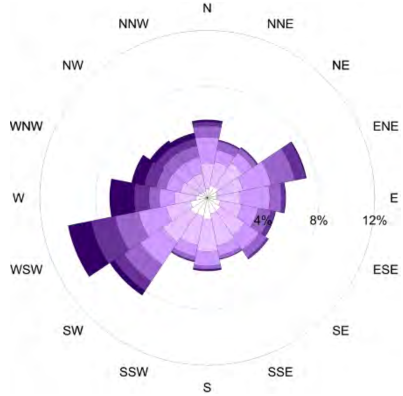
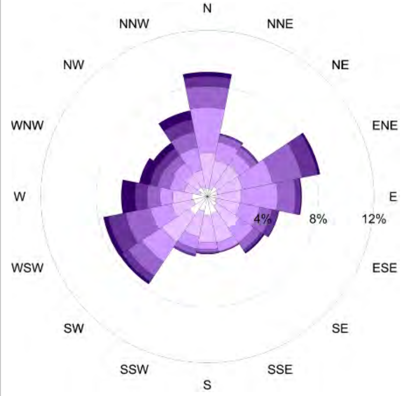
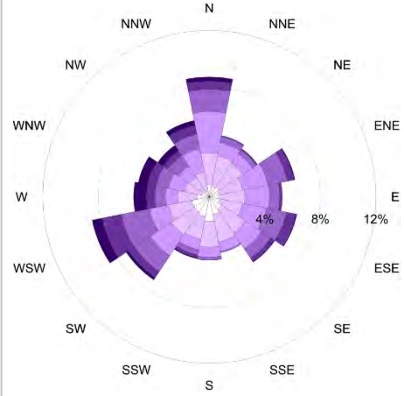
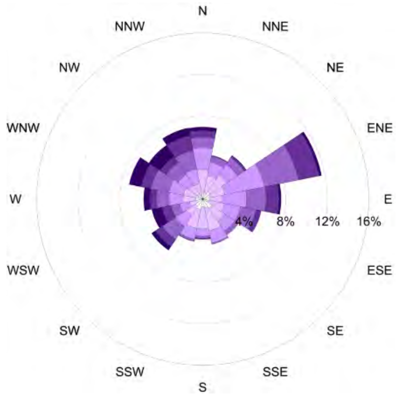
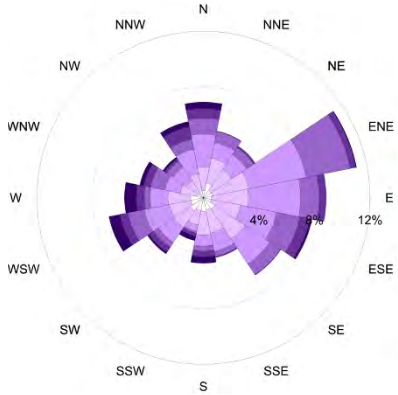
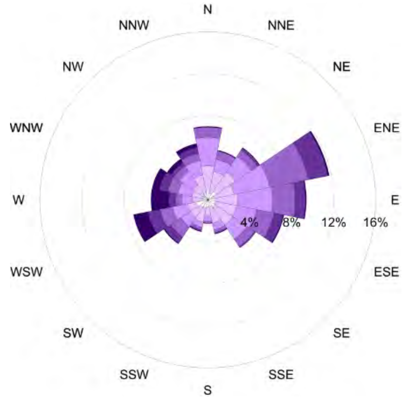
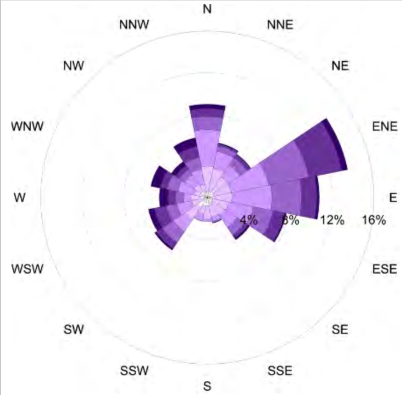
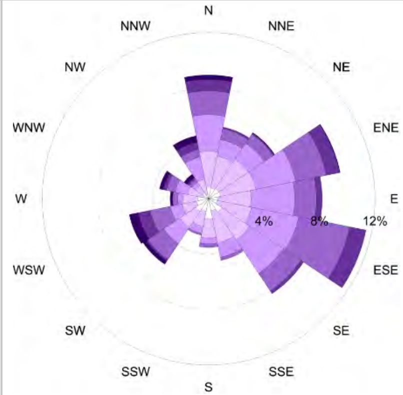
	Within 1% of 2016 to 2020 5-year average
	Within 1 to 2% of 2016 to 2020 5-year average

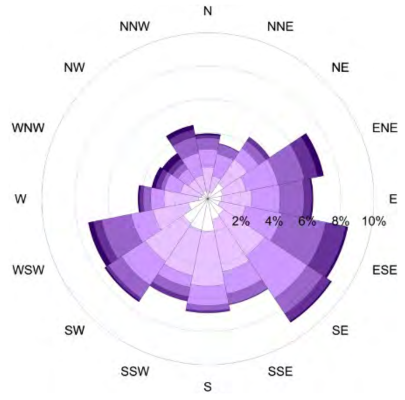
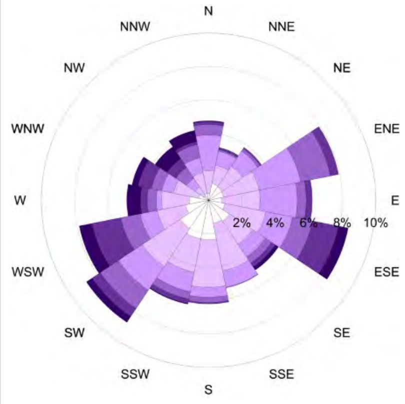
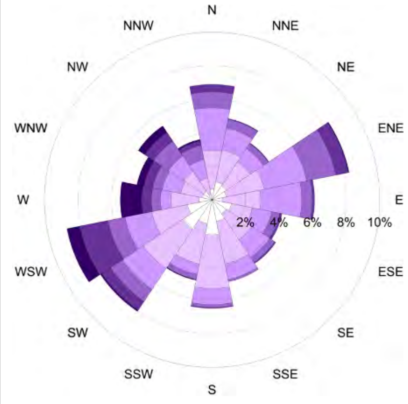
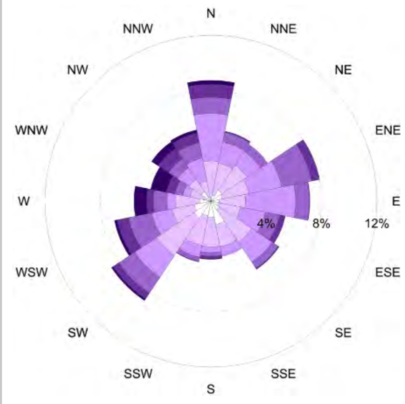
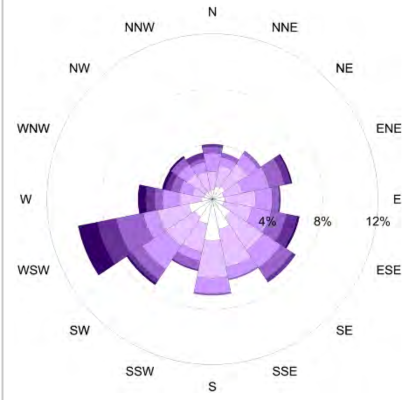
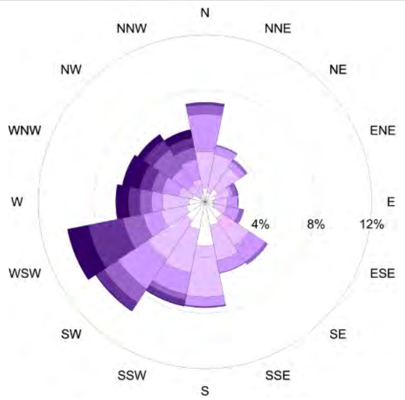
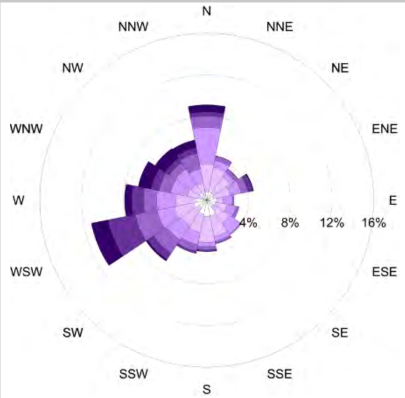
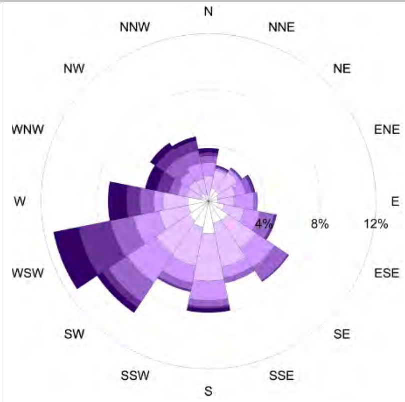
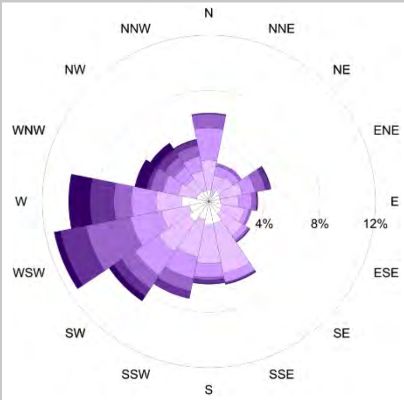
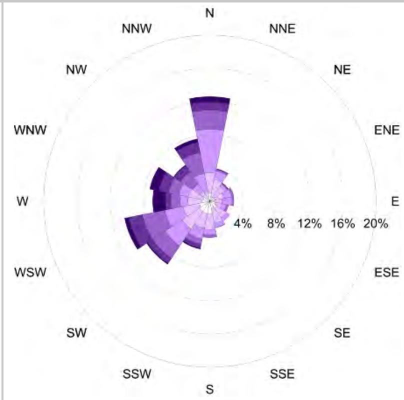
As displayed in **Table 4.3**, over the years reviewed, the mean wind speed ranged from 3.2 to 3.4 m/s at BoM's Bathurst Airport station and from 1.6 to 1.8 m/s at DPE's station located at Bathurst STP. The 99th percentile wind speeds (i.e. wind speeds only exceeded one percent of the time) were also consistent, ranging between 9 and 10.1 m/s BoM's Bathurst Airport station and from 6 to 7 m/s at the DPE station. The percentage occurrence of calm conditions (i.e. when wind speeds were recorded less than 0.5 m/s) ranged between 5.8 and 8.8 %, and 21.4 and 27.4 % at the BoM and DPE Bathurst stations respectively.

There are notable differences in the wind speeds observed from both stations, with the average and 99th percentile speeds recorded at the DPE Bathurst station being considerably lower than at BoM's Bathurst Airport station. The frequency of winds greater than 6 m/s are also much lower, with the frequency of calm conditions recorded as being around 18% higher. These results are not expected given that the stations are only located 7 kilometres apart.

AS/NZS 3580.1.1:2016 provides guidance of avoiding the siting of meteorological stations within '10 x height of the obstruction' metres of the monitor to avoid associated obstructions and interferences. Aerial imagery reveals the presence of several structures within 50-60 metres (10 x 5-6 metre building height), suggesting that the results recorded at the DPE station may be obstructed. This is supported by the results from other stations located throughout central NSW where recorded meteorology are more consistent with the observations at BoM's Bathurst Airport station. Further, the Bathurst Airport Station is located at a more comparable elevation (745 metres) compared to the site (see **Section 4.2** above) than the DPE station (651 metres). Considering these factors, data from BoM's Bathurst Airport station have been considered for the identification of a suitable metrological year for the assessment.

Annual meteorological datasets used for the purpose of dispersion modelling in NSW are required to be contain records that are at least 90% complete. As listed in **Table 4.3**, the 90% data capture target was achieved at BoM's Bathurst Airport station for all five years reviewed. Annual and seasonal wind roses displayed below in **Figure 4.3** were developed for further analysis to identify a representative year for modelling.

2017	2018	2019	2020	2021
Annual				
 Calms:5.8%	 Calms:7.4%	 Calms:7.0%	 Calms:6.3%	 Calms:8.8%
Summer				
 Calms:5.0%	 Calms:5.4%	 Calms:6.2%	 Calms:4.3%	 Calms:6.9%
Autumn				

2017	2018	2019	2020	2021
 Calms:7.2%	 Calms:8.3%	 Calms:8.6%	 Calms:5.6%	 Calms:11.9%
Winter				
 Calms:8.2%	 Calms:9.4%	 Calms:8.8%	 Calms:8.7%	 Calms:9.3%
Spring				

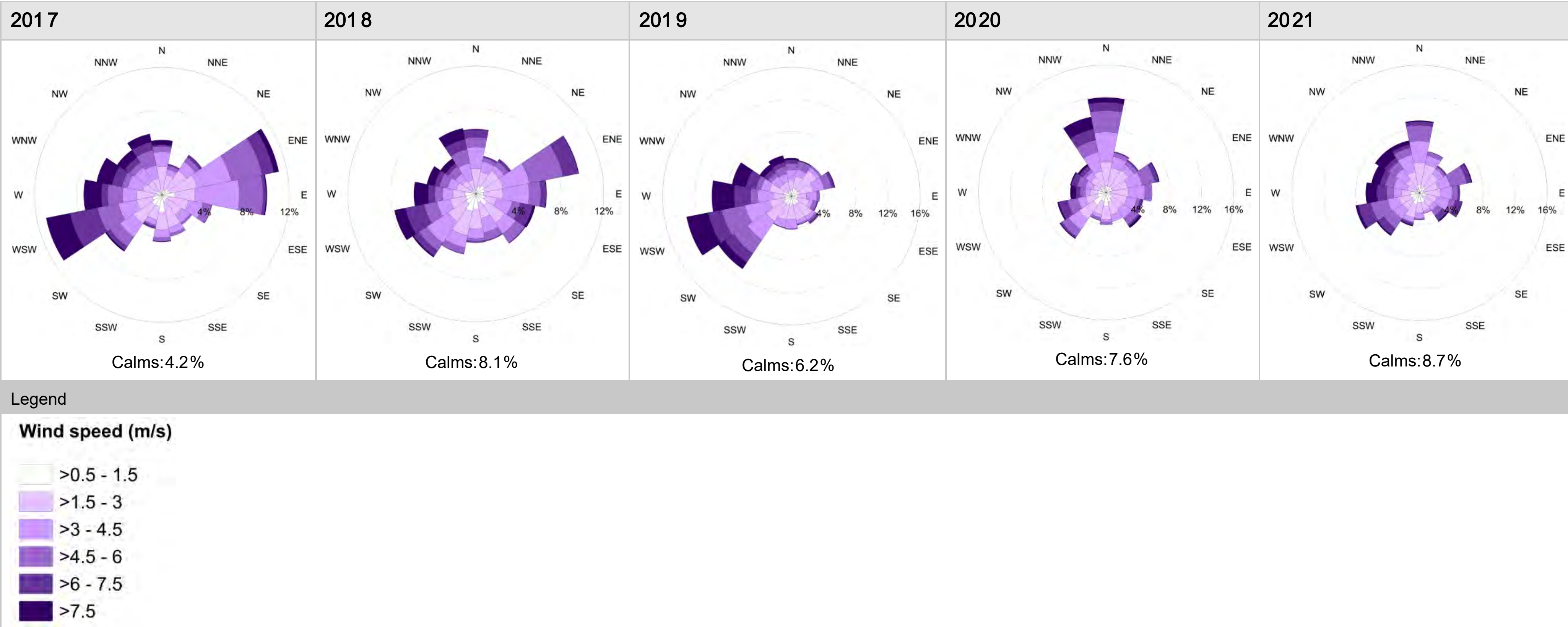


Figure 4.3. Annual and seasonal wind roses forBoM Bathurst, 2017 to 2021

As displayed in **Figure 4.3**, annual and seasonal wind roses were consistent across all five years with the following trends observed:

- Annual: Winds blowing from the west-southwest and east-northeast most common, with winds from the north and east-southeast also occurring often;
- Summer: Similar trends to those observed annually, with winds blowing from the east-northeast most common
- Autumn: Similar trends to those observed annually, with winds blowing from the southeast also common
- Winter: Winds blowing from the north and west-southwest occurring most often.
- Spring: Similar trends to those observed annually.

Considering the consistency of observations, none of the five years were excluded as being an unsuitable representative meteorological year. Background air quality trends outlined below in **Section 4.4** were therefore also reviewed to identify a suitable representative year for the purpose of the assessment.

4.4 Background air quality

4.4.1 Overview

To provide a comprehensive assessment of impacts against the relevant air quality criteria (see **Section 0**), it is necessary to have information or estimates of the existing air quality conditions. Although there is no air quality monitoring undertaken at or directly around the site, there a number of regional monitoring stations operated by DPE which can be used to provide an indication of the air quality conditions in similar, rural environments. Details of these monitoring locations are listed in **Table 4.4** below.

Table 4.4. Summary of relevant air quality monitoring stations

Station location	Operated by	Type	Approximate distance (km) and direction from the proposal	Type	Pollutant(s) of interest monitored
Bathurst	DPE	Regional air quality monitoring station	40 km to the northwest	TEOM, BAM	PM_{10}, $PM_{2.5}$
Orange	DPE	Regional air quality monitoring station	82 km to the northwest	TEOM, BAM	PM_{10}, $PM_{2.5}$
Beresfield	DPE	Regional air quality monitoring station	200 km to the northeast	Chemiluminescence $NO/NO_2/NO_X$ Analyzer	NO_x
Albion Park	DPE	Regional air quality monitoring station	130 km to the southeast		NO_x
Goulburn	DPE	Regional air quality monitoring station	115 km to the south		NO_x

TEOM= Tapered element oscillating microbalance and BAM = Beta attenuation monitor

As listed in **Table 4.4**, the nearest regional air quality monitoring stations operated by DPE are at Bathurst and Orange. The Orange monitoring station was only commissioned in January 2019. PM_{10} and $PM_{2.5}$ data were considered from these two stations. The assessment of plant exhaust emissions and blast fume also requires an understanding of background NO_2 concentrations, which is not monitored at Bathurst or Orange. Measured NO_2 data were considered from Beresfield, Albion Park, Wagga Wagga and Goulburn in order to establish suitable background levels for these components of the assessment.

The quality or level of completeness is an important factor in determining whether data are suitable for the purpose of representing background air quality conditions in the environmental around a proposal. Generally, a data capture rate of 90% or more is considered acceptable, taking into account periods of servicing, calibration and maintenance. **Table 4.5** summarises the rate of data capture at both of the monitors.

Table 4.5. PM_{10} and $PM_{2.5}$ data capture rates (per cent)

Year	DPE Bathurst	DPE Orange
PM_{10}		
2017	97%	ND
2018	98%	ND
2019	99%	93%
2020	98%	97%
2021	96%	99%
$PM_{2.5}$		
2017	94%	ND
2018	95%	ND
2019	95%	93%
2020	98%	97%
2021	99%	99%

'ND' = No data, station not yet commissioned; '-' = not measured at station; 'N/A' = not applicable to the assessment; and below 90% quality objective

PM_{10} and $PM_{2.5}$ capture rates higher than 90 per cent were met at both DPE Bathurst and Orange stations for all years that they operated (5 and 3 years respectively). This indicates the suitability of the data sets collected over the last five years.

Capture rates of NO_2 data for DPE Beresfield, Albion Park and Goulburn stations in 2017, 2018, 2019, 2020 and 2021 are listed below in **Table 4.6**.

Table 4.6. NO_2 data capture rates (per cent)

Year	DPE Beresfield	DPE Albion Park	DPE Goulburn
NO_2			
2017	92%	93%	ND
2018	92%	93%	ND
2019	84%	91%	ND
2020	86%	83%	89%
2021	85%	58%	89%

'ND' = No data, station not yet commissioned; '-' = not measured at station; 'N/A' = not applicable to the assessment; and below 90% quality objective

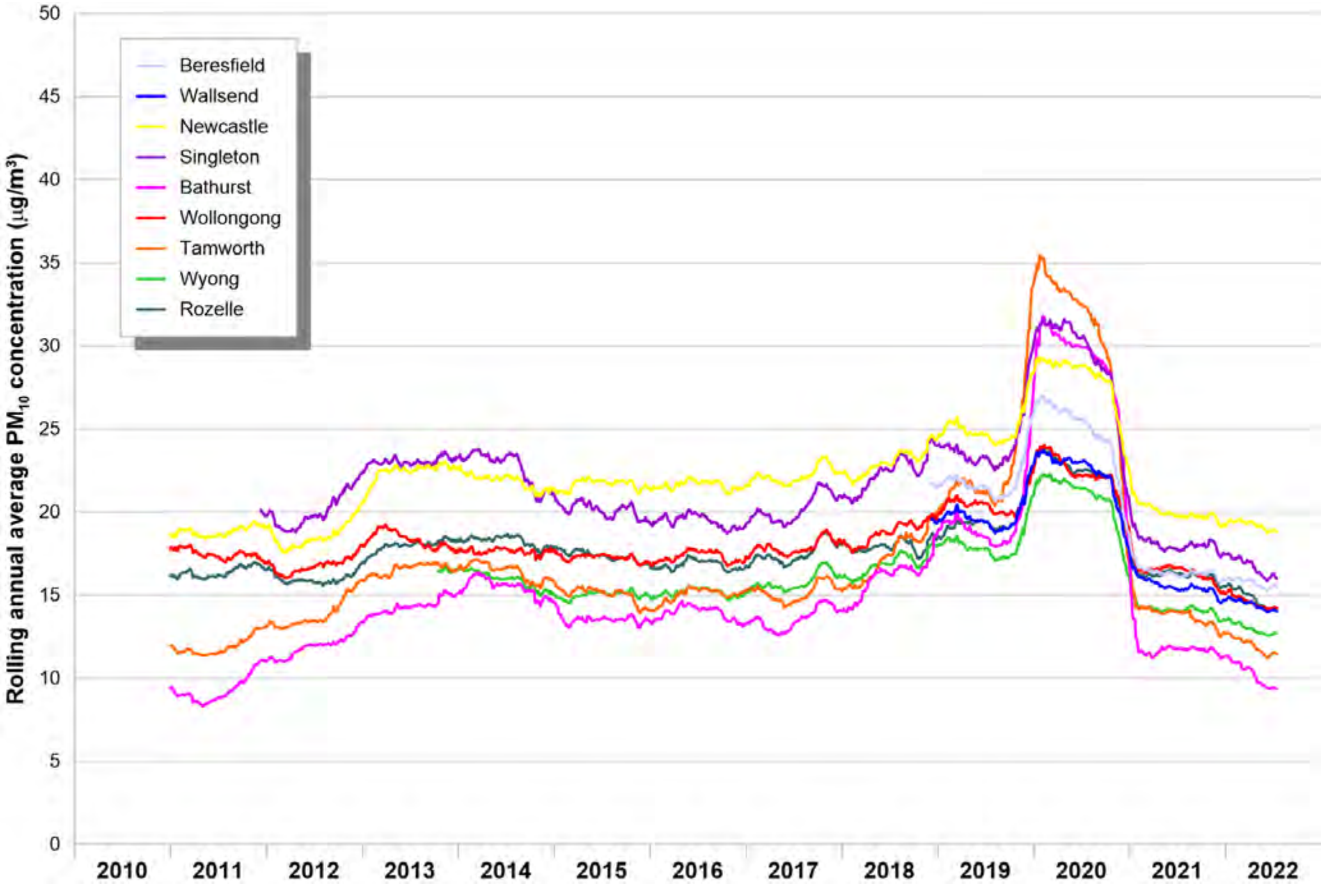
As displayed, there were several years where hourly NO_2 capture rates were less than 90%.

4.4.2 Extraordinary events

Air quality in many parts of NSW, including the Central Tablelands, was adversely influenced by drought conditions between 2017 and early 2020 with lower-than-average rainfall. A deterioration in air quality conditions in recent years was not unique to the Central Tablelands and extraordinary events, beyond normal conditions, have been identified as part of annual reviews of monitoring data.

In their 'Annual Air Quality Statement 2018' the DPE concluded that particle levels increased across NSW due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH, 2019). The DPE subsequently concluded, from their "Annual Air Quality Statement 2019", that air quality in NSW was greatly affected by the continuing intense drought conditions and unprecedented extensive bushfires during 2019. In addition, the continued "intense drought has led to an increase in widespread dust events throughout the year" (DPIE, 2020).

The influence of drought conditions on air quality is evident in the DPE's monitoring data. **Figure 4.4** shows the rolling annual average PM_{10} concentrations from data collected at various rural and urban air quality monitoring sites since 2011. These data clearly show an increase in PM_{10} concentrations at all rural and urban locations from 2017 onwards, reflecting the onset of drought conditions, and increased bushfire activity in 2019 and into early 2020.



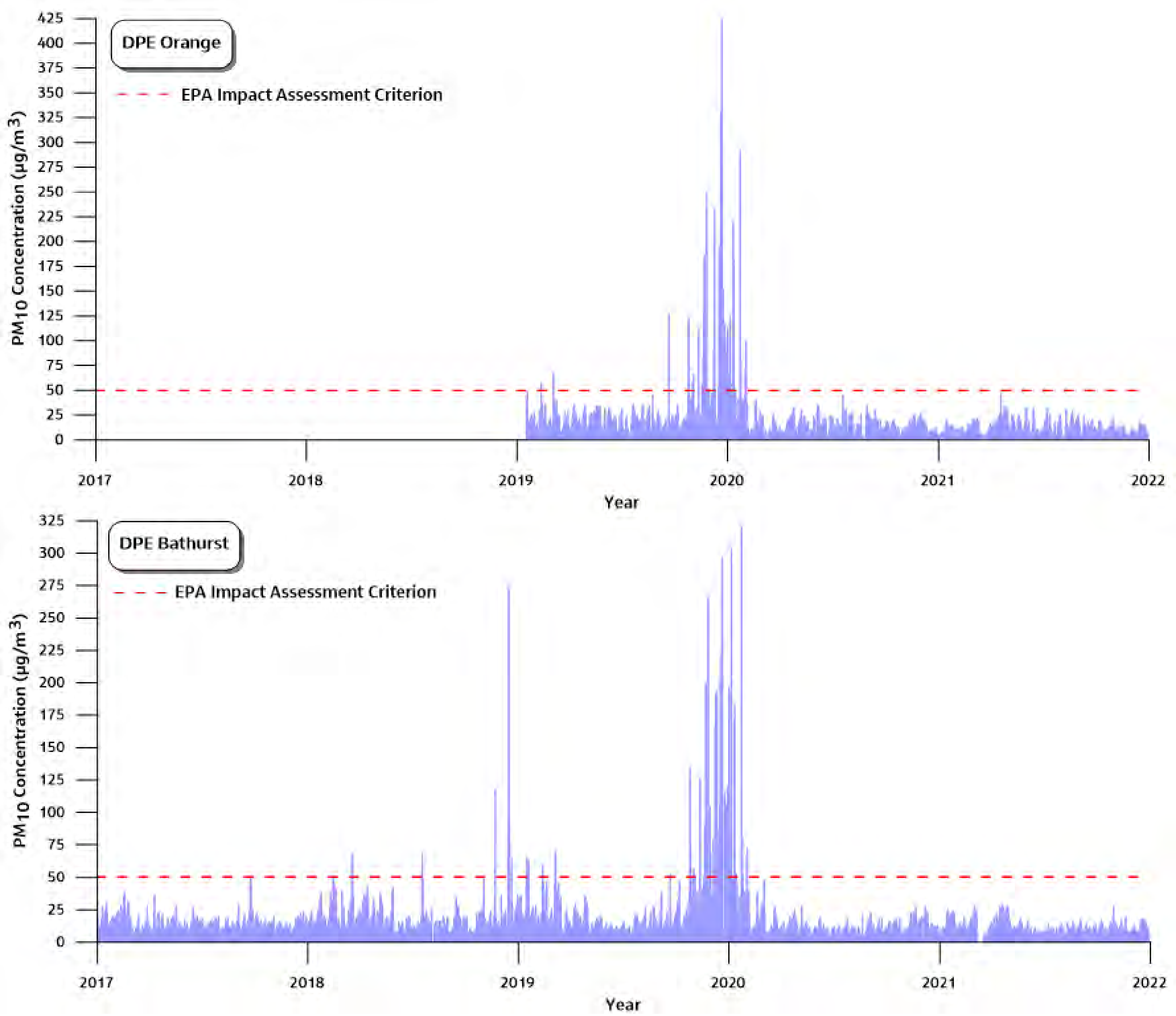
Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.4. Annual average PM_{10} concentrations from various NSW air quality monitoring sites

The use of years with elevated air quality levels, largely driven by extraordinary events or extreme climatic conditions (or both) are avoided in modelling studies primarily because they do not address the definition of representative. In addition, extraordinary events cannot be reliably simulated in air dispersion models as it is not possible to identify all possible factors that led to these events, for example, the factors that influence the time, location and intensity of bushfires. This context has been considered in the analysis below.

4.4.3 Particulate matter as PM_{10}

Continuous PM10 measurements are collected at DPE's Orange and Bathurst stations. Time-series of daily (that is, 24-hour average) measurements from 2017 to 2021 is displayed below in **Figure 4.5**. The NSW EPA's daily impact assessment criterion of 50 µg/m3 is also displayed.



Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.5. Measured 24-hour average PM_{10} concentrations at DPE Bathurst and Orange, 2017 to 2021

As shown in **Figure 4.5**, from 2017 to 2021 there were several instances where daily PM_{10} concentrations exceeded 50 µg/m^3. **Table 4.7** summarises these results.

Table 4.7. Summary of PM_{10} measurement statistics at DPE Bathurst and Orange, 2017 to 2021

Year	DPE Bathurst	DPE Orange	Criterion
Maximum 24-hour average in µg/m^3			
2017	49.9	ND	50
2018	274.1	ND	
2019	296.6	423.7	

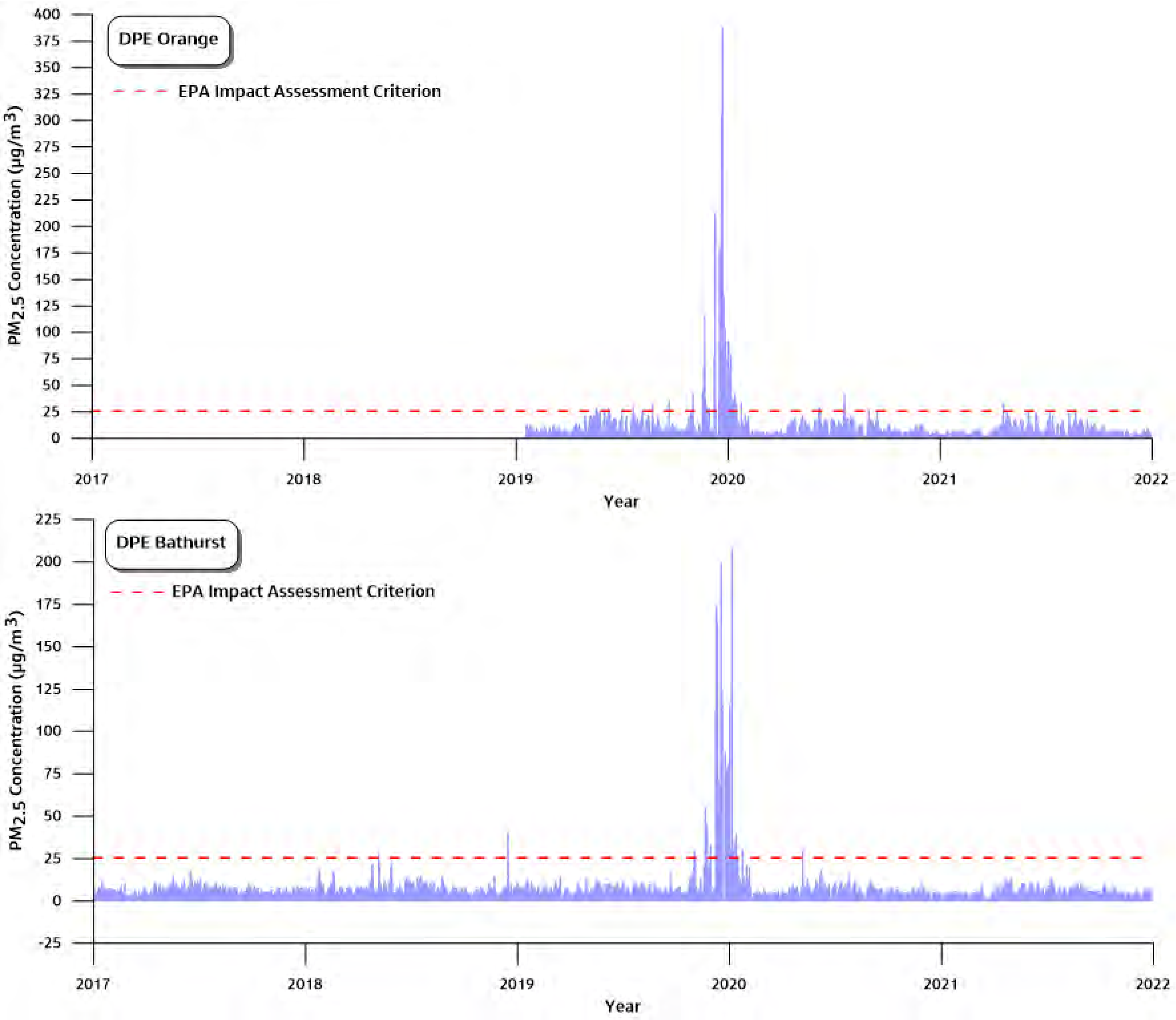
Year	DPE Bathurst	DPE Orange	Criterion
2020	320.4	291.8	
2021	29.2	46.3	
Number of days above 24-hour average criteria (50 µg/m^3)			
2017	0	ND	-
2018	8	ND	
2019	40	35	
2020	14	12	
2021	0	0	
Annual average in µg/m^3			
2017	14.1	ND	30
2018	18.8	ND	
2019	27.4	28.3	25 (applicable from 20 Jan 2017 onwards)
2020	17	17.9	
2021	11.3	11.4	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

As evident in **Table 4.7** there was a higher frequency of exceedances in 2019 compared with other years. A high number of these exceedances occurred in the fourth quarter, corresponding to an unprecedented fire season, causing a significant deterioration in air quality throughout Central and Eastern Australia. This is reflected in the higher annual average PM_{10} concentration at Bathurst (27 µg/m^3) compared with previous years.

4.4.4 Particulate matter as $PM_{2.5}$

PM2.5 is also monitored at the DPE's Orange and Bathurst stations. Like for PM10, only limited years of data were available, particularly from the Orange station. **Figure 4.6** shows a time-series of daily measurements collected from 2017 to 2021, with the 25 µg/m3 NSW EPA daily impact assessment criterion also displayed.



Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.6. Measured 24-hour average $PM_{2.5}$ concentrations at DPE Bathurst and Orange, 2017 to 2021

As for PM_{10}, there were several days where $PM_{2.5}$ concentrations exceeded the NSW EPA's 25µg/m^3 impact assessment criterion. **Table 4.8** summarises these results.

Table 4.8. Summary of $PM_{2.5}$ measurement statistics at DPE Bathurst and Orange, 2017 to 2021

Year	DPE Bathurst	DPE Orange	Criterion
Maximum 24-hour average in µg/m^3			
2017	17.5	ND	-
2018	40.5	ND	

Year	DPE Bathurst	DPE Orange	Criterion
2019	199.5	387.4	25 (applicable from 20 Jan 2017 onwards)
2020	207.3	92.3	
2021	13.8	32.3	
Number of days above 24-hour average criteria (25 μg/m³)			
2017	0	ND	-
2018	2	ND	
2019	24	31	
2020	13	15	
2021	0	3	
Annual average in μg/m³			
2017	6.1	ND	-
2018	7	ND	
2019	11.3	15.8	8 (applicable from 20 Jan 2017 onwards)
2020	7.6	9.1	
2021	5.1	6.6	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

As for PM_{10}, **Table 4.8** shows how maximum daily $PM_{2.5}$ concentrations were recorded several times higher (up to 387 μg/m³) than the EPA's impact assessment criterion (25 μg/m³) during the 2019/20 Australian bushfires. Annual $PM_{2.5}$ concentrations exceeded 8 μg/m³ at both stations in 2019, and also in 2020 at Orange.

4.4.5 Total suspended particulates (TSP)

Air quality criteria for TSP are usually set to protect against nuisance amenity impacts. No known monitoring of TSP is conducted near the Project. The NSW Minerals Council estimated that, for rural environments in NSW, the average PM_{10} concentrations are typically 40 per cent of the TSP concentrations (Minerals Council, 2000). **Table 4.9** shows the estimated TSP concentrations at the DPE monitoring locations based on this PM_{10} to TSP relationship. Concentrations are estimated to be much lower than the EPA assessment criterion. Even lower concentrations would be expected near the Project.

Table 4.9. Estimated TSP concentrations

Year	DPE Bathurst	DPE Orange	Criterion
Annual average in μg/m³			
2017	35.3	ND	90
2018	47	ND	
2019	68.5	70.8	
2020	42.5	44.8	
2021	28.3	28.5	

4.4.6 Deposited dust

As outlined in the AQMP (Umwelt, 2019), deposited dust monitoring was completed at four locations around the site. The location of the four gauges are displayed below in **Figure 4.7**.

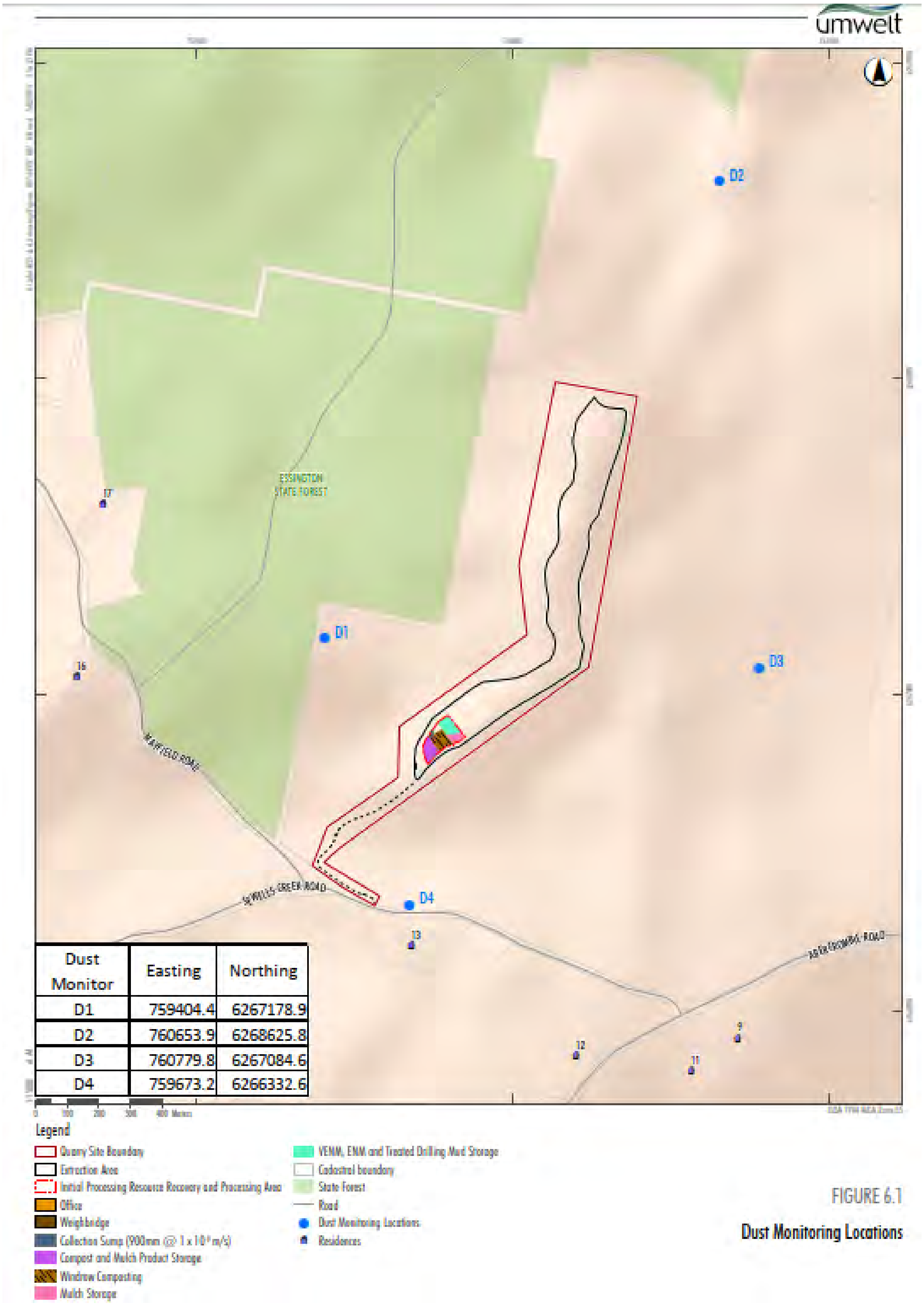


Figure 4.7. Site deposited dust monitoring locations (Source: Umwelt, 2019)

Results from these monitors for 2021 are summarised below in **Table 4.10**. As listed, the highest annual average measured was 0.9 g/m^2/month at gauge D4. These results indicate that in 2021, local deposited dust levels remained below the EPA's 4 g/m^2/month impact assessment criterion.

Table 4.10. Measured local deposited dust levels around the site (Source: Oberon Earthmoving, 2022)

Period	Reported insoluble solids (g/m ^{2}/month)				EPA impact assessment criterion (g/m ^{2}/month)
	D1	D2	D3	D4	
January 2021	0.1	0.2	0.4	0.5	4
February 2021	0.4	0.2	0.5	1.2	
March 2021	0.7	0.7	0.6	0.7	
April 2021	0.6	0.3	0.4	0.9	
May 2021	0.2	<0.1	0.2	0.4	
June 2021	1.0	0.5	0.3	1.3	
July 2021	0.5	0.9	ND	ND	
August 2021	0.6	ND	ND	0.8	
September 2021	1.1	1.0	0.3	1.0	
October 2021	1.5	0.8	0.6	0.7	
November 2021	0.8	ND	0.1	1.0	
December 2021	1.6	1.6	0.1	1.7	
2021	**0.8**	**0.6**	**0.4**	**0.9**	

4.4.7 Nitrogen dioxide

The assessment of plant exhaust emissions and blast fume also requires an understanding of background NO_2 concentrations. **Table 4.11** provides a summary of the measured NO_2 concentrations from DPE's Beresfield, Albion Park and Goulburn stations from 2017 to 2021. These data show that the maximum NO_2 concentrations have not exceeded the EPA's 1-hour average assessment criterion of 164 µg/m^3 with the exception of Goulburn in 2020. Annual averages have not exceeded the EPA's annual average assessment criterion of 31 µg/m^3.

Table 4.11. Summary of representative NO_2 measurements

Year	DPE Beresfield	DPE Albion Park	DPE Goulburn	Criterion
Maximum 1-hour average in µg/m ^{3}				
2017	82	78	ND	164
2018	82	80	ND	
2019	115	84	ND	
2020	72	80	**203**	
2021	70	66	60	
Annual average in µg/m ^{3}				
2017	18	8	ND	31
2018	18	8	ND	
2019	16	8	ND	
2020	14	6	6	
2021	12	4	6	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Nitrogen dioxide is a component of NO_x. Emissions of NO_x from combustion related sources will include both nitric oxide (NO) and NO_2. In general, at the point of emission, NO will comprise the greatest proportion of the total NO_x emission. Typically, this is 90% by volume of the NO_x. The remaining 10% will comprise mostly NO_2.

Ultimately however, much of the NO emitted into the atmosphere is oxidised to NO_2. The rate at which this oxidisation takes place depends on prevailing atmospheric conditions including temperature, humidity and the presence of other substances in the atmosphere such as ozone. It can vary from a few minutes to many hours. The rate of conversion is important because from the point of emission to the point of maximum ground-level concentration there will be an interval of time during which some oxidation will take place. If the dispersion is sufficient to have diluted the plume to the point where the concentration is very low, then the level of oxidation is unimportant. However, if the oxidation is rapid and the dispersion is slow then high concentrations of NO_2 can occur.

The NO_x monitoring data from the DPE Beresfield, Albion Park and Goulburn monitors in 2021 show that percentage of NO_2 in the NO_x is inversely proportional to the total NO_x concentration, and when NO_x concentrations are high, the percentage of NO_2 in the NO_x is typically of the order of 20% or less. This is demonstrated by **Figure 4.8** which shows that, for high NO_x concentrations, the NO_2 to NO_x ratio reduces to less than 20%.

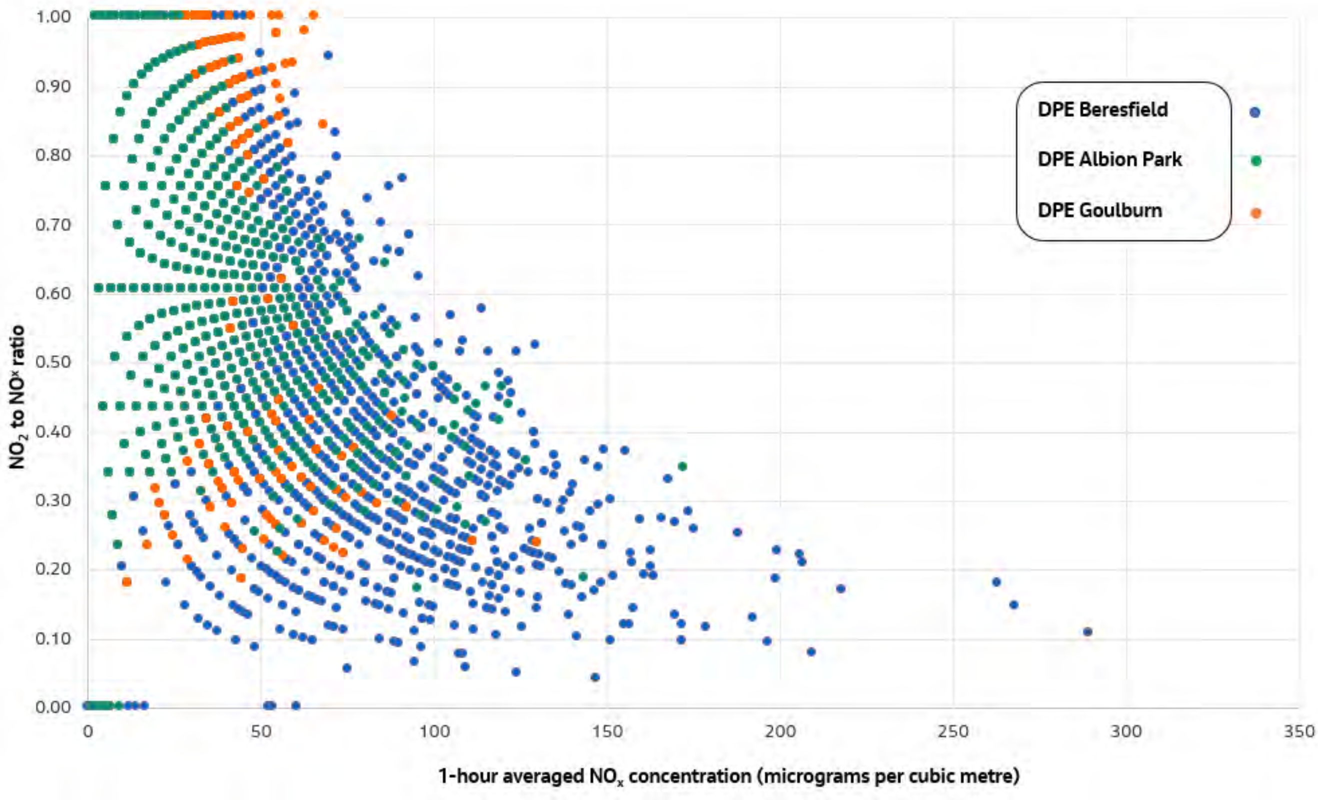


Figure 4.8. Measured NO_2 to NO_x ratios from hourly average data collected at DPE Beresfield, Albion Park and Goulburn in 2021

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

4.5 Selection of a representative assessment year and establishment of background air quality conditions

The review of the existing environment led to the following observations:

- Meteorological conditions do not vary significantly from year to year and conditions in 2021 can be considered as representative of the long-term conditions near the site.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal location.

- Concentrations of key air quality indicators would be expected to be lower near the proposal than in areas of higher population densities (i.e., where the monitoring data considered for the assessment were collected).

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to proposal contributions for the assessment of potential cumulative impacts. Table 4.12 shows the assumed background levels that apply at sensitive receptors. These levels have been added to proposal contributions to determine the potential cumulative impacts, as per the Approved Methods.

Table 4.12. Adopted background air quality conditions

Pollutant	Averaging time	Adopted value	Justification	EPA impact assessment criterion
Particulate matter as PM_{10}	24-hour	Variable by day, noting the maximum daily concentration observed being 29.2 µg/m^3	Measured PM_{10} concentrations from DPE Bathurst in the representative year, 2021	50 µg/m^3
	Annual	11.3 µg/m^3		25 µg/m^3
Particulate matter as $PM_{2.5}$	24-hour	Variable by day, noting the maximum daily concentration observed being 13.8 µg/m^3	Measured $PM_{2.5}$ concentrations from DPE Bathurst in the representative year, 2021	25 µg/m^3
	Annual	5.1 µg/m^3		8 µg/m^3
Particulate matter, TSP	Annual	28.3 µg/m^3	Estimated annual average concentration for Bathurst in the representative year, 2021	90 µg/m^3
Deposited dust	Annual	0.9 g/m^2/ month	Highest deposited dust level measured across all four deposited dust gauges surrounding the site in 2021	4 g/m^2/ month
Nitrogen dioxide (NO_2)	1-hour	70 µg/m^3	Highest NO_2 concentration from DPE Beresfield, Albion Park and Goulburn in the representative year, 2021	164 µg/m^3
	Annual	12 µg/m^3		31 µg/m^3

5. Assessment methodology

5.1 Operational dust

Potential dust impacts associated with the proposed modification have been quantified by air dispersion modelling. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporal and spatial varying flow fields due to influences of the local complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions. The CALPUFF model has been selected. This model is specifically listed in the Approved Methods and has been used to predict ground-level particulate matter concentrations and deposition levels due to the Proposal and other sources. Concentrations and deposition levels have been simulated for every hour of the representative year and results at local communities and sensitive receptors have then been compared to the relevant air quality assessment criteria. **Figure 5.1** shows an overview of the model inputs and how they interact. Each are described in further detail, including details of how CALPUFF was configured below.

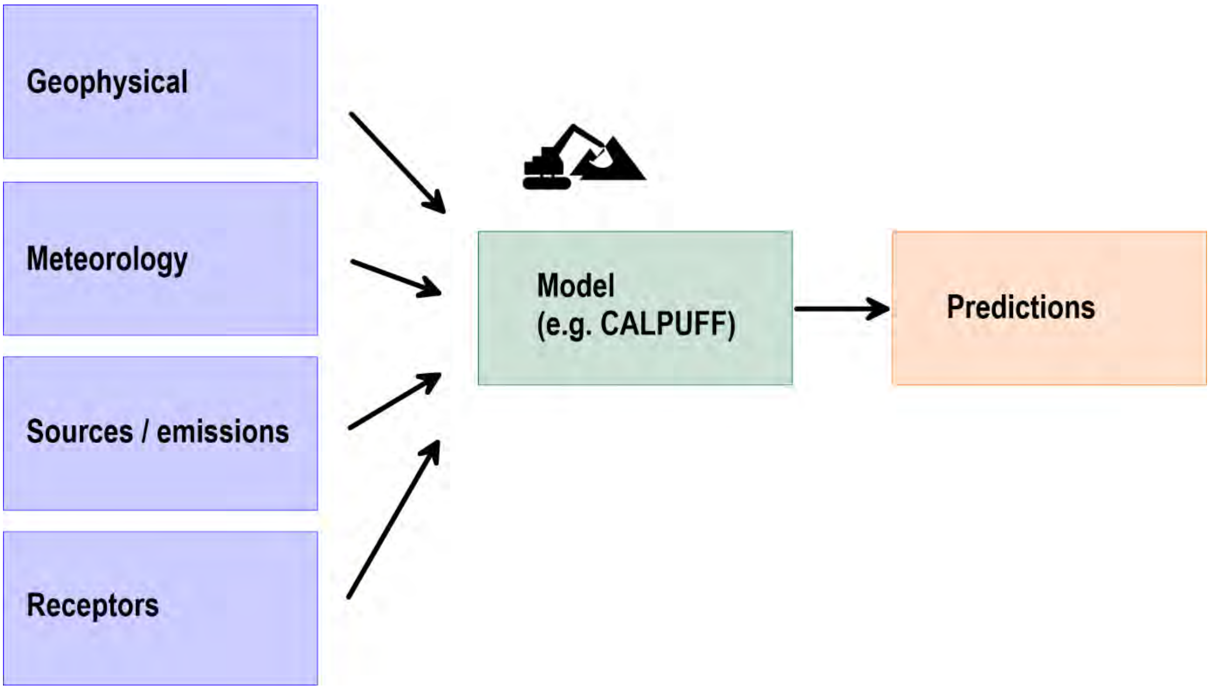


Figure 5.1. Overview of model inputs

5.1.1 Geophysical

The geophysical inputs of the model are the terrain and land-use information applied. These are displayed below in **Figure 5.2**. Elevations across the modelling domain were determined using 1 second (30 metre) digital elevation data from the Shuttle Research Topography Mission (SRTM). Land uses were digitised from aerial imagery and classified in-line with the land use types specified in 'CALPUFF Modeling System Version 6 User Instructions', (TRC, 2011).

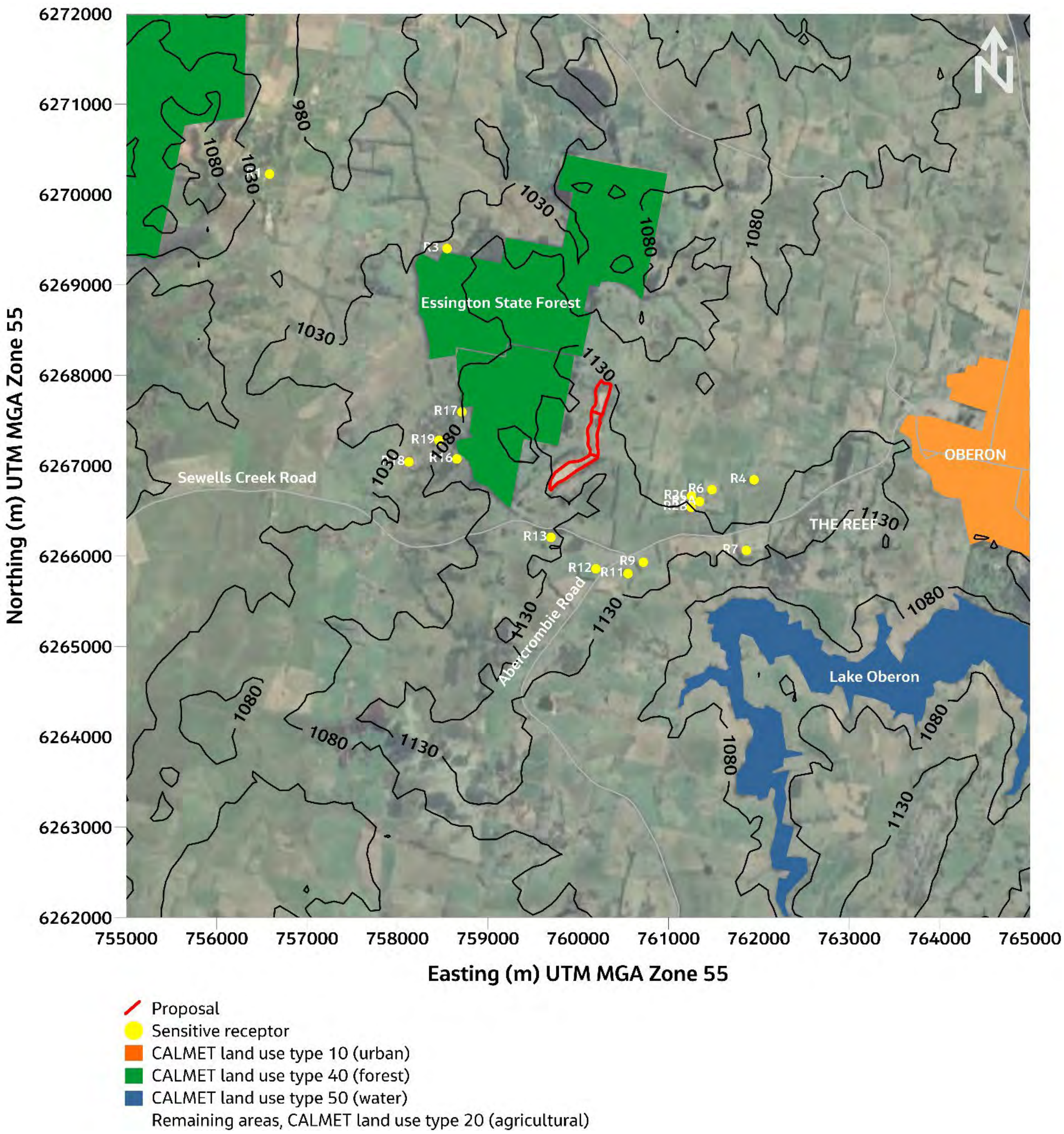


Figure 5.2. Terrain and land use inputs

5.1.2 Meteorology

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

Meteorological data collected in 2021 from the BoM Bathurst Airport surface station and upper air data generated by TAPM at this location were used to initialise the CALMET model. The meteorological modelling followed the guidance of TRC (2011) and adopted the “observations” mode. Key setup details for TAPM and CALMET are listed in **Table 5.1** and **Table 5.2** respectively.

Table 5.1. TAPM setup details

Aspect	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2021, with one “spin-up” day.
Centre of analysis	33°42’ S, 149°48.5’ E
Terrain data source	Shuttle Research Topography Mission (SRTM), 90 m resolution
Land use data source	Default
Meteorological data assimilation	BoM Bathurst Airport Station Radius of influence = 5 km. Number of vertical levels for assimilation = 4 Quality factor = 1

Table 5.2. CALMET setup details

Aspect	Value(s)
Model version	6.334
Run mode	“observations” mode
Terrain data source(s)	NASA SRTM 1 second 30 metre resolution dataset
Land-use data source(s)	Digitized from aerial imagery and classified as displayed above in **Figure 5.2**.
Meteorological grid domain	10.3 km x 10.3 km x 2km (vertically)
Meteorological grid resolution	0.1 km
Meteorological grid dimensions	103 x 103 x 9
Meteorological grid origin	754850 m E, 6261850 m S. MGA Zone 55
Surface meteorological inputs	BoM Bathurst Airport Station for observations of wind speed and wind direction. TAPM for temperature, relative humidity, air pressure, ceiling height and cloud cover.
Upper air meteorological inputs	Upper air data file for the location of BoM Bathurst Airport Station derived by TAPM Biased towards surface observations (-1, -0.8, -0.6, -0.4, -0.2, 0, 0, 0, 0)
Simulation length	8760 hours (1 Jan 2021 to 31 Dec 2021)
R1, R2	0.5, 1.0
RMAX1, RMAX2	5, 20
TERRAD	4

Using this approach, the meteorological conditions displayed in **Figure 5.3** were predicted at the approximate location of the proposal.

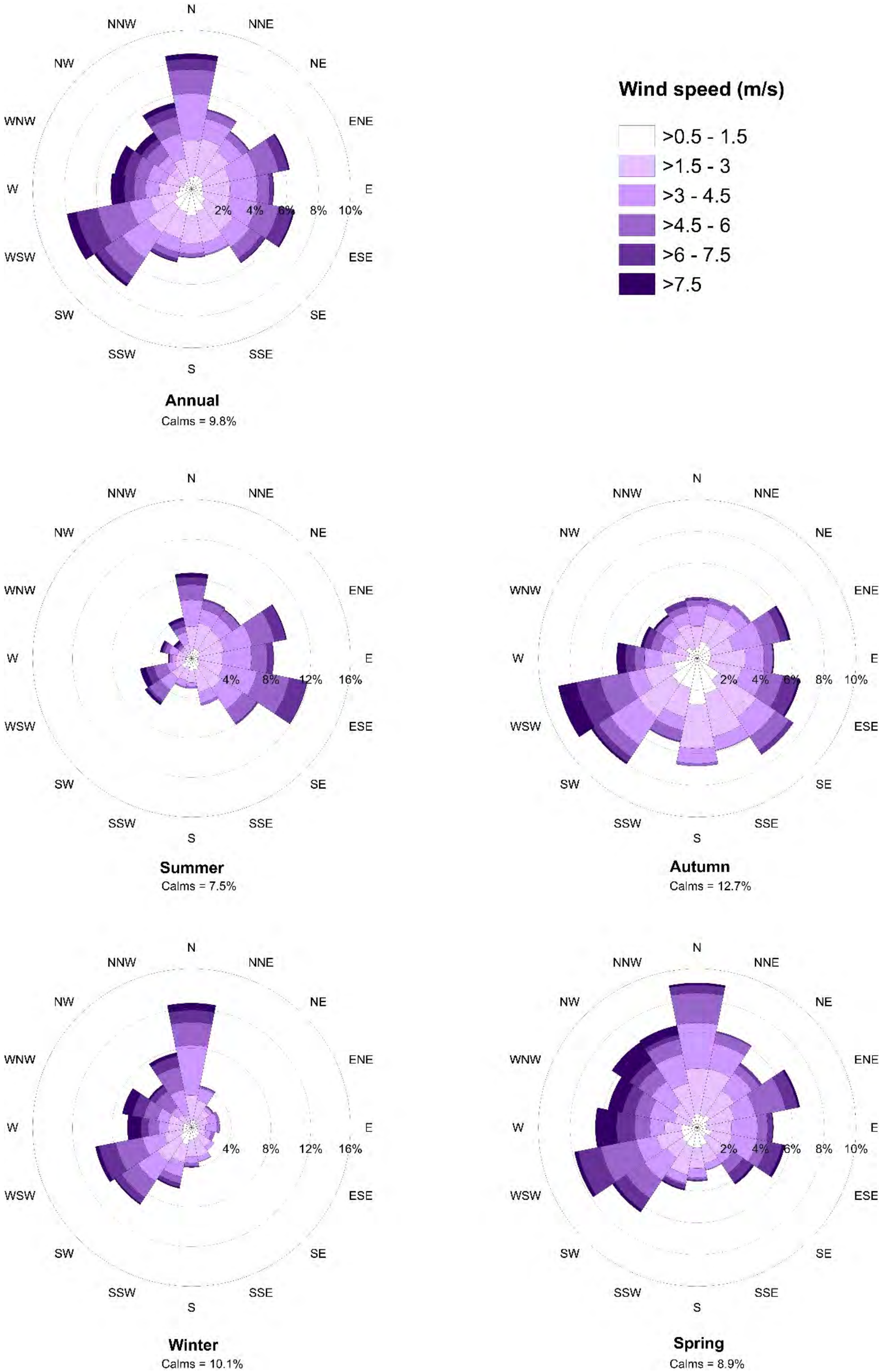


Figure 5.3. Site meteorology

As Figure 5.3 shows, winds blowing from the north, west southwest and southwest were predicted to occur most often annually at the site. The simulation may over-estimate the frequency of winds blowing from the north, although this is not considered to represent an issue noting that the nearest sensitive receptors are located to the south of the site (i.e., conservatively in the direction of these winds from the site). The winds blowing from the west, west southwest and southwest are well represented in the dataset, which are also expected to be a significant feature at the site given its location in the Central Tablelands to the west of the Blue Mountains. The frequency of calm conditions (9.8%) consistent with what was observed at BoM's Bathurst Airport station in 2021. This is important, noting that low wind speeds contribute to poor dispersion which can result in elevated near-field concentrations.

5.1.3 Sources and emissions

Dust (particulate matter) will be the most significant emission to air during proposal and estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing details of the proposal and identifying the location and intensity of dust-generating activities. Operational parameters have been combined with emissions factors:

- Emission Estimation Technique Manual for Mining (NPI, 2012); and
- AP 42 (US EPA 1985 and updates).

Dust emissions inventories were developed for three stages of operations:

- **Stage 1:** Stage 1 involves the continued blasting and extraction of materials from Cell 1 as displayed below in Figure 5.4. Imported materials would also be managed in the central portion of Cell 1, with crushing and screening of excavated materials and waste concrete products and product storage also taking place in this general location. The new storage area for composting materials would also be in-use.
- **Stage 2:** Blasting and extraction of materials moves to Cell 2 (see Figure 5.4 below). A mobile unit would be established at Cell 2 to crush and screen excavated materials directly within the cell. Waste concrete materials would continue to be crushed and screened at the same location as for Stage 1 using the fixed units. Imported materials would continue being managed in the central portion of Cell 1, and use of the new storage area for composting materials would continue.
- **Stage 3:** Blasting and extraction of materials moves to Cell 3 (see Figure 5.4 below). A mobile unit would be established at Cell 3 to crush and screen excavated materials directly within the cell. Waste concrete materials would continue to be crushed and screened at the same location as for Stage 1 using the fixed units. Imported materials would continue being managed in the central portion of Cell 1, and use of the new storage area for composting materials would continue. Rehabilitation of Cell 2 would be underway, noting that Cell 1 is unlikely to be rehabilitated until completion.

The location of each source as represented in the dispersion model is displayed below in Figure 5.4. The specific locations where each source/activity was set for each of the three assessment stages above is listed in Table 5.3, with the specific TSP, PM_{10} and $PM_{2.5}$ emission rates (kilograms per year) applied as detailed in Table 5.4. Further details of how each emission rate was determined is provided in Appendix A, with the basis for the control effectiveness applied outlined in Table 5.5.

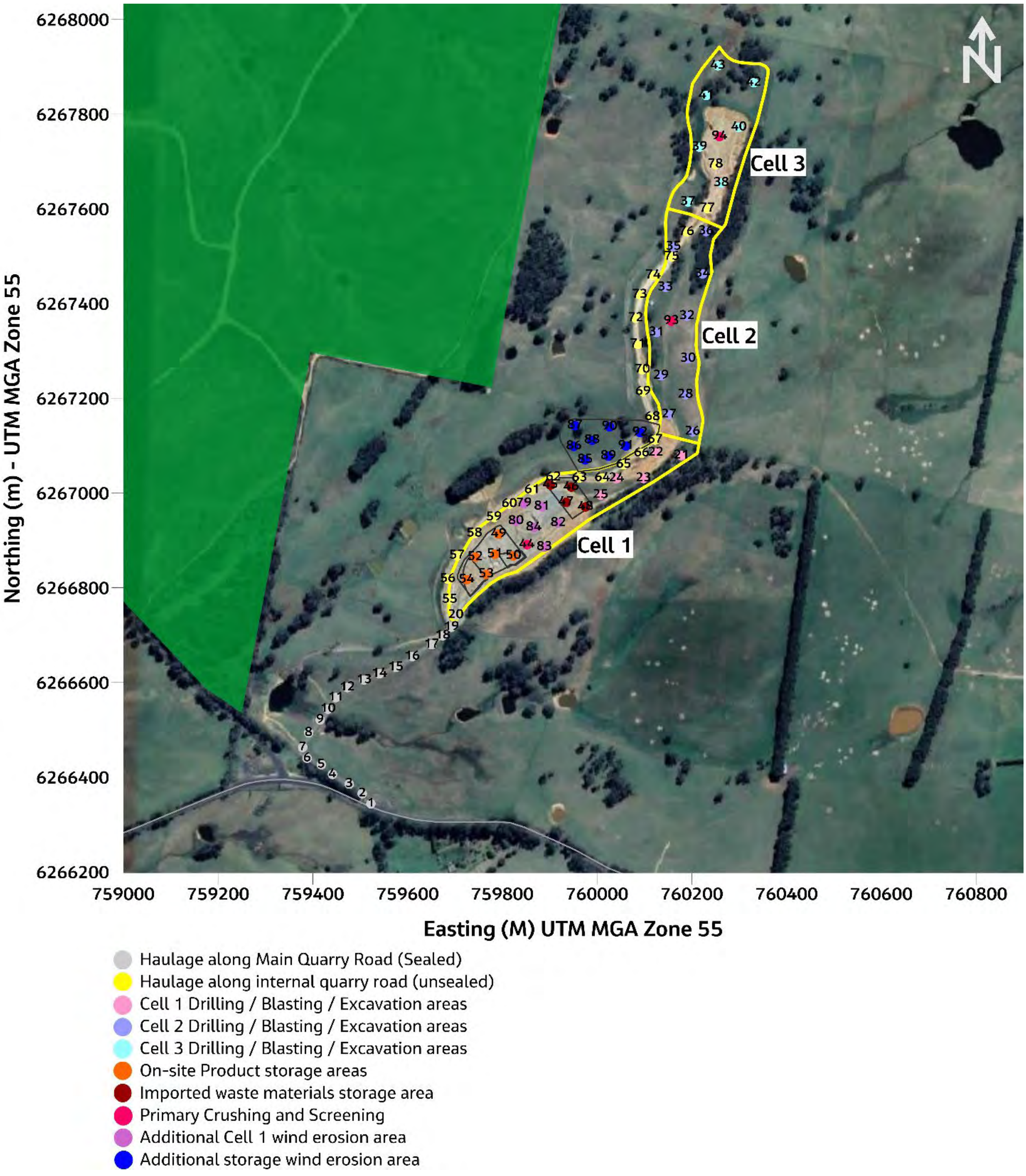


Figure 5.4. Operational dust assessment source locations

Table 5.3. Source locations

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
On-site won materials			
Drilling	21 to 25	26 to 36	37 to 43
Blasting	21 to 25	26 to 36	37 to 43
Dozers on raw materials	21 to 25	26 to 36	37 to 43

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
Excavators loading raw materials to trucks	21 to 25	26 to 36	37 to 43
Hauling raw materials from pit to processing units	21 to 25, 59 to 67 and 80	26 to 36	37 to 43
Unloading raw materials to processing units	44	93	94
Primary crushing	44	93	94
Screening	44	93	94
Front end loader loading product to trucks	44	93	94
Hauling product to storage stockpiles	49 to 54	31, 57 to 71 and 49 to 54	57 to 78
Unloading product to storage stockpiles	49 to 54	49 to 54	49 to 54
Wind erosion from stored product in stockpiles	49 to 54	49 to 54	49 to 54
Loading product for export	49 to 54	49 to 54	49 to 54
Off-site export of product via sealed quarry access road	1 to 20	1 to 20	1 to 20
Off-site export of product via internal unsealed internal road	55 to 59	55 to 59	55 to 59
Wind erosion from remaining Cell 1 areas	21 to 25 and 79 to 83	21 to 25 and 79 to 83	21 to 25 and 79 to 83
Wind erosion from Cell 2	N/A	26 to 36	26 to 36
Wind erosion from Cell 3	N/A	N/A	37 to 43
Management of imported resource recovery materials			
Import of organic woody waste (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20
Import of organic woody waste (haulage along unsealed internal roads)	55 to 67 and 85 to 92	55 to 67 and 85 to 92	55 to 67 and 85 to 92
Import of VENM, ENM and treated drilling mud (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	55 to 63 and 45 to 48	55 to 63 and 45 to 48	55 to 63 and 45 to 48
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	45 to 48	45 to 48	45 to 48
Import of waste concrete (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
Import of waste concrete (haulage along unsealed internal roads)	55 to 59 and 80	55 to 59 and 80	55 to 59 and 80
Primary crushingof waste concrete	44	44	44
Screening of waste concrete	44	44	44
Loading of waste concrete product to trucks for storage	44	44	44
Hauling waste concrete product to storage stockpiles	79 to 84	79 to 84	79 to 84
Unloading waste concrete product to storage stockpiles	79 to 84	79 to 84	79 to 84
Wind erosion from stored waste products (exduding organic woody waste)	45 to 48	45 to 48	45 to 48
Wind erosion from composting area	85 to 92	85 to 92	85 to 92

Table 5.4. Estimated annual dust emissions, operations (kg/year)

Source/activity	Estimated annual emissions (kg/y ear)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
On-site won materials									
Drilling	9	5	0	9	5	0	9	5	0
Blasting	70	36	3	70	36	3	70	36	3
Dozers on raw materials	5,236	1,135	550	5,236	1,135	550	5,236	1,135	550
Excavators loading raw materials to trucks	566	268	28	566	268	28	566	268	28
Hauling raw materials from pit to processing units	6,846	1,947	97	3,423	973	49	2,567	730	36
Unloading raw materials to processing units	28	10	1	28	10	1	28	10	1
Primary crushing	2,000	800	100	2,000	800	100	2,000	800	100
Screening	2,500	860	125	2,500	860	125	2,500	860	125
Front end loader loading product to trucks	28	10	1	28	10	1	28	10	1
Hauling product to storage stockpiles	1,284	365	18	13,691	3,893	195	20,537	5,840	292
Unloading product to storage stockpiles	5	2	0	5	2	0	5	2	0

Source/activity	Estimated annual emissions (kg/y ear)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Wind erosionfrom stored product in stockpiles	550	275	28	511	255	26	550	275	28
Loading product for export	28	10	1	28	10	1	28	10	1
Off-site export of product via sealed quarry access road	3,289	631	131	3,289	631	131	3,289	631	131
Off-site export of product via internal unsealed internal road	2,322	660	33	2,322	660	33	2,322	660	33
Wind erosion from remaining Cell 1 areas	7,796	3,898	390	7,796	3,898	390	7,796	3,898	390
Wind erosion from Cell 2	N/A	N/A	N/A	8,234	4,117	412	5,764	2,882	288
Wind erosion from Cell 3	N/A	N/A	N/A	N/A	N/A	N/A	7,534	3,767	377
Management of imported resource recovery materials									
Import of organic woody waste (haulage along sealed quarry accessroad)	411	79	16	411	79	16	411	79	16
Import of organic woody waste (haulage along unsealed internal roads)	1,209	344	17	1,209	344	17	1,209	344	17
Import of VENM, ENM and treated drilling mud (haulage along sealed quarry accessroad)	1,809	347	72	1,809	347	72	1,809	347	72
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4,789	1,362	68	4,789	1,362	68	4,789	1,362	68
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	1,320	473	66	1,320	473	66	1,320	473	66

Source/activity	Estimated annual emissions (kg/year)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Import of waste concrete (haulage along sealed quarry accessroad)	575	110	23	575	110	23	575	110	23
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	847	241	12	847	241	12
Primary crushing of waste concrete	7,000	700	350	7,000	700	350	7,000	700	350
Screening of waste concrete	2,800	2,100	140	2,800	2,100	140	2,800	2,100	140
Loading of waste concrete product to trucks for storage	5	2	0	5	2	0	5	2	0
Hauling waste concrete product to storage stockpiles	449	128	6	449	128	6	449	128	6
Unloading waste concrete product to storage stockpiles	1	0	0	1	0	0	1	0	0
Wind erosion from stored waste products (excluding organic woody waste)	858	429	43	858	429	43	858	429	43
Wind erosion from composting area	2,628	1,314	131	2,628	1,314	131	2,628	1,314	131
Total	**57,258**	**18,540**	**2,455**	**74,438**	**25,193**	**2,992**	**85,530**	**29,448**	**3,333**

In consultation with Umwelt and Oberon Earthmoving, the controls listed in **Table 5.5** were applied in the inventories. Control efficiency values were applied consistent with guidance presented in Table 4 of NPI, 2012.

Table 5.5. Emission control measures

Source/activity	Control measure	Control efficiency (%)	Reference
Drilling	Water sprays	70%	(NPI, 2012), Table 4
Hauling materials	Watering of haulage routes	50%	(NPI, 2012), Table 4
Wind erosion	Water sprays	50%	(NPI, 2012), Table 4
	Water sprays and rehabilitation	65%	(NPI, 2012), Table 4, including multiple concurrent controls equation

5.1.4 Receptors

Predictions were made at 867 discrete receptors (including the 16 nearby sensitive receptors shown in **Figure 4.1**) to allow for contouring of results. The locations of the modelled discrete receptors are shown in **Figure 5.5**. This approach allowed the creation of a higher density of receptors near the proposal site where resulting concentrations and levels are expected to be higher.

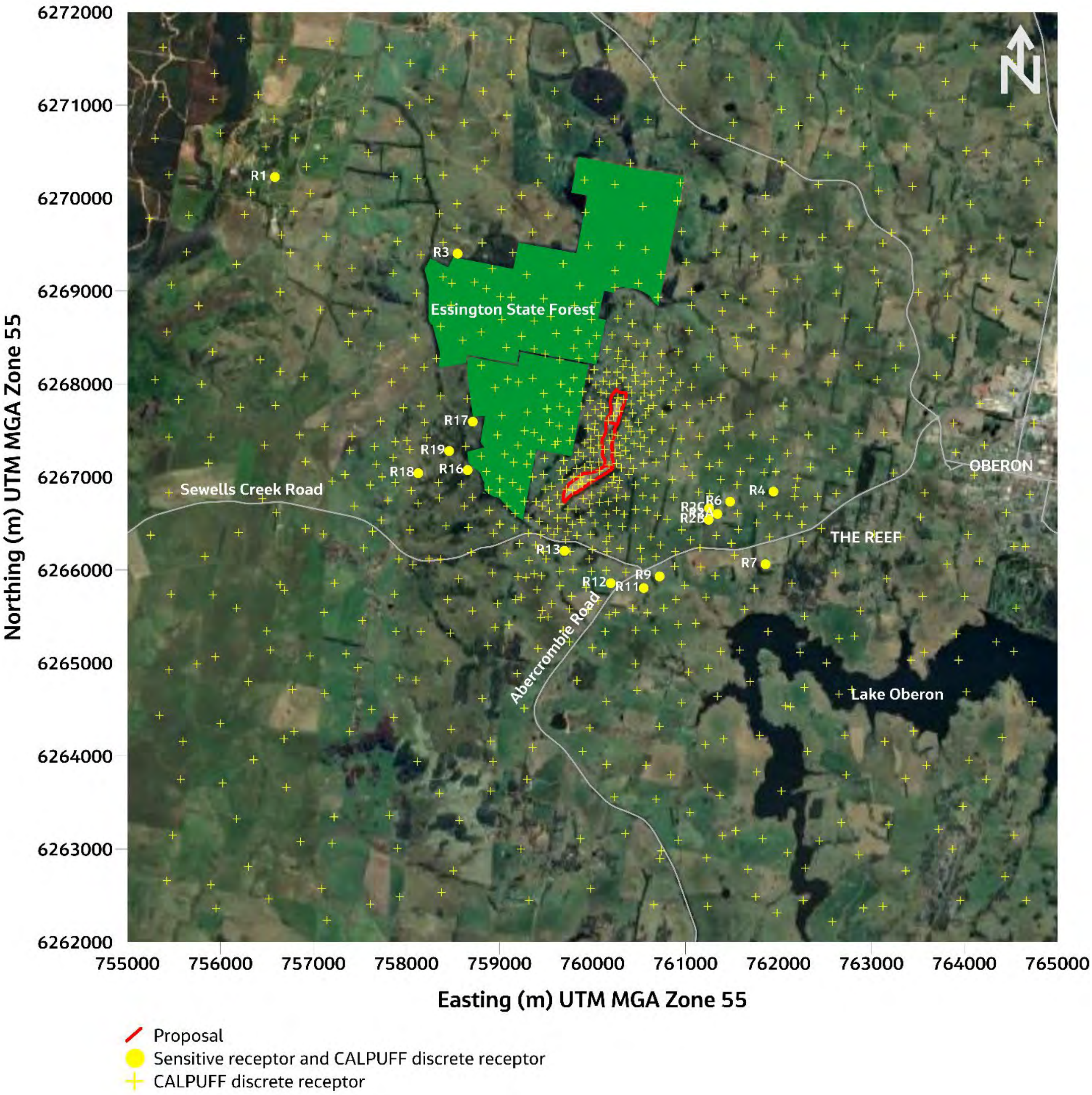


Figure 5.5. Modelled CALPUFF discrete receptors

5.1.5 Dispersion modelling

Ground-level concentration and deposition levels due to the identified emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap, and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long -range transport and near calm conditions. CALPUFF has the ability to model the effect of emissions entrained in the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA, 2016).

The modelling was performed using the geophysical, meteorological, source and receptor inputs described above with the following key settings listed in Table 5.6 applied.

Table 5.6. CALPUFF setup details

Aspect	Value(s)
Model version	6.334
Computational grid domain	103 x 103 grid points
Chemical transformation	None
Dry deposition	Yes
Wind speed profile	ISC rural
Puff element	Puff
Dispersion option	Turbulence from micrometeorology
Time step	3600 seconds (1 hour)
Terrain adjustment	Partial plume path
Number of volume sources	See Section 5.1.3 above
Number of discrete receptors	See Section 5.1.4 above

5.2 Operational blast fume

Blasting activities have the potential to result in fume and particulate matter emissions. Particulate matter emissions from blasting are produced from the modelling discussed in Section 5.1. Post-blast fume has also been quantified by modelling.

Post-blast fume can be produced in non-ideal explosive conditions of the ammonium nitrate/fuel oil (ANFO) and is visible as an orange / brown plume. The fumes comprise of NO_x including NO and NO_2 and from the NO_x monitoring in the Lower Hunter (Section 4.4.7) the percentage of NO_2 in the NO_x is inversely proportional to the total NO_x concentration. When NO_x concentrations are high, the percentage of NO_2 in the NO_x is typically of the order of 20%.

The methodology for the operational post-blast fume modelling is outlined below:

- Blast modelled as a single volume source in the centre of Cell 2. It is acknowledged that moving the blast location, for example further to the north (i.e., Cell 3) or south (i.e., Cell 1), would lead to a corresponding shift in the contours, potentially changing the predicted extent of impacts. However, as discussed in Section 6.2 that impacts are predicted to be well within assessment criteria so an alternative assumption on the blast location would not change outcomes.
- Release height of 10 m, effective plume height of 20 m, initial horizontal spread (sigma y) of 25 m and initial vertical spread (sigma z) of 10 m. These are conservative estimates based on the data presented by Attalla et al. (2008). No plume rise due to buoyancy was modelled, which is again a conservative assumption.
- Emissions assumed to occur every hour between 10 am and 3 pm.
- Blasting could be on any day of the week (a conservative assumption as the Proposal does not propose any activities on Sundays).
- NO_x emissions based on data presented in the Queensland Guidance Note for the management of oxides in open cut blasting (DEEDI, 2011). It was conservatively assumed that the initial NO_2 concentration in the

plume would be 17 ppm (34.9 mg/m ^{3}) based on the Rating 3 Fume Category in the Queensland Guidance Note.

- The initial NO_2 concentration in the plume was converted to a total NO_x emission rate based on a detailed measurement program of NO_x in blast plumes in the Hunter Valley made by Attalla et al. (2008) which found that the NO:NO_2 ratio was typically 27:1, giving a NO_x:NO_2 ratio of approximately 18.6 g NO_x/ g NO_2.
- Calculated emission of 43 g/s of NO_x per blast and an emission release time of 5 minutes.
- 20% of the NO_x is NO_2 at the points of maximum 1-hour average concentrations and at sensitive receptors.

Model results for post-blast fume have been compared to the applicable EPA air quality assessment criterion for NO_2; that is 164 µg/m^3 as a 1-hour average and taking background levels into account. **Section 6.2** provides the assessment of operational post blast fume.

5.3 Operational diesel exhaust

Emissions from diesel exhausts associated with off-road vehicles and equipment at quarries are often deemed a lower air quality impact risk than dust emissions from material handling activities. This is because of the relatively few emission sources involved, for example when compared to a busy motorway, and the large distances between the sources and sensitive receptors. Nevertheless, a review of the potential impacts has been carried out, including modelling to quantify the potential level of the impacts.

The most significant emissions from diesel exhausts are products of combustion including CO, NO_x, PM_{10} and $PM_{2.5}$. It is the NO_x, or more specifically NO_2, and PM_{10} (including $PM_{2.5}$) which have been assessed. DPE monitoring data have shown that CO concentrations have not exceeded relevant air quality criteria at rural or urban monitoring stations in NSW, indicating that this indicator represents a much lower air quality risk.

The modelling for operational dust (**Section 5.1**) has considered emission factors that represent the contribution from both wheel-generated particulates and the exhaust particulates. These emission factors, including with control factors, are based on measured emissions which included diesel particulates in the form of both PM_{10} and $PM_{2.5}$. The emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (that is, older trucks). Todoroski Air Sciences has also reported (TAS, 2016) that several studies, reported to the EPA, confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission. This information highlights that the potential impacts of diesel exhaust emissions (as PM_{10} and $PM_{2.5}$) are represented in the model results for operational dust (**Section 6.1**).

Table 5.7 provides the explicit estimates of PM_{10} and $PM_{2.5}$ emissions due only to diesel plant and equipment exhausts. Emission factors for "Industrial off-road vehicles and equipment" from the EPA's 2008 Air Emissions Inventory (EPA, 2012) were used for the calculations and it has been assumed that there will be no reduction to emissions in the future; a conservative approach. These factors relate to diesel exhaust and evaporative emissions.

Table 5.7. Estimated PM_{10} and $PM_{2.5}$ emissions from diesel engines

Parameter	Existing	Proposed
Estimated fuel usage(kL/y) (Source:Oberon Earthmoving)	35	55
PM_{10} calculations		
Diesel exhaust emission factor (kg/kL)	2.84	2.84
Diesel exhaust emissions- all equipment (kg/y)	99	157
$PM_{2.5}$ calculations		
Diesel exhaust emission factor (kg/kL)	2.75	2.75
Diesel exhaust emissions- all equipment (kg/y)	96	152

Emissions of NO_x from diesel exhausts have been estimated using fuel consumption data, provided by Oberon Earthmoving, and an emission factor from the EPA's Air Emissions Inventory for 2008 (EPA, 2012). **Table 5.8** shows the calculations. Again, it has been assumed that there will be no reduction to emissions in the future; a conservative approach.

Table 5.8. Estimated NO_x emissions from diesel engines

Parameter	Existing	Proposed
Estimated fuel usage (kL/y) (Source: Oberon Earthmoving)	35	55
NO_x calculations		
Diesel exhaust emission factor (kg/kL)	40.77	40.77
Diesel exhaust emissions - all equipment (kg/y)	1,427	2,242

The NO_x emission estimates for Stage 2 have been explicitly modelled to provide an indication of the off-site NO_2 concentrations due to diesel exhaust emissions. This was selected being the most representative, centrally located stage. **Section 6.3** provides the assessment of operational diesel exhaust.

5.4 Road transport

As well as emissions generated from processing and operational activities, an assessment of emissions associated with the transportation of quarry products was also completed. Emissions from transportation along internal roads have already considered as outlined above. Roads and Maritime Services air quality screening tool known as TRAQ ("Tool for Roadside Air Quality") was used to assess the effects of diesel emissions from trucks transporting quarry products along public roads. TRAQ adopts emission factors from the EPA's Motor Vehicle Emissions Inventory (MVEI) and uses the CALINE air dispersion model to predict the maximum near roadside air pollutant concentrations based on traffic volume, traffic mix, traffic speed, road type, road grade, and other factors. The model considers conservative, worst-case conditions to determine the potential for impacts. . The key conservative assumptions include worst-case wind angles, stable atmospheric conditions, and low winds that allow for high air pollutant concentrations to occur. A high-level summary of the assessment process is shown in **Figure 5.6**.

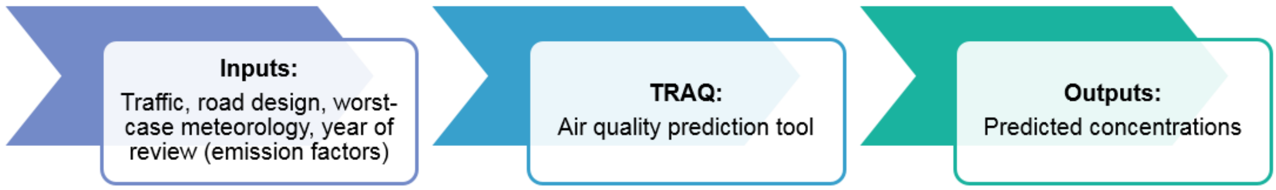


Figure 5.6. Overview of TRAQ assessment process

The key input settings that were applied in the model are listed below in **Table 5.9**.

Table 5.9. TRAQ inputs

Aspect	Value(s)
Model version	TRAQ version 1.3 (2017)
Modelled meteorological conditions	Worst-case meteorological conditions assumed (that is, wind speed of 1 metre per second, Pasquil atmospheric stability Class F (i.e. highly stable), and 15 degrees Celsius).
Assessment location	Worst-case, roadside along Italia Road and the pacific highway
Road geometry	Single lane in either direction (representing conditions on surrounding local roads including Sewells Creek Road, Beaconsfield Road, Mayfield Road and O'Connell Road)
Traffic inputs	Maximum of 180 truck movements per day

Aspect	Value(s)
Vehicle emissions	2021 NSW EPA emission factors were conservatively applied, noting that these generally improve into the future. Emissions included worst-case cold start effects.

Results were assessed by comparing predictions with impact assessment criteria from the EPA's Approved Methods. This aspect of the assessment is presented below in Section 6.

5.5 Crystalline silica

Silica (SiO_2) occurs in abundance in nature and comprises minerals composed of silicon and oxygen. It exists in crystalline and amorphous forms which relate to the structural arrangement of the oxygen and silicon atoms. Only the crystalline forms are known to be fibrogenic (that is, dust which causes an increase of scar tissue after deposition in the gas exchange region of the lung) and only the respirable particles, being those which are capable of reaching the gas exchange region of the lungs, are considered in determining health effects of crystalline silica.

Dust from quarrying activities such as crushing may contain silica. The potential impacts have been informed by ambient monitoring carried out by Buttai Gravel at the Martins Creek Quarry (Jacobs, 2020). Section 6.5 presents the assessment.

6. Assessment of impacts

6.1 Operational dust

6.1.1 Overview

This section presents and discusses the results of the operational dust assessment by classification of particulate matter. The significance of the predictions was assessed by evaluating the cumulative (i.e., background plus change as a result of the proposal) concentrations and levels against the criteria and guidance from the EPA's Approved Methods as well as the VLAMP presented in **Section 3**.

6.1.2 Particulate matter as PM_{10}

Predicted contributions from the proposal and cumulative annually averaged PM_{10} concentrations at the identified surrounding sensitive receptors are shown below in **Table 6.1**. The cumulative concentrations consider an annual PM_{10} background concentration of 11.3 µg/m^3 as established above in **Section 4.5**.

Table 6.1. Predicted results, annually averaged PM_{10}

Receptor	Proposal contribution (µg/m^3)			Cumulative concentration (µg/m^3)			EPA criterion (µg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<11.4	<11.4	<11.4	25
R2A	0.1	0.1	0.2	11.4	11.4	11.5	
R2B	0.1	0.2	0.2	11.4	11.5	11.5	
R2C	0.1	0.2	0.2	11.4	11.5	11.5	
R3	<0.1	<0.1	<0.1	<11.4	<11.4	<11.4	
R4	0.1	0.1	0.1	11.4	11.4	11.4	
R6	0.1	0.1	0.1	11.4	11.4	11.4	
R7	0.1	0.1	0.1	11.4	11.4	11.4	
R9	0.1	0.2	0.2	11.4	11.5	11.5	
R11	0.2	0.2	0.2	11.5	11.5	11.5	
R12	0.3	0.3	0.3	11.6	11.6	11.6	
R13	0.4	0.4	0.4	11.7	11.7	11.7	
R16	0.1	0.1	0.1	11.4	11.4	11.4	
R17	0.1	0.1	0.1	11.4	11.4	11.4	
R18	<0.1	<0.1	0.1	<11.4	<11.4	11.4	
R19	0.1	0.1	0.1	11.4	11.4	11.4	

As **Table 6.1** displays, cumulative annually averaged PM_{10} concentrations were predicted to remain below the EPA's 25 µg/m^3 impact assessment criterion at all surrounding sensitive receptors, during all assessed stages of the proposal. Annually averaged PM_{10} contributions from the proposal are also displayed as ground-level concentration contour plots below in **Figure 6.1** for all three assessment stages considered.

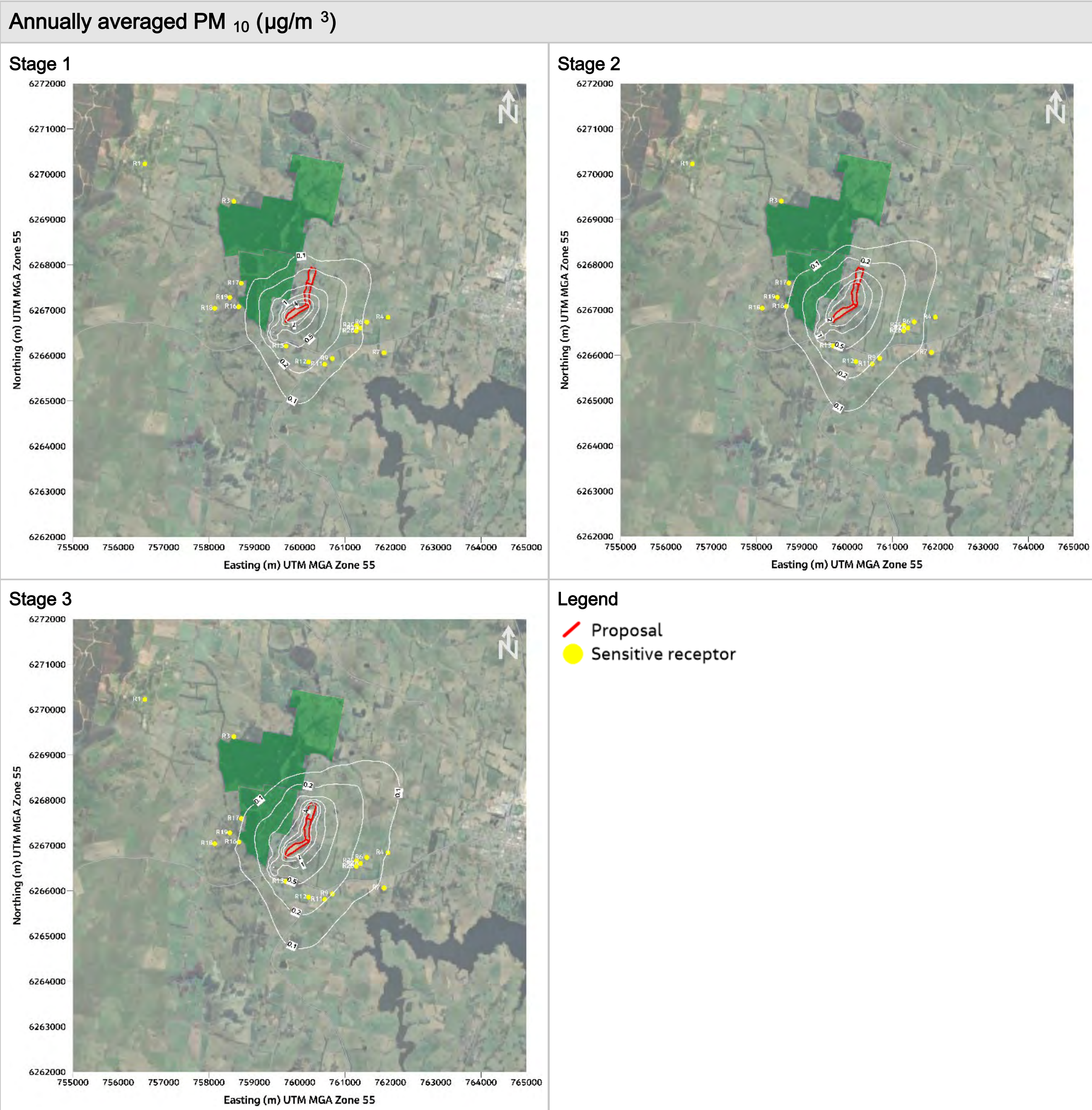


Figure 6.1. Ground-level concentration contours, proposal annually averaged PM_{10} contributions

The maximum 24-hour averaged PM_{10} concentration in 2021 at the DPE's Bathurst station was 29.2 µg/m^3 (see **Section 4.5**). As such the objective of this aspect of the assessment was to determine whether the proposal could result in exceedances of the EPA's 50 µg/m^3 criterion at the surrounding sensitive receptors. The results from the dispersion modelling are listed below in **Table 6.2** (contributions from the proposal are also displayed as ground-level concentration contours below in **Figure 6.2**). The cumulative concentrations conservatively consider the worst-case (i.e., highest 29.2 µg/m^3 2021 DPE Bathurst measured value) rather than applicable time-varying concentration.

Table 6.2. Predicted results, maximum 24-hour averaged PM_{10}

Receptor	proposal contribution (µg/m^3)			Cumulative concentration (µg/m^3)			EPA criterion (µg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	0.1	0.1	0.1	29.3	29.3	29.3	50
R2A	0.8	1.2	1.1	30.0	30.4	30.3	
R2B	1.0	1.2	1.2	30.2	30.4	30.4	
R2C	0.9	1.3	1.2	30.1	30.5	30.4	
R3	0.2	0.2	0.2	29.4	29.4	29.4	
R4	0.6	0.7	0.9	29.8	29.9	30.1	
R6	0.7	1.1	1.0	29.9	30.3	30.2	
R7	0.8	1.0	1.0	30.0	30.2	30.2	
R9	1.7	1.6	1.6	30.9	30.8	30.8	
R11	1.4	1.4	1.4	30.6	30.6	30.6	
R12	2.2	2.4	2.4	31.4	31.6	31.6	
R13	4.2	4.7	4.8	33.4	33.9	34.0	
R16	0.5	0.7	0.7	29.7	29.9	29.9	
R17	0.6	0.7	0.7	29.8	29.9	29.9	
R18	0.3	0.4	0.4	29.5	29.6	29.6	
R19	0.4	0.4	0.5	29.6	29.6	29.7	

As shown, even with the conservatively adopted background assumption, maximum 24-hour averaged PM_{10} concentrations were predicted to remain below the 50 µg/m^3 impact assessment criterion. This was the case at all identified surrounding sensitive receptors, and for all three assessment stages considered.

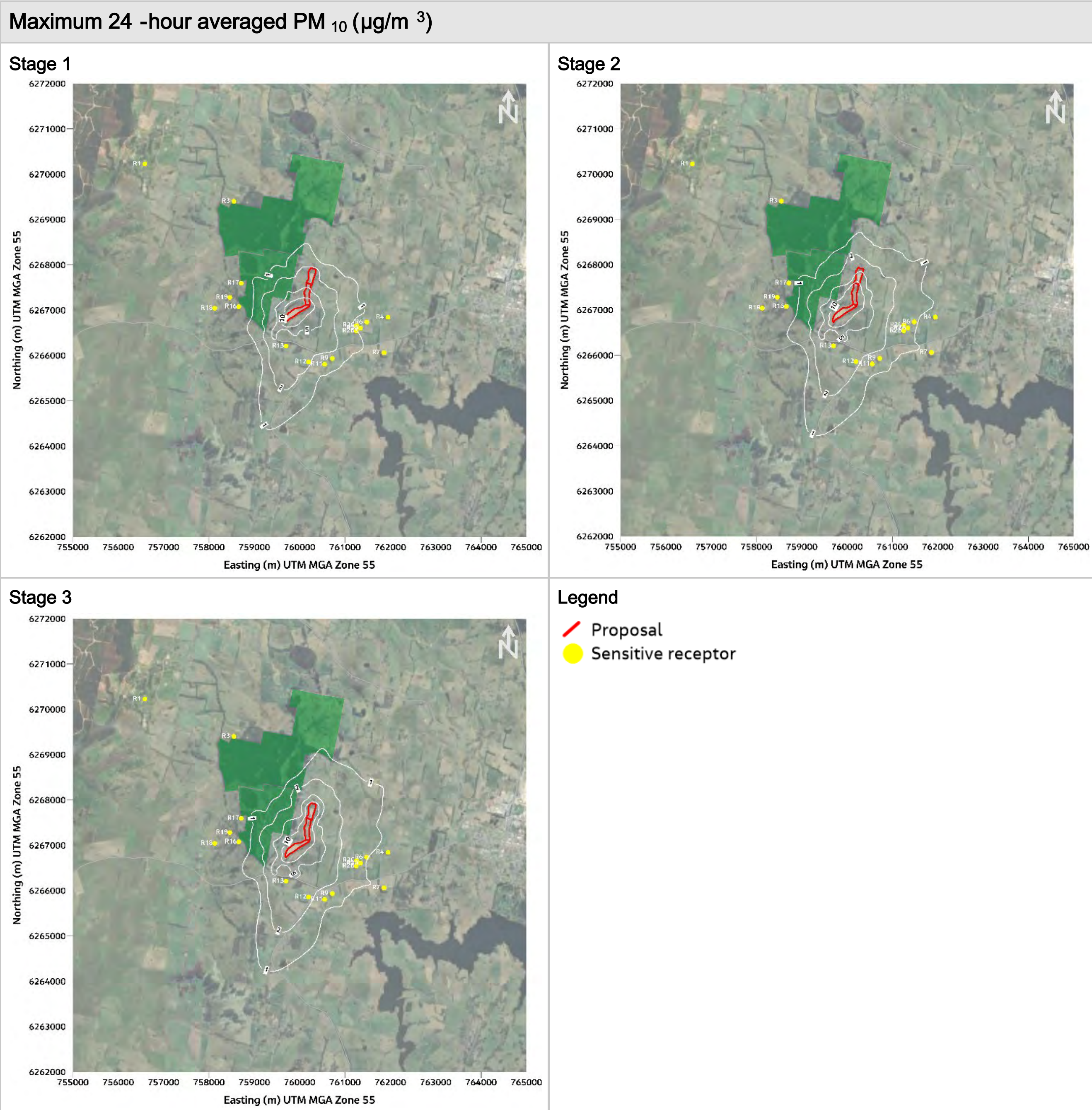


Figure 6.2. Ground-level concentration contours, proposal maximum 24-hour averaged PM_{10} contributions

Based on the results presented and discussed above it was determined that there would be no unacceptable changes in annually averaged and maximum daily PM_{10} concentrations at surrounding sensitive receptors over the operational life of the proposal. Still, measures to control PM_{10} emissions from the proposal are recommended in **Section 7**.

6.1.3 Particulate matter as $PM_{2.5}$

Predicted changes in annually averaged $PM_{2.5}$ concentrations as a result of the proposal are listed below in **Table 6.3**. The cumulative concentrations consider an annual $PM_{2.5}$ background concentration of 5.1 µg/m^3 as determined in **Section 4.5**. Contributions from the proposal are also displayed as ground-level concentration contour plots below in **Table 6.3** for all three assessment stages considered.

Table 6.3. Predicted results, annually averaged $PM_{2.5}$

Receptor	proposal contribution (µg/m^3)			Cumulative concentration (µg/m^3)			EPA criterion (µg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	8
R2A	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R2B	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R2C	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R3	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R4	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R6	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R7	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R9	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R11	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R12	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R13	0.1	0.1	0.1	5.2	5.2	5.2	
R16	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R17	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R18	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R19	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	

As shown, cumulative annually averaged $PM_{2.5}$ concentrations were predicted to remain below the EPA's 8 µg/m^3 impact assessment criterion. The highest predicted contribution (0.1 µg/m^3 at R13) was approximately 1% of the 8 µg/m^3 criterion, demonstrating the negligible expected effect of proposal operations on local annually averaged $PM_{2.5}$.

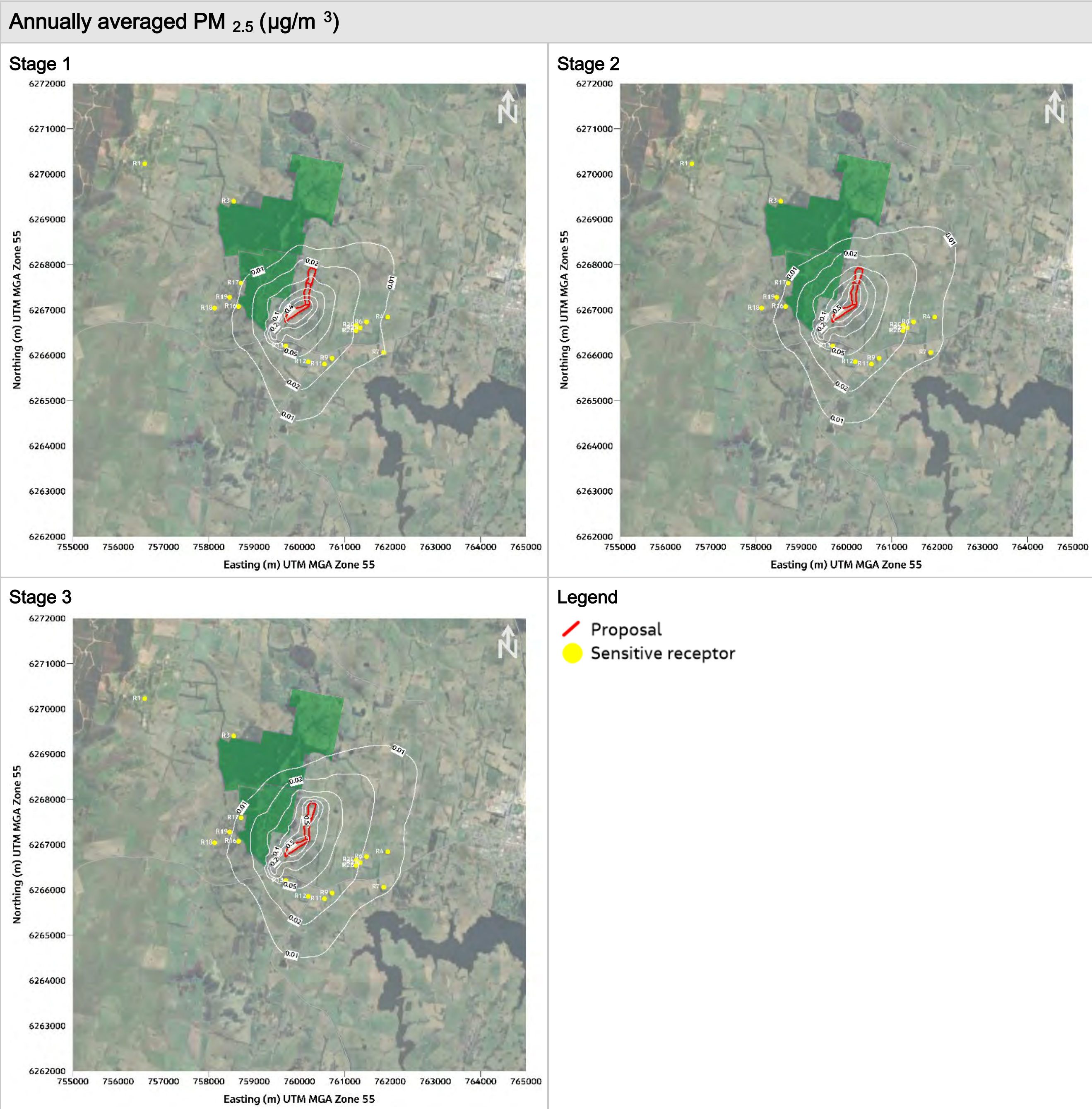


Figure 6.3. Ground-level concentration contours, proposal annually averaged $PM_{2.5}$ contributions

The maximum 24-hour averaged $PM_{2.5}$ concentration in 2021 at the DPE's Bathurst station was 13.8 µg/m^3 (refer to **Section 4.5**). Given that this is below the EPA's 25 µg/m^3 criterion, the objective of the assessment was to assess whether the proposal had the potential to result in exceedances of this value at the surrounding sensitive receptors. The results are listed below in **Table 6.4** with contributions displayed as ground-level concentration contours below in **Figure 6.4**. The. As above, the cumulative concentrations displayed conservatively consider the worst-case (i.e., highest 13.8 µg/m^3 2021 DPE Bathurst measured value) rather than applicable time-varying concentrations.

Table 6.4. Predicted results, maximum 24-hour averaged $PM_{2.5}$

Receptor	proposal contribution (µg/m³)			Cumulative concentration (µg/m³)			EPA criterion (µg/m³)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<13.9	<13.9	<0.1	25
R2A	0.1	0.1	0.1	13.9	13.9	13.9	
R2B	0.2	0.2	0.2	14.0	14.0	14.0	
R2C	0.1	0.2	0.1	13.9	14.0	13.9	
R3	<0.1	<0.1	<0.1	<13.9	<13.9	<0.1	
R4	0.1	0.1	0.1	13.9	13.9	13.9	
R6	0.1	0.1	0.1	13.9	13.9	13.9	
R7	0.1	0.1	0.1	13.9	13.9	13.9	
R9	0.3	0.3	0.2	14.1	14.1	14.0	
R11	0.2	0.2	0.2	14.0	14.0	14.0	
R12	0.4	0.3	0.3	14.2	14.1	14.1	
R13	0.6	0.5	0.5	14.4	14.3	14.3	
R16	0.1	0.1	0.1	13.9	13.9	13.9	
R17	0.1	0.1	0.1	13.9	13.9	13.9	
R18	<0.1	0.1	0.1	<13.9	13.9	13.9	
R19	0.1	0.1	0.1	13.9	13.9	13.9	

Even with this conservative approach to background levels, **Table 6.4** shows that maximum 24-hour averaged concentrations were predicted to remain below 25 µg/m³ for all three assessment stages considered.

Maximum 24-hour averaged $PM_{2.5}$ (µg/m³)

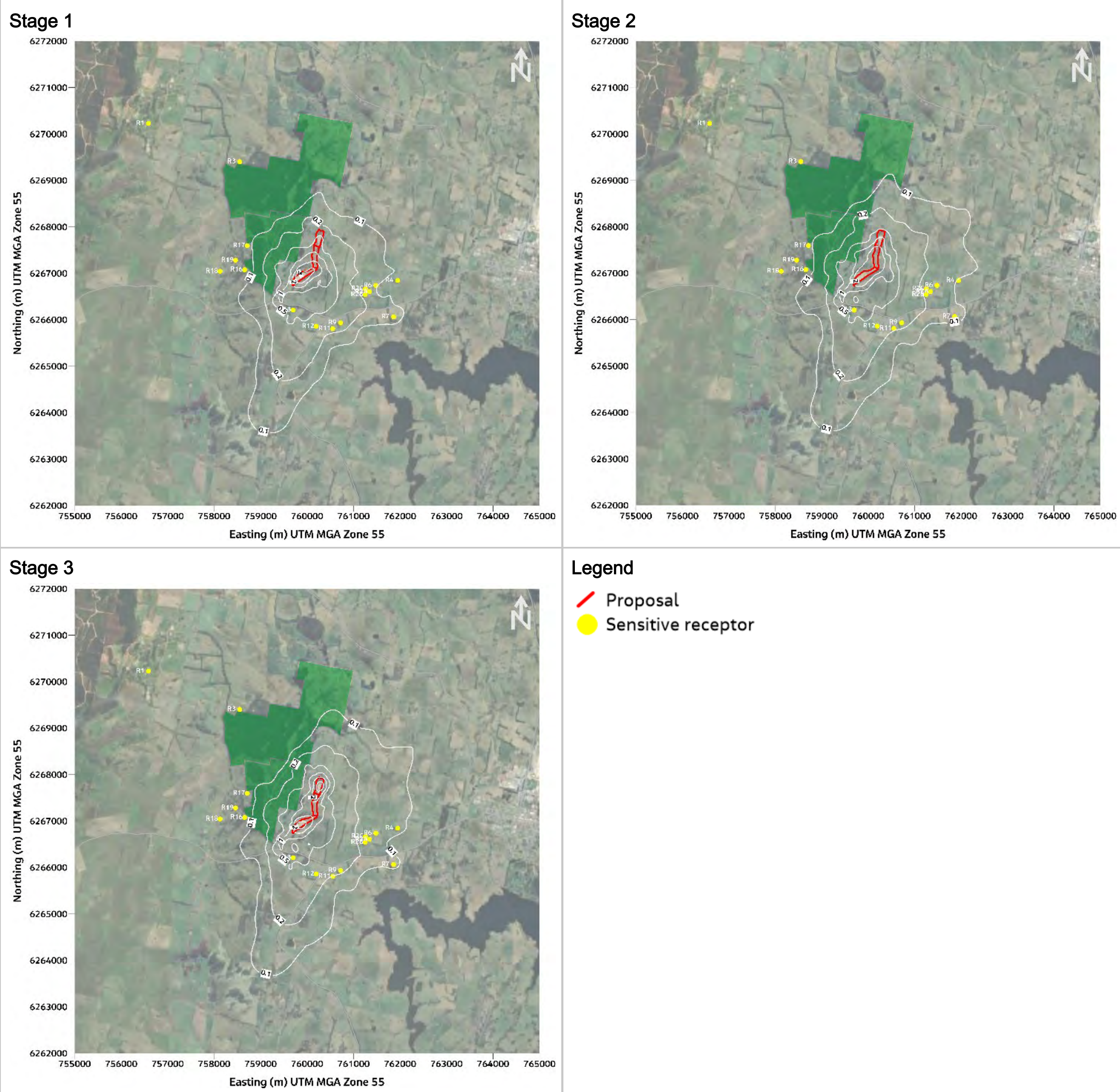


Figure 6.4. Ground-level concentration contours, proposal maximum 24-hour averaged $PM_{2.5}$ contributions

Based on these results it was determined that there would be no unacceptable changes in annually averaged and maximum daily $PM_{2.5}$ concentrations as a result of the proposal. Still, measures committed in the inventory as well as other recommendations to reduce emissions are provided below in Section 7.

6.1.4 Total suspended particulates (TSP)

Changes in annually averaged TSP concentrations at surrounding sensitive receptors was also predicted. The results are displayed below in Table 6.5. A background concentration of 28.3 µg/m³ was applied as determined in Section 4.5. proposal contributions also displayed as ground-level concentration contour plots below Table 6.5 for all three assessment stages considered.

Table 6.5. Predicted results, annually averaged TSP

Receptor	proposal contribution (μg/m^3)			Cumulative concentration (μg/m^3)			EPA criterion (μg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<28.4	<28.4	<28.4	90
R2A	0.2	0.3	0.3	28.5	28.6	28.6	
R2B	0.2	0.3	0.3	28.5	28.6	28.6	
R2C	0.2	0.3	0.3	28.5	28.6	28.6	
R3	<0.1	<0.1	<0.1	<28.4	<28.4	<28.4	
R4	0.1	0.2	0.2	28.4	28.5	28.5	
R6	0.2	0.3	0.3	28.5	28.6	28.6	
R7	0.1	0.2	0.2	28.4	28.5	28.5	
R9	0.3	0.4	0.4	28.6	28.7	28.7	
R11	0.3	0.4	0.4	28.6	28.7	28.7	
R12	0.5	0.6	0.6	28.8	28.9	28.9	
R13	1.1	1.1	1.1	29.4	29.4	29.4	
R16	0.2	0.2	0.2	28.5	28.5	28.5	
R17	0.1	0.2	0.2	28.4	28.5	28.5	
R18	0.1	0.1	0.1	28.4	28.4	28.4	
R19	0.1	0.1	0.1	28.4	28.4	28.4	

Table 6.5 and **Figure 6.5** shows how the cumulative annually averaged TSP concentrations at surrounding sensitive receptors were predicted to remain below the EPA's 90 μg/m^3 impact assessment criterion. Based on these findings it was determined that there would be no unacceptable changes in annually TSP concentrations as a result of the proposal.

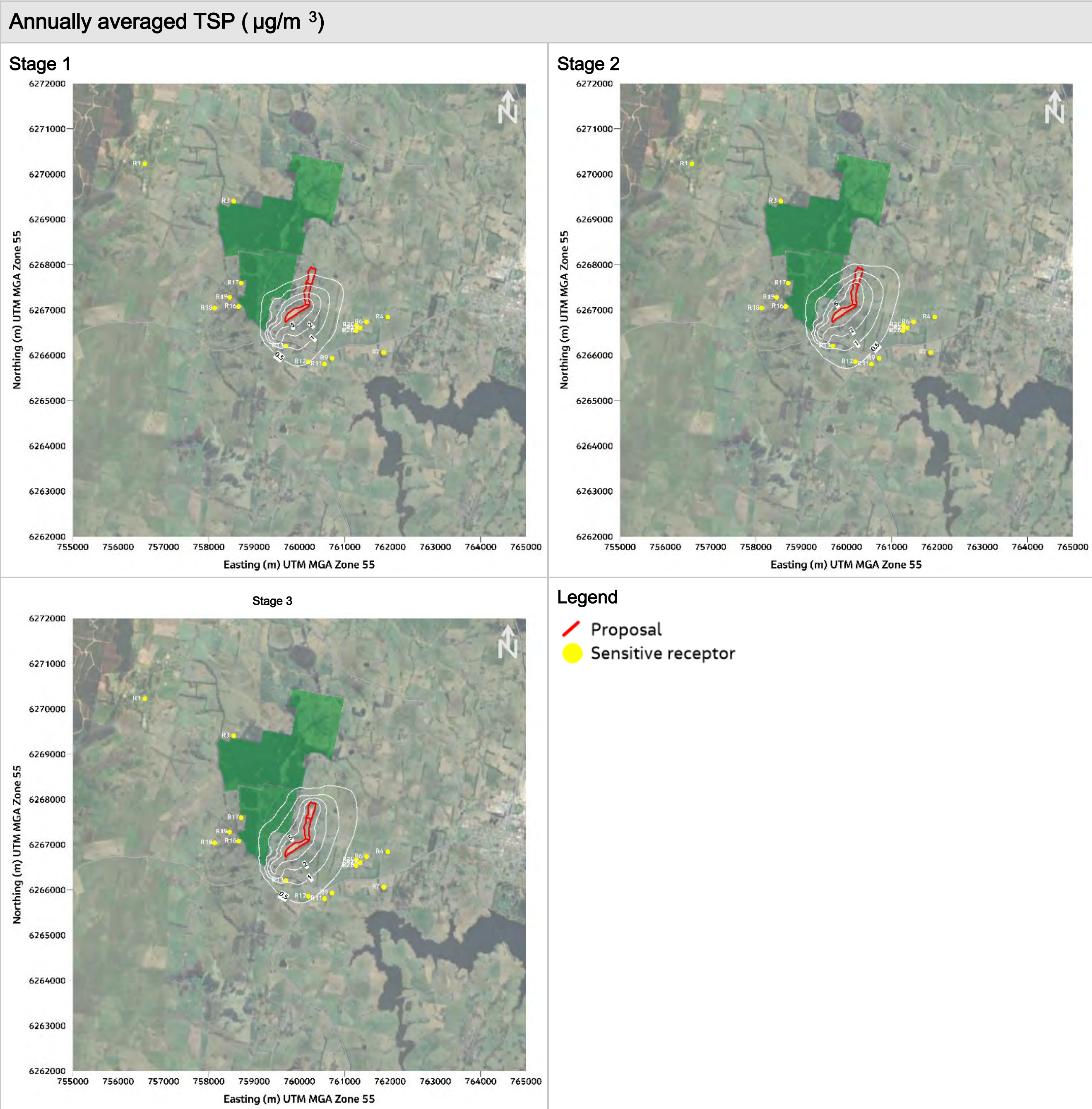


Figure 6.5. Ground-level concentration contours, proposal annually averaged TSP contributions

6.1.5 Deposited dust

Finally, regarding deposited dust, predicted results are listed below in **Table 6.6**. Annually averaged deposited dust contributions from the proposal are also displayed below in **Figure 6.6** for all three assessment stages considered. The cumulative levels in **Table 6.6** consider a background level of 0.9 g/m^2/month as established in **Section 4.5**.

Table 6.6. Predicted results, annually averaged deposited dust

Receptor	proposal contribution (g/m ^{2}/month)			Cumulative concentration (g/m ^{2}/month)			EPA criterion (g/m ^{2}/ month)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	4
R2A	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R2B	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R2C	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R3	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R4	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R6	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R7	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R9	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R11	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R12	0.1	<0.1	<0.1	1.0	<1.0	<1.0	
R13	0.2	0.1	0.1	1.1	1.0	1.0	
R16	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R17	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R18	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R19	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	

Table 6.6 displays how deposited dust levels were predicted to remain below 4 g/m ^{2}/month at surrounding receptors. Based on this, it is expected that changes in deposited dust associated with the proposal would not result in unacceptable levels at surrounding sensitive receptors.

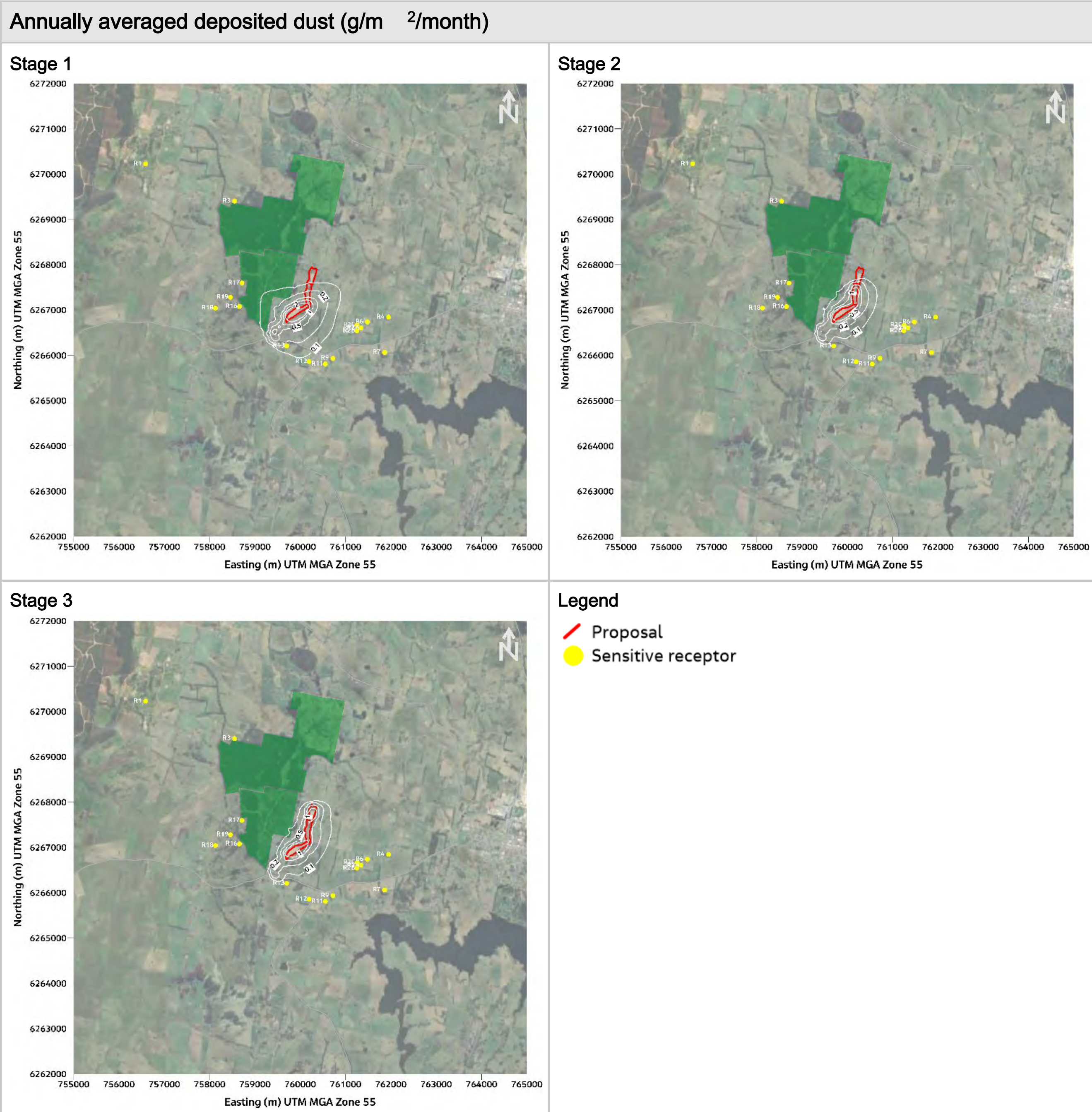


Figure 6.6. Ground-level contours, proposal annually averaged deposited dust contributions

6.2 Operational blast fume

Predicted maximum 1-hour average NO_2 concentrations at the nearest surrounding sensitive receptors due to post-blast fume are listed below in **Table 6.7**. A background concentration of 70.0 µg/m^3 was applied as determined in **Section 4.5.** Proposal contributions also displayed as ground-level concentration contour plots below in **Figure 6.7**.

Table 6.7. Predicted results, maximum 1-hour averaged NO_2 from blasting

Receptor	proposal contribution (µg/m ^{3})	Cumulative concentration (µg/m ^{3})	EPA criterion (µg/m ^{3})
R1	0.5	70.5	164
R2A	4.3	74.3	
R2B	4.1	74.1	
R2C	4.8	74.8	
R3	0.9	70.9	
R4	1.9	71.9	
R6	4.1	74.1	
R7	2.3	72.3	
R9	3.1	73.1	
R11	2.7	72.7	
R12	3.0	73.0	
R13	4.2	74.2	
R16	2.2	72.2	
R17	1.8	71.8	
R18	1.3	71.3	
R19	1.4	71.4	

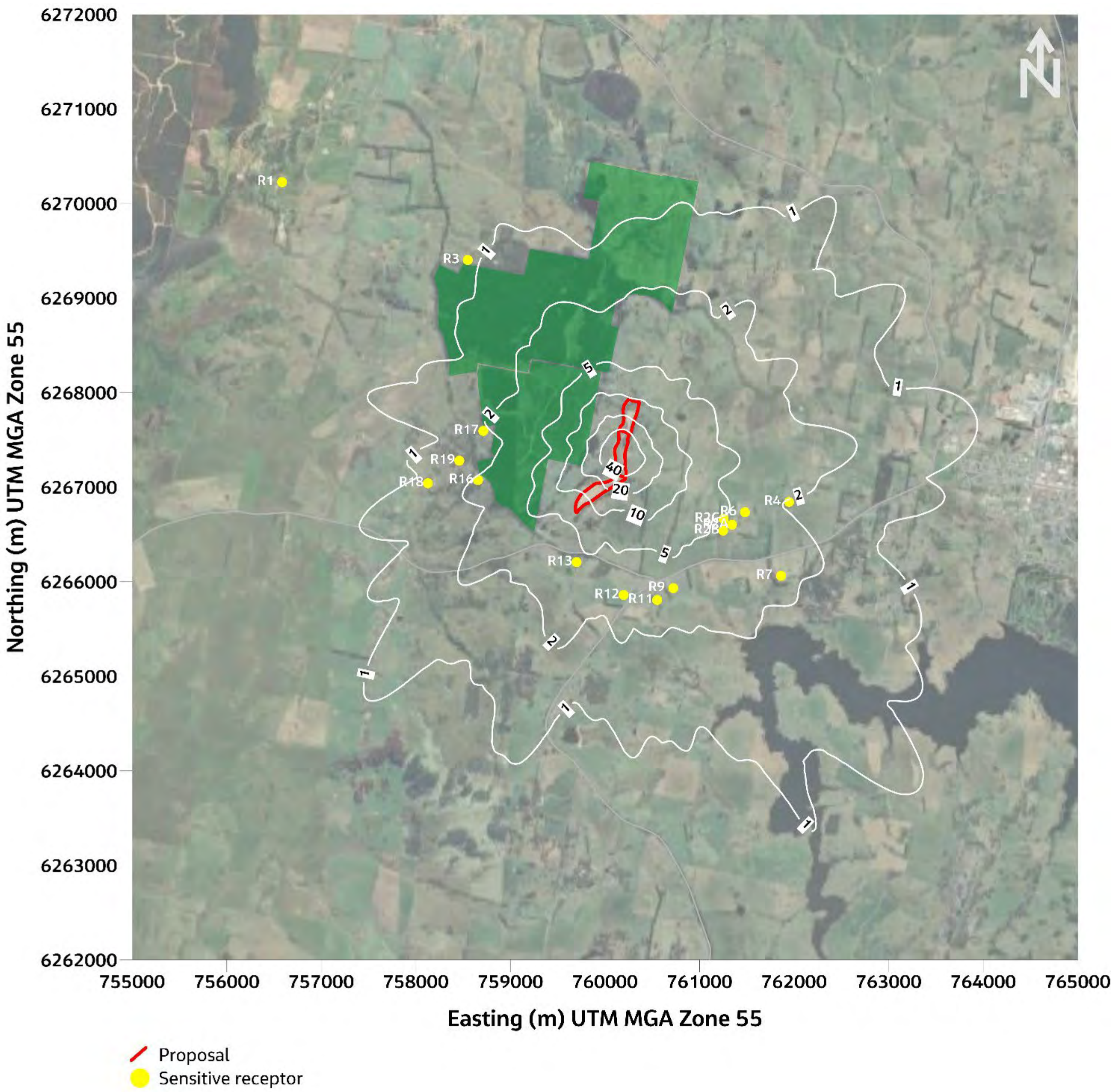


Figure 6.7. Modelled maximum 1 -hour averaged NO_2 from blasting (µg/m ^{3})

The results displayed in **Table 6.7** and **Figure 6.7** demonstrate compliance with the EPA's 164 µg/m^3 impact assessment criterion. The modelling predicts that the proposal will not cause adverse blast fume impacts due to blasting. Still measures to ensure that the proposal will not cause adverse blast fume impacts are included below in **Section 7**.

6.3 Operational diesel exhaust

6.3.1 Particulate matter as PM_{10} and $PM_{2.5}$

The emission factors, presented in **Section 5.1** and Appendix A, represent the contribution from both wheel-generated particulates and the exhaust particulates. These emission factors, with control factors, are based on measured emissions which include diesel particulates in the form of both PM_{10} and $PM_{2.5}$. As noted in **Section 5.3** these emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (i.e., older trucks). Todoroski Air Sciences reported (TAS 2016) that several studies confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission.

Based on the information collated above, the potential impacts of diesel exhaust emissions (as PM_{10} and $PM_{2.5}$) are represented in the preceding results, in **Section 6.1.2** and **Section 6.1.3**. As reported in these sections, PM_{10} and $PM_{2.5}$ emissions from the proposal (including diesel exhaust emissions) were not predicted to result in unacceptable off-site impacts.

6.3.2 Nitrogen dioxide (NO_2)

Predicted NO_2 contributions from diesel exhaust emissions associated with the proposal at the identified surrounding sensitive receptors are summarised below in **Table 6.8**. The cumulative concentrations consider the background concentrations established above in **Section 4.5**. Annual and maximum 1-hour ground level concentration results (proposal contributions) are also displayed in Error! Reference source not found. and Error! Reference source not found..

Table 6.8. Predicted results, maximum 1-hour averaged NO_2 from diesel exhaust

Receptor	Annually averaged NO_2			Maximum 1-hour averaged NO_2		
	proposal (µg/m^3)	Cumulative (µg/m^3)	EPA criterion (µg/m^3)	proposal (µg/m^3)	Cumulative (µg/m^3)	EPA criterion (µg/m^3)
R1	<0.1	<12.1	31	0.1	70.1	164
R2A	<0.1	<12.1		0.6	70.6	
R2B	<0.1	<12.1		0.7	70.7	
R2C	<0.1	<12.1		0.6	70.6	
R3	<0.1	<12.1		0.1	70.1	
R4	<0.1	<12.1		0.4	70.4	
R6	<0.1	<12.1		0.5	70.5	
R7	<0.1	<12.1		0.5	70.5	
R9	<0.1	<12.1		0.9	70.9	
R11	<0.1	<12.1		0.8	70.8	
R12	<0.1	<12.1		1.3	71.3	
R13	0.1	12.1		1.9	71.9	
R16	<0.1	<12.1		0.4	70.4	
R17	<0.1	<12.1		0.2	70.2	
R18	<0.1	<12.1		0.2	70.2	
R19	<0.1	<12.1		0.3	70.3	

As **Figure 6.8**Error! Reference source not found. and **Figure 6.9Error! Reference source not found.** show, annually averaged and maximum 1-hour cumulative NO_2 concentrations from diesel exhaust em issions were also predicted to remain below the relevant EPA impact assessment criteria. Based on these findings, it was determined that diesel exhaust emissions from the proposal are unlikely to present an unacceptable risk. Still measures to ensure that all plant and equipment are operated in a proper and efficient manner in order to preserve this outcome are recommended below in Section 7.

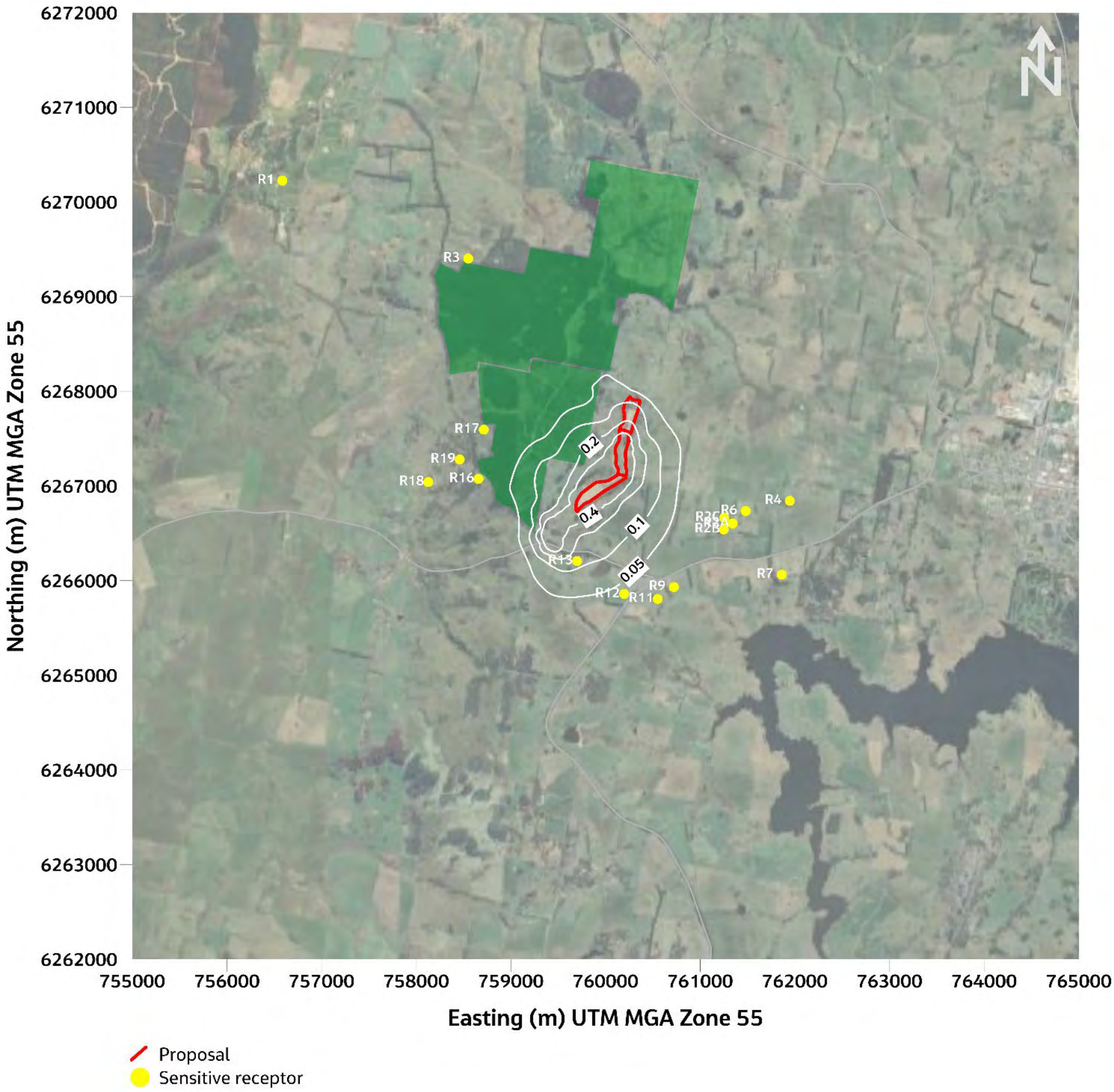


Figure 6.8. Modelled annually averaged NO_2 from diesel emissions (μg/m^3)

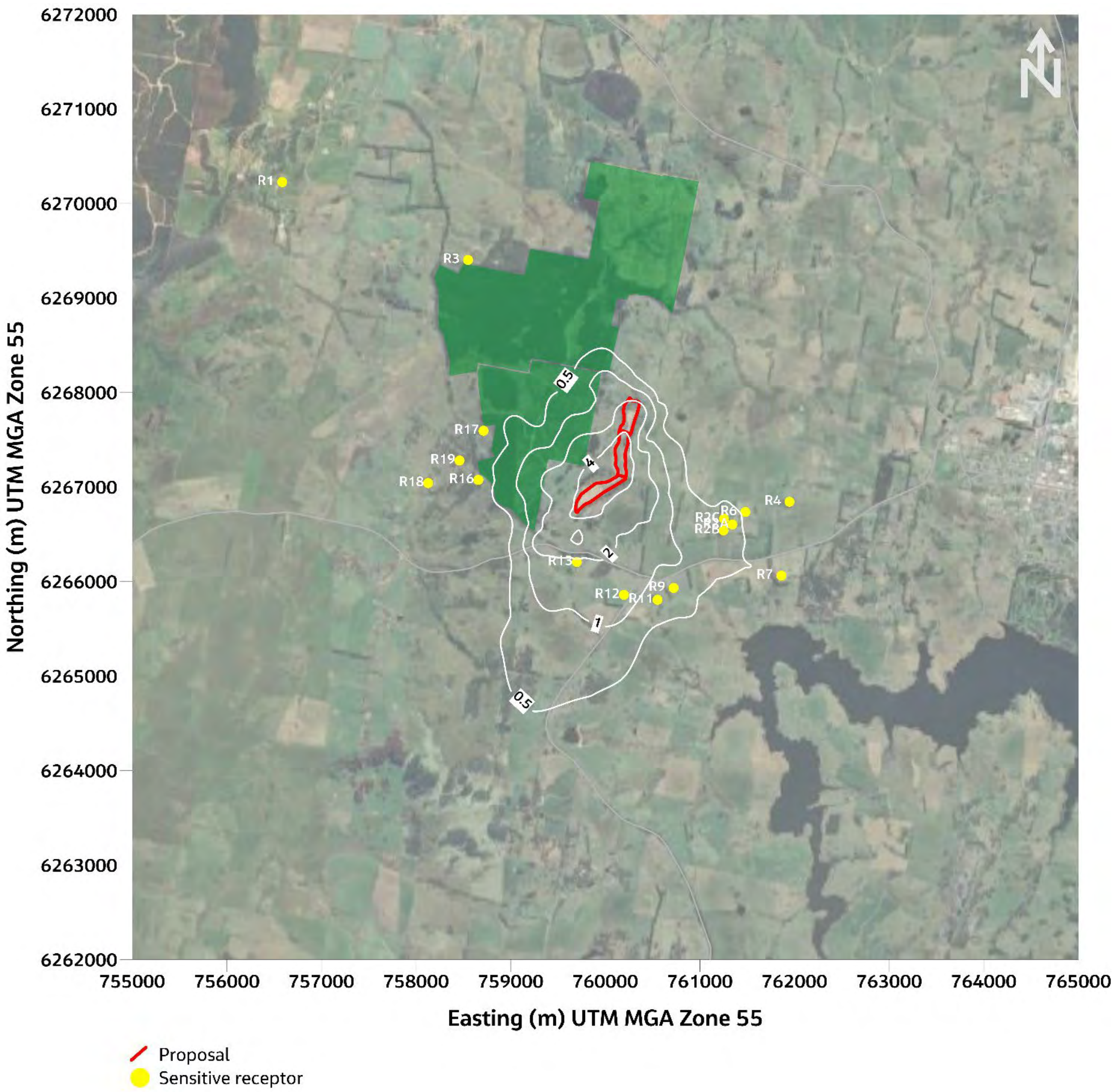


Figure 6.9. Modelled maximum 1 -hour averaged NO_2 from diesel emissions (μg/m [3])

6.4 Road transport

As outlined in **Section 5.4**, Roads and Maritime Services TRAQ was used to predict the effects of diesel emissions from trucks transporting quarry products along public roads. **Table 6.9** show the maximum concentrations at kerbside of key air quality indicators as predicted by TRAQ along the expected typical off-site haulage roads. The background concentrations for NO_2 and PM_{10} were applied as determined in **Section 4.5**, with the maximum 24-hour averaged PM_{10} value of 29.2 µg/m^3 measured at DPE Bathurst in 2021 applied. The default background 1-hour and 8-hour averaged CO concentrations for 'rural' environments were applied. The predictions from TRAQ were combined with these adopted background concentrations to predict resulting changes in cumulative roadside air quality as a result of the additional quarry-related transportation. These concentrations were evaluated by comparing the results against the applicable EPA assessment criteria.

Table 6.9. Predicted maximum concentrations at kerbside due to diesel exhaust emissions

Pollutant	Averaging time	Due to diesel exhaust emissions from proposal traffic	Background level	Cumulative	Criterion
Carbon monoxide (CO) (mg/m^3)	1-hour	<0.1	0.7*	<0.8	30
	8-hour	<0.1	0.7*	<0.8	10
Nitrogen dioxide (NO_2) (µg/m^3)	1-hour	1.2	70	71.2	164
	Annual	0.2	12	12.2	31
Particulate matter (PM_{10}) (µg/m^3)	24-hour	0.9	29.2	30.1	50
	Annual	0.3	11.3	11.6	25

* TRAQ defaults for "rural" environment

As **Table 6.9** shows, diesel exhausts emissions from traffic along on public roads generated from the proposal will not lead to any exceedances of the EPA's impact assessment criteria. On this basis it is considered that additional traffic from the quarry along the public network is unlikely to result in adverse air quality impacts.

6.5 Crystalline silica

Martins Creek Quarry is a hard rock quarry located in the Dungog Shire Council Local Government Area (LGA) operated by Buttai Gravel Pty Ltd. The Report, 'Martins Creek Quarry Extension – Air Quality Impact Assessment', (Jacobs, 2020) describes the outcomes of ambient monitoring of respirable crystalline silica carried out at the quarry in 2019. The monitoring involved the installation of a monitor located on the site boundary and positioned downwind of the quarry activities on a day representative of normal operations. The monitor was fitted with a PVC filter to allow for analysis of crystalline silica. The sampling and analysis was conducted in accordance with the following methods:

- Inhalable Dust – AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust; Gravimetric analysis of samples was performed by GCG Health Safety & Hygiene, Townsville, Queensland, NATA Site Number 20653, NATA accreditation number 16791.
- Respirable Dust – AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust; Gravimetric analysis of samples was performed by GCG Health Safety & Hygiene, Townsville, Queensland, NATA Site Number 20653, NATA accreditation number 16791.
- Analysis for Crystalline Silica was conducted by MPL Laboratories (NATA Accreditation 2901) by direct on filter Infra-Red Spectrometry following ashing and redeposition.

Results from the sampling at Martins Creek were used to estimate a maximum annual average respirable crystalline silica concentration at the proposal site boundary for comparison with the relevant assessment criteria. The results from Martins Creek Quarry have been reproduced below in **Table 6.10**.

Table 6.10. Crystalline silica review outcomesfrom Martins Creek reference site

Substance	Measured result at site boundary	Estimated annual average at Proposal site boundary, based on operating times and assuming quarry operations every day of the year	Criterion
Martins Creek Quarry (reference site), June 2019			
Respirable crystalline silica	4.2 μg/m^3	2.0 μg/m^3	3 μg/m^3

Source: Jacobs, 2020

The estimated annual average at the site boundary for Martins Creek considered a maximum annual extraction rate of 1.1 Mtpa. Up to 0.315 Mtpa of quarry product/sales per year is planned at the proposal, including products associated with imported materials. Scaling the estimated annual average at the site boundary from Martins Creek based on this lower rate of production results in a maximum estimated annual boundary concentration of 0.6 μg/m^3. This does not exceed the 3 μg/m^3 criterion noted by the Victorian EPA.

Additionally, respirable crystalline silica is noted as being a subset of $PM_{2.5}$. The highest annually averaged $PM_{2.5}$ concentration at a surrounding sensitive receiver was 0.1 μg/m^3 (refer to **Section 6.1.3**). This re-affirms the estimated outcome based on the monitoring from the Martins Creek reference site and suggests that the proposal is unlikely to cause adverse air quality impacts with respect to crystalline silica.

7. Safeguards and monitoring

7.1 Particulate matter

The modelling presented above in Section 6 predicted that the change in dust concentrations and deposited dust levels due to the proposal would not cause any exceedances of the relevant EPA assessment criteria at the nearest private sensitive receptors. These predictions considered the application of the following control measures, which should be implemented during operations:

Table 7.1. Emission control measures

Source/activity	Control measure	Control efficiency (%)	Reference
Drilling	Water sprays	70%	(NPI, 2012), Table 4
Hauling materials	Watering of haulage routes	50%	(NPI, 2012), Table 4
Wind erosion	Water sprays	50%	(NPI, 2012), Table 4
	Water sprays and rehabilitation	65%	(NPI, 2012), Table 4, including multiple concurrent controls equation

The following dust management provisions in the site AQMP should continue to be adhered to:

Table 7.2. Existing site dust management controls (Source: Umwelt, 2019)

Source/activity	Reference
Tree planting around the extraction area in accordance with the Quarry Rehabilitation and Landscape management Plan [to] reduce the effect of wind exposed areas of the Quarry site.	AQMP, Section 5.1
Avoid dusty activities such as soil stripping and rock extraction (by ripping or excavation) during windy (wind speeds greater than 5 m/s) conditions.	
Ensuring that the plant and equipment used for drilling and blasting utilises water injection or suitable alterativ e dust collection controls.	
Use of a water truck to maintain active internal unsealed haul routes, as well as any areas where dust generation is observed.	
Where possible, extracted rock and overburden and imported materials should be stockpiled as close to the completed face of extraction as possible.	
Stockpiles of rock to be crushed and screened is to be wetted down as required to prevent dust lift-off, and to maintain moisture content to reduce dust generation during crushing and screening. Dust suppression sprays are to be fitted to crushing and screening units as required to reduce associated dust emissions.	
Mobile crushing plant are to be located where the extraction area or stockpiles provide shielding from the effects of wind.	
Education and training to minimise drop heights of products and materials from front end loaders	
Exhausts of earthmoving equipment are to be diverted away from the ground surface.	
Soil stockpiles are to be revegetated to provide 70% coverage within 60 days of establishment (unless t soil is to be re-excavated and used in rehabilitation within the next 6 months).	
The Quarry Access Road is sealed to reduce dust generation as well as mud tracked onto the public road network.	
All trucks delivering materials for resource recovery and composting, and dispatching products will have their loads covered.	
Progressive rehabilitation over the life of the Quarry to reduce the extent of exposed areas generating dust.	

Additionally, the triggers, complaints and incident management and response provisions of the site AQMP (Section 5.3), as well as the monitoring plan (Section 6.10) remain appropriate and should continue being implemented.

7.2 Post Blast Fume

Although the assessment determined that proposal will not cause adverse blast fume impacts due to blasting, the following measure is recommended to ensure that this outcome is achieved:

- Update the site AQMP to include the following additional provisions to manage blasting activities:
  - It is expected that this plan would define the allowable times of the day when blasting can occur.
  - The plan should also identify weather conditions that may lead to higher potential risks, and the process that would be implemented to avoid or otherwise effectively manage blasting during these conditions.

7.3 Diesel exhaust

Though diesel exhaust emissions from site operations were not determined to present an issue, the following recommendations should be applied:

- Servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance.
- Targeting the maintenance to ensure, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle.
- Defining failure modes, effects and criticality which helps to minimise potential equipment failure.

These measures are consistent with the equipment maintenance and engine replacement strategies from the 'NSW Coal Mining Benchmarking Study: Best practice measures for reducing non-road diesel exhaust emissions', (EPA, 2014), understanding that the proposal is not a coal development but are consistent with best practice.

8. Conclusions

This report has provided an assessment of the potential air quality and greenhouse gas impacts of the Middle Creek Quarry Modification proposal. In summary, the air quality assessment involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling the potential impact of the Project on local air quality. The modelling was carried out in accordance with the assessment procedures prescribed by the EPA.

The key air quality issue was identified as dust during operations. This was the focus of the assessment, along with impacts from diesel exhaust emissions, NO_2 emissions from blasting, impacts from associated road transport activities and the effects of crystalline silica.

As part of the assessment, key features of the existing environment were identified including surrounding sensitive receptors, local meteorology and background air quality. Aerial imagery was used to identify the location of surrounding receptors. Meteorological and ambient air quality data collected at monitors operated by DPE and BoM (Meteorology only) surrounding were reviewed to characterise existing local conditions. The following conclusions were made in relation to the existing environment:

- Meteorological conditions do not vary significantly from year to year, and conditions in 2021 were identified as most representative of the long term, local conditions.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal setting.

Air quality emission rates for key dust-generating activities associated with the proposed modification were estimated from local and international guidance. Modelling was then carried out with these emissions to predict potential changes to local air quality. The assessment determined that air quality impacts associated with the proposal would meet the relevant requirements from the EPA's Approved Methods. Specifically, it was predicted that:

- Operational dust emissions due are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on modelling which showed compliance with the EPA assessment criteria.
- No exceedances of the EPA's NO_2 criteria from diesel exhaust emissions or from blasting.
- Emissions from truck diesel exhausts travelling on public roads are not expected to result in any adverse air quality impacts based on modelling which showed that maximum kerbside concentrations would not exceed EPA criteria.
- Monitoring from a similar site and results from modelling suggest that the proposal is not expected to cause, adverse air quality impacts with respect to crystalline silica.

While this assessment has shown the proposal is not expected to cause any adverse air quality impacts s, a range of mitigation and management measures were recommended including a consideration of real-time air quality monitoring.

9. References

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Appendix A. Emissions calculations

Emission estimates, controls factors, emission factors and input variables

Stage 1:

Annual emissions and variables

Emission calculations																						
Middle Creek Quarry Cell 1 - Rev 2 27/9/22																						
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 1 Materials																						
Drilling rock - Cell 1	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 1	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 1 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 1 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 1 raw materials to Processing Units	6846	1947	97	50	4000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.8	8.3	-	-
Unloading Cell 1 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Crushing of Cell 1 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 1 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 1 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling Cell 1 Product to storage Stockpiles	1284	365	18	50	750	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.2	8.3	-	-
Unloading Cell 1 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored Cell 1 Product in stockpiles	550	275	28	50	0.96	ha	1146.4	kg/ha/y	573.2	kg/ha/y	57.3	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 1 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Off-site export of Cell 1 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 1 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-

References

Emission calculations	
Middle Creek Quarry Cell 1 - Rev 2 27/9/22	
Activity	Reference
Cell 1 Materials	
Drilling rock - Cell 1	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 1	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 1 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 1 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 1 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 1 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 1 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 1 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 1 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 1 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 1 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 1 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 1 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 1 Product via sealed Quarry Access Road	AP42-13.2.1, Equation 1 (US EPA)
Off-site export of Cell 1 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2.1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2.1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2.1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EETM Mining, 2012 ; AP42-13.2.4-1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2-1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport , 2021); Haulage distances (m) = measured; dump and haulage truck loaded weights (t) = supplied; controls (%) = default values (Tab le 4 EETM Mining, 2012); activity intensities = supplied.

Stage 2:

Annual emissions and variables

Emission calculations																						
Middle Creek Quarry Cell 2 - Rev 2 27/9/22																						
	Annual emissions (kg/y						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 2 Materials and wind erosion from Cell 1																						
Drilling rock - Cell 2	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 2	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 2 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 2 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 2 raw materials to Processing Units	3423	973	49	50	2000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.4	8.3	-	-
Unloading Cell 2 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Crushing of Cell 2 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 2 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 2 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling Cell 2 Product to storage Stockpiles	13691	3893	195	50	8000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	1.6	8.3	-	-
Unloading Cell 2 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored Cell 2 Product in stockpiles	511	255	26	50	0.96	ha	1064.4	kg/ha/y	532.2	kg/ha/y	53.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 2 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Off-site export of Cell 2 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 2 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Cell 2	8234	4117	412	50	4.7	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Total	**74438**	**25193**	**2992**																			

References

Emission calculations	
Middle Creek Quarry Cell 2 - Rev 2 27/9/22	
Activity	Reference
Cell 2 Materials and wind erosion from Cell 1	
Drilling rock - Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 2 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 2 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 2 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 2 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 2 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 2 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 2 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 2 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 2 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 2 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 2 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 2 Product via sealed Quarry Access Road	AP42-13.2. 1, Equation 1 (US EPA)
Off-site export of Cell 2 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EE TM Mining, 2012; AP42 -13.2.4-1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2-1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport, 2021); Haulage distance s (m) = measured; dump and haulage truck loaded weights (t) = supplied; controls (%) = default values (Table 4 EETM Mining, 2012); activity intensities = supplied.

Stage 3:

Annual emissions and variables

Emission calculations

Middle Creek Quarry Cell 3 - Rev 2 27/9/22

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	$(ws/2.2)^{1.3}$	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 3 Materials and wind erosion from Cells 1 and 2																						
Drilling rock - Cell 3	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 3	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 3 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 3 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 3 raw materials to Processing Units	2567	730	36	50	1500	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading Cell 3 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Crushing of Cell 3 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 3 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 3 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling Cell 3 Product to storage Stockpiles	20537	5840	292	50	12000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	2.4	8.3	-	-
Unloading Cell 3 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored Cell 3 Product in stockpiles	550	275	28	50	0.96	ha	1146.4	kg/ha/y	573.2	kg/ha/y	57.3	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 3 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Off-site export of Cell 3 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 3 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind Erosion from Cell 2	5764	2882	288	65	4.7	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Cell 3	7534	3767	377	50	4.3	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Total	**85530**	**29448**	**3333**																			

References

Emission calculations

Middle Creek Quarry Cell 3 - Rev 2 27/9/22

Activity	Reference
Cell 3 Materials and wind erosion from Cells 1 and 2	
Drilling rock - Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 3 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 3 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 3 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 3 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 3 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 3 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 3 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 3 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 3 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 3 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 3 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 3 Product via sealed Quarry Access Road	AP42-13.2. 1, Equation 1 (US EPA)
Off-site export of Cell 3 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind Erosion from Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EETM Mining, 2012 ; AP42-13.2.4-1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2-1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport, 2021); Haulage distances (m) = measured; dump and haulage truck loaded weights (t) = supplied ; controls (%) = default values (Table 4 EETM Mining, 2012); activity intens ities = supplied.

Appendix B. Model input codes

CALMET example input file

```
CALMET.INP     2.1          Hour Start and End Times with Seconds

Middle Creek Quarry

CALMET Simulation


---------------- Run title (3 lines) ------------------------------------------


          CALMET MODEL CONTROL FILE

          --------------------------


-------------------------------------------------------------------------------


INPUT GROUP: 0 -- Input and Output File Names




Subgroup (a)

------------

Default Name  Type        File Name

------------  ----        ---------

GEO.DAT      input    ! GEODAT=GEO.DAT     !

SURF.DAT     input    ! SRFDAT=SURF2021.DAT    !

CLOUD.DAT    input    * CLDDAT=         *

PRECIP.DAT   input    * PRCDAT=         *

WT.DAT       input    * WTDAT=          *


CALMET.LST   output   ! METLST=MET01.LST !

CALMET.LST   output   ! METDAT=MET01.DAT !

PACOUT.DAT   output   * PACDAT=         *
```

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = F !

F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

Number of upper air stations (NUSTA) No default ! NUSTA = 1 !

Number of overwater met stations

(NOWSTA) No default ! NOWSTA = 0 !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

Number of MM4/MM5/3D.DAT files

(NM3D) No default ! NM3D = 0 !

Number of IGF-CALMET.DAT files

(NIGF) No default ! NIGF = 0 !

!END!

Subgroup (b)

Upper air files (one per station)

Default Name Type File Name

------------ ---- ---------

UP1.DAT input 1 ! UPDAT=UP1.DAT! !END!

UP2.DAT input 2 * UPDAT=UP2.DAT* *END*

------------------------------- ---

Subgroup (c)

Overwater station files (one per station)

Default Name Type File Name

------------ ---- ---------

SEA1.DAT input 1 * SEADAT=SEA_449.DAT * *END*

Subgroup (d)

MM4/MM5/3D.DAT files (consecutive or overlapping)

Default Name Type File Name

------------ ---- ---------

MM51.DAT input 1 * M3DDAT=LSP2003.DAT * *END*

-- ----------

Subgroup (e)

IGF-CALMET.DAT files (consecutive or overlapping)

Default Name Type File Name

------------ ---- ---------

IGFn.DAT input 1 * IGFDAT=CALMET0.DAT * *END*

Subgroup (f)

Other file names

Default Name Type File Name

------------ ---- ---------

DIAG.DAT input * DIADAT= *

PROG.DAT input * PRGDAT= *

TEST.PRT output * TSTPRT= *

TEST.OUT output * TSTOUT= *

TEST.KIN output * TSTKIN= *

TEST.FRD output * TSTFRD= *

TEST.SLP output * TSTSLP= *

DCST.GRD output * DCSTGD= *

--- ------------

NOTES: (1) File/path names can be up to 70 characters in length

(2) Subgroups (a) and (f) must have ONE 'END' (surrounded by

delimiters) at the end of the group

(3) Subgroups (b) through (e) are included ONLY if the corresponding

number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have

an 'END' (surround by delimiters) at the end of EACH LINE

!END!

-- ----------------------

INPUT GROUP: 1 - General run control parameters

!IBYR = 2021!

!IBMO = 1!

!IBDY = 1 !

!IBHR = 0 !

!IBSEC = 0 !

!IEYR = 2021!

!IEMO = 2!

!IEDY = 1 !

!IEHR = 0 !

!IESEC = 0 !

UTC time zone (ABTZ) -- No default ! ABTZ= UTC+1000 !

(character*8)

PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000

CST = UTC-0600, EST = UTC-0500

Length of modeling time-step (seconds)

Must divide evenly into 3600 (1 hour)

(NSECDT) Default:3600 ! NSECDT = 3600 !

Units: seconds

Run type (IRTYPE) -- Default: 1 ! IRTYPE= 1 !

0 = Computes wind fields only

1 = Computes wind fields and micrometeorological variables

(u*, w*, L, zi, etc.)

(IRTYPE must be 1 to run CALPUFF or CALGRID)

Compute special data fields required

by CALGRID (i.e., 3-D fields of W wind

components and temperature)

in additional to regular Default: T ! LCALGRD = T !

fields ? (LCALGRD)

(LCALGRD must be T to run CALGRID)

Flag to stop run after

SETUP phase (ITEST) Default: 2 ! ITEST= 2 !

(Used to allow checking

of the model inputs, files, etc.)

ITEST = 1 - STOPS program after SETUP phase

ITEST = 2 - Continues with execution of

COMPUTATIONAL phase after SETUP

Test options specified to see if

they conform to regulatory

values? (MREG) No Default ! MREG = 0 !

0 = NO checks are made

1 = Technical options must conform to USEPA guidance

IMIXH -1 Maul-Carson convective mixing height

over land; OCD mixing height overwater

ICOARE 0 OCD deltaT method for overwater fluxes

THRESHL 0.0 Threshold buoyancy flux over land needed

to sustain convective mixing height growth

ISURFT > 0 Pick one representative station, OR

-2 in NOOBS mode (ITPROG=2) average all
surface prognostic temperatures to get
a single representative surface temp.
IUPT > 0 Pick one representative station, OR
-2 in NOOBS mode (ITPROG>0) average all surface
prognostic temperatures to get a single
representative surface temp.
IZICRLX 0 Do NOT use convective mixing height
relaxation to equilibrium value

!END!

INPUT GROUP: 2 -- Map Projection and Grid control parameters

Projection for all (X,Y):

Map projection

(PMAP) Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator

TTM : Tangential Transverse Mercator

LCC : Lambert Conformal Conic

PS : Polar Stereographic

EM : Equatorial Mercator

LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin

(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 0.000 !

(FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 55 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = S !

N : Northern hemisphere projection

S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin

(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = 34.45N !

(RLON0) No Default ! RLON0 =150.88W !

TTM : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

LCC : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

PS : RLON0 identifies central (grid N/S) meridian of projection

RLAT0 selected for convenience

EM : RLON0 identifies central meridian of projection

RLAT0 is REPLACED by 0.0N (Equator)

LAZA: RLON0 identifies longitude of tangent-point of mapping plane

RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection

(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = -30N !

(XLAT2) No Default ! XLAT2 = -60N !

LCC : Projection cone slices through Earth's surface at XLAT1 and XLAT2

PS : Projection plane slices through Earth at XLAT1

(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a

letter N,S,E, or W indicating north or south latitude, and

east or west longitude. For example,

35.9 N Latitude = 35.9N

118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character

string. Many mapping products currently available use the model of the

Earth known as the World Geodetic System 1984 (WGS-84). Other local

models may be in use, and their selection in CALMET will make its output

consistent with local mapping products. The list of Datum-Regions with

official transformation parameters is provided by the National Imagery and

Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

-- -

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)

NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)

NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)

NWS-84 NWS 6370KM Radius, Sphere

ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates

(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

Horizontal grid definition:

Rectangular grid defined for projection PMAP,

with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 103 !

No. Y grid cells (NY) No default ! NY = 103 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = 0.1 !

Units: km

Reference grid coordinate of

SOUTHWEST corner of grid cell (1,1)

X coordinate (XORIGKM) No default ! XORIGKM = 754.850 !

Y coordinate (YORIGKM) No default ! YORIGKM = 6261.850 !

Units: km

Vertical grid definition:

No. of vertical layers (NZ) No default ! NZ = 9 !

Cell face heights in arbitrary

vertical grid (ZFACE(NZ+1)) No defaults

Units: m

! ZFACE = 0.,20.,40.,80.,160.,320.,700.,1200.,1500.,2000. !

!END!

INPUT GROUP: 3 Output Options

DISK OUTPUT OPTION

Savemet. fields in an unformatted

output file ? (LSAVE) Default: T ! LSAVE = T !

(F = Do not save, T = Save)

Type of unformatted output file:

(IFORMO) Default: 1 ! IFORMO = 1 !

1 = CALPUFF/CALGRID type file (CALMET.DAT)

2 = MESOPUFF-II type file (PACOUT.DAT)

LINE PRINTER OUTPUT OPTIONS:

Print met. fields ? (LPRINT) Default: F ! LPRINT = F !

(F = Do not print, T = Print)

(NOTE: parameters below control which

met. variables are printed)

Print interval

(IPRINF) in hours Default: 1 ! IPRINF = 96 !

(Meteorological fields are printed

every 96 hours)

Specify which layers of U, V wind component

to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T) Defaults: NZ*0

! IUVOUT = 1 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which levels of the W wind component to print

(NOTE: W defined at TOP cell face 9 values)

(IWOUT(NZ))-- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0

! IWOUT = 1 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which levels of the 3D temperature field to print

(ITOUT(NZ))-- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0

! ITOUT = 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which meteorological fields

to print

(used only if LPRINT=T) Defaults: 0 (all variables)

Variable Print ?

(0 = do not print,

1 = print)

-------- ------------------

! STABILITY = 1 - PGT stability class

! USTAR = 0 - Friction velocity

! MONIN = 0 - Monin-Obukhov length

! MIXHT = 0 - Mixing height

! WSTAR = 0 - Convective velocity scale

! PRECIP = 0 - Precipitation rate

! SENSHEAT = 0 - Sensible heat flux

! CONVZI = 0 - Convective mixing ht.

Testing and debug print options for micrometeorological module

Print input meteorological data and

internal variables (LDB) Default: F ! LDB = F !

(F = Do not print, T = print)

(NOTE: this option produces large amounts of output)

First time step for which debug data

are printed (NN1) Default: 1 ! NN1 = 1 !

Last time step for which debug data

are printed (NN2) Default: 1 ! NN2 = 2 !

Print distance to land

internal variables (LDBCST) Default: F ! LDBCST = F !

(F = Do not print, T = print)

(Output in .GRD file DCST.GRD, defined in input group 0)

Testing and debug print options for wind field module

(all of the following print options control output to
wind field module's output files: TEST.PRT, TEST.OUT,
TEST.KIN, TEST.FRD, and TEST.SLP)

Control variable for writing the test/debug
wind fields to disk files (IOUTD)
(0=Do not write, 1=write) Default: 0 ! IOUTD = 0 !

Number of levels, starting at the surface,
to print (NZPRN2) Default: 1 ! NZPRN2 = 1 !

Print the INTERPOLATED wind components ?
(IPR0) (0=no, 1=yes) Default: 0 ! IPR0 = 0 !

Print the TERRAIN ADJUSTED surface wind
components ?
(IPR1) (0=no, 1=yes) Default: 0 ! IPR1 = 0 !

Print the SMOOTHED wind components and
the INITIAL DIVERGENCE fields ?
(IPR2) (0=no, 1=yes) Default: 0 ! IPR2 = 0 !

Print the FINAL wind speed and direction
fields ?
(IPR3) (0=no, 1=yes) Default: 0 ! IPR3 = 0 !

Print the FINAL DIVERGENCE fields ?
(IPR4) (0=no, 1=yes) Default: 0 ! IPR4 = 0 !

Print the winds after KINEMATIC effects

are added ?

(IPR5) (0=no, 1=yes) Default: 0 ! IPR5 = 0 !

Print the winds after the FROUDE NUMBER

adjustment is made ?

(IPR6) (0=no, 1=yes) Default: 0 ! IPR6 = 0 !

Print the winds after SLOPE FLOWS

are added ?

(IPR7) (0=no, 1=yes) Default: 0 ! IPR7 = 0 !

Print the FINAL wind field components ?

(IPR8) (0=no, 1=yes) Default: 0 ! IPR8 = 0 !

!END!

INPUT GROUP: 4 Meteorological data options

NO OBSERVATION MODE (NOOBS) Default: 0 ! NOOBS = 0 !

0 = Use surface, overwater, and upper air stations

1 = Use surface and overwater stations (no upper air observations)

Use MM4/MM5/3D.DAT for upper air data

2 = No surface, overwater, or upper air observations

Use MM4/MM5/3D.DAT for surface, overwater, and upper air data

NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

Number of surface stations (NSSTA) No default ! NSSTA = 1 !

Number of precipitation stations

(NPSTA=-1: flag for use of MM5/3D.DAT precip data)

(NPSTA) No default ! NPSTA = 0 !

CLOUD DATA OPTIONS

Gridded cloud fields:

(ICLOUD) Default: 0 ! ICLOUD = 4 !

ICLOUD = 0 - Gridded clouds not used

ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT

ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT

ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity

at 850mb (Teixera)

ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity

at all levels (MM5toGrads algorithm)

FILE FORMATS

Surface meteorological data file format

(IFORMS) Default: 2 ! IFORMS = 2 !

(1 = unformatted (e.g., SMERGE output))

(2 = formatted (free-formatted user input))

Precipitation data file format

(IFORMP) Default: 2 ! IFORMP = 2 !

(1 = unformatted (e.g., PMERGE output))

(2 = formatted (free-formatted user input))

Cloud data file format

(IFORMC) Default: 2 ! IFORMC = 2 !

(1 = unformatted - CALMET unformatted output)

(2 = formatted - free-formatted CALMET output or user input)

!END!

INPUT GROUP: 5 -- Wind Field Options and Parameters

WIND FIELD MODEL OPTIONS

Model selection variable (IWFCOD) Default: 1 ! IWFCOD = 1 !

0 = Objective analysis only

1 = Diagnostic wind module

Compute Froude number adjustment

effects ? (IFRADJ) Default: 1! IFRADJ = 1 !

(0 = NO, 1 = YES)

Compute kinematic effects ? (IKINE) Default: 0 ! IKINE = 0 !

(0 = NO, 1 = YES)

Use O'Brien procedure for adjustment

of the vertical velocity ? (IOBR) Default: 0 ! IOBR = 0 !

(0 = NO, 1 = YES)

Compute slope flow effects ? (ISLOPE) Default: 1 ! ISLOPE = 1 !

(0 = NO, 1 = YES)

Extrapolate surface wind observations

to upper layers ? (IEXTRP) Default: -4 ! IEXTRP = -4 !

(1 = no extrapolation is done,

2 = power law extrapolation used,

3 = user input multiplicative factors

for layers 2 - NZ used (see FEXTRP array)

4 = similarity theory used

-1, -2, -3, -4 = same as above except layer 1 data

at upper air stations are ignored

Extrapolate surface winds even

if calm? (ICALM) Default: 0 ! ICALM = 0 !

(0 = NO, 1 = YES)

Layer-dependent biases modifying the weights of

surface and upper air stations (BIAS(NZ))

-1<=BIAS<=1

Negative BIAS reduces the weight of upper air stations

(e.g. BIAS=-0.1 reduces the weight of upper air stations

by 10%; BIAS=-1, reduces their weight by 100 %)

Positive BIAS reduces the weight of surface stations

(e.g. BIAS= 0.2 reduces the weight of surface stations by 20%; BIAS=1 reduces their weight by 100%)

Zero BIAS leaves weights unchanged (1/R**2 interpolation)

Default: NZ*0

! BIAS = -1 , -.8 , -.6 , -.4 , -.2 , 0 , 0 , 0 , 0 !

Minimum distance from nearest upper air station

to surface station for which extrapolation

of surface winds at surface station will be allowed

(RMIN2: Set to -1 for IEXTRP = 4 or other situations

where all surface stations should be extrapolated)

Default: 4. ! RMIN2 = 1.0 !

Use gridded prognostic wind field model

output fields as input to the diagnostic

wind field model (IPROG) Default: 0 ! IPROG = 0 !

(0 = No, [IWFCOD = 0 or 1]

1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]

2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]

3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]

4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]

5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]

13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD = 0]

14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]

15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

Timestep (seconds) of the prognostic

model input data (ISTEPPGS) Default: 3600 ! ISTEPPGS = 3600 !

Use coarse CALMET fields as initial guess fields (IGFMET)

(overwrites IGF based on prognostic wind fields if any)

Default: 0 ! IGFMET = 0 !

RADIUS OF INFLUENCE PARAMETERS

Use varying radius of influence Default: F ! LVARY = F!

(if no stations are found within RMAX1,RMAX2,

or RMAX3, then the closest station will be used)

Maximum radius of influence over land

in the surface layer (RMAX1) No default ! RMAX1 = 5. !

Units: km

Maximum radius of influence over land

aloft (RMAX2) No default ! RMAX2 = 20. !

Units: km

Maximum radius of influence over water

(RMAX3) No default ! RMAX3 = 20. !

Units: km

OTHER WIND FIELD INPUT PARAMETERS

Minimum radius of influence used in

the wind field interpolation (RMIN) Default: 0.1 ! RMIN = 0.1 !

Units: km

Radius of influence of terrain

features (TERRAD) No default ! TERRAD = 4. !

Units: km

Relative weighting of the first

guess field and observations in the

SURFACE layer (R1) No default ! R1 = 0.5 !

(R1 is the distance from an Units: km

observational station at which the

observation and first guess field are

equally weighted)

Relative weighting of the first

guess field and observations in the

layers ALOFT (R2) No default ! R2 = 1. !

(R2 is applied in the upper layers Units: km

in the same manner as R1 is used in

the surface layer).

Relative weighting parameter of the

prognostic wind field data (RPROG) No default ! RPROG = 0. !

(Used only if IPROG = 1) Units: km

Maximum acceptable divergence in the

divergence minimization procedure

(DIVLIM) Default: 5.E-6 ! DIVLIM= 5.0E-06 !

Maximum number of iterations in the

divergence min. procedure (NITER) Default: 50 ! NITER = 50 !

Number of passes in the smoothing

procedure (NSMTH(NZ))

NOTE: NZ values must be entered

Default: 2,(mxnz-1)*4 ! NSMTH =

2 , 4 , 4 , 4 , 4 , 4 , 4 , 4 , 4 !

Maximum number of stations used in

each layer for the interpolation of

data to a grid point (NINTR2(NZ))

NOTE: NZ values must be entered Default: 99. ! NINTR2 =

99 , 99 , 99 , 99 , 99 , 99 , 99 , 99 , 99 !

Critical Froude number (CRITFN) Default: 1.0 ! CRITFN = 1. !

Empirical factor controlling the

influence of kinematic effects

(ALPHA) Default: 0.1 ! ALPHA = 0.1 !

Multiplicative scaling factor for

extrapolation of surface observations

to upper layers (FEXTR2(NZ)) Default: NZ*0.0

! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0. !

(Used only if IEXTRP = 3 or 3)

BARRIER INFORMATION

Number of barriers to interpolation

of the wind fields (NBAR) Default: 0 ! NBAR = 0 !

Level (1 to NZ) up to which barriers

apply (KBAR) Default: NZ ! KBAR = 9 !

THE FOLLOWING 4 VARIABLES ARE INCLUDED

ONLY IF NBAR > 0

NOTE: NBAR values must be entered No defaults

for each variable Units: km

X coordinate of BEGINNING

of each barrier (XBBAR(NBAR)) ! XBBAR = 0. !

Y coordinate of BEGINNING

of each barrier (YBBAR(NBAR)) ! YBBAR = 0. !

X coordinate of ENDING

of each barrier (XEBAR(NBAR)) ! XEBAR = 0. !

Y coordinate of ENDING

of each barrier (YEBAR(NBAR)) ! YEBAR = 0. !

DIAGNOSTIC MODULE DATA INPUT OPTIONS

Surface temperature (IDIOPT1) Default: 0 ! IDIOPT1 = 0 !

0 = Compute internally from

hourly surface observations or prognostic fields

1 = Read preprocessed values from

a data file (DIAG.DAT)

Surface met. station to use for

the surface temperature (ISURFT) Default: -1 ! ISURFT = -1 !

(Must be a value from 1 to NSSTA,

or -1 to use 2-D spatially varying

surface temperatures,

or -2 to use a domain-average prognostic

surface temperatures (only with ITPROG=2))

(Used only if IDIOPT1 = 0)

Temperature lapse rate used in the Default: 0 ! IDIOPT2 = 0 !

computation of terrain -induced

circulations (IDIOPT2)

0 = Compute internally from (at least) twice-daily

upper air observations or prognostic fields

1 = Read hourly preprocessed values

from a data file (DIAG.DAT)

Upper air station to use for

the domain-scale lapse rate (IUPT) Default: 1 ! IUPT = 1 !

(Must be a value from 1 to NUSTA,

or -1 to use 2-D spatially varying lapse rate,

or -2 to use a domain-average prognostic

lapse rate (only with ITPROG>0))

(Used only if IDIOPT2 = 0)

Depth through which the domain-scale

lapse rate is computed (ZUPT) Default: 200. ! ZUPT = 200. !

(Used only if IDIOPT2 = 0) Units: meters

Initial Guess Field Winds

(IDIOPT3) Default: 0 ! IDIOPT3 = 0 !

0 = Compute internally from

observations or prognostic wind fields

1 = Read hourly preprocessed domain-average wind values

from a data file (DIAG.DAT)

Upper air station to use for

the initial guess winds (IUPWND) Default: -1 ! IUPWND = -1 !

(Must be a value from -1 to NUSTA, with

-1 indicating 3-D initial guess fields,

and IUPWND>1 domain-scaled (i.e. constant) IGF)

(Used only if IDIOPT3 = 0 and noobs=0)

Bottom and top of layer through

which the domain-scale winds

are computed

(ZUPWND(1), ZUPWND(2)) Defaults: 1., 1000. ! ZUPWND= 1., 1000. !

(Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0) Units: meters

-------------- ------------

Observed surface wind components

for wind field module (IDIOPT4) Default: 0 ! IDIOPT4 = 0 !

0 = Read WS, WD from a surface

data file (SURF.DAT)

1 = Read hourly preprocessed U, V from

a data file (DIAG.DAT)

Observed upper air wind components

for wind field module (IDIOPT5) Default: 0 ! IDIOPT5 = 0 !

0 = Read WS, WD from an upper

air data file (UP1.DAT, UP2.DAT, etc.)

1 = Read hourly preprocessed U, V from

a data file (DIAG.DAT)

LAKE BREEZE INFORMATION

Use Lake Breeze Module (LLBREZE)

Default: F ! LLBREZE = F !

Number of lake breeze regions (NBOX) ! NBOX = 0 !

X Grid line 1 defining the region of interest

! XG1 = 0. !

X Grid line 2 defining the region of interest

! XG2 = 0. !

Y Grid line 1 defining the region of interest

! YG1 = 0. !

Y Grid line 2 defining the region of interest

! YG2 = 0. !

X Point defining the coastline (Straight line)

(XBCST) (KM) Default: none ! XBCST = 0. !

Y Point defining the coastline (Straight line)

(YBCST) (KM) Default: none ! YBCST = 0. !

X Point defining the coastline (Straight line)

(XECST) (KM) Default: none ! XECST = 0. !

Y Point defining the coastline (Straight line)

(YECST) (KM) Default: none ! YECST = 0. !

Number of stations in the region Default: none ! NLB = 0 !

(Surface stations + upper air stations)

Station ID's in the region (METBXID(NLB))

(Surface stations first, then upper air stations)

! METBXID = 0 !

!END!

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters

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EMPRICAL MIXING HEIGHT CONSTANTS

Neutral, mechanical equation

(CONSTB) Default: 1.41 ! CONSTB = 1.41 !

Convective mixing ht. equation

(CONSTE) Default: 0.15 ! CONSTE = 0.15 !

Stable mixing ht. equation

(CONSTN) Default: 2400. ! CONSTN = 2400.!

Overwater mixing ht. equation

(CONSTW) Default: 0.16 ! CONSTW = 0.16 !

Absolute value of Coriolis

parameter (FCORIOL) Default: 1.E-4 ! FCORIOL = 7.87E-05!

Units: (1/s)

SPATIAL AVERAGING OF MIXING HEIGHTS

Conduct spatial averaging

(IAVEZI) (0=no, 1=yes) Default: 1 ! IAVEZI = 1 !

Max. search radius in averaging

process (MNMDAV) Default: 1 ! MNMDAV = 1 !

Units: Grid

cells

Half-angle of upwind looking cone

for averaging (HAFANG) Default: 30. ! HAFANG = 30. !

Units: deg.

Layer of winds used in upwind

averaging (ILEVZI) Default: 1 ! ILEVZI = 1 !

(must be between 1 and NZ)

CONVECTIVE MIXING HEIGHT OPTIONS:

Method to compute the convective

mixing height(IMIHXH) Default: 1 ! IMIXH = 1 !

1: Maul-Carson for land and water cells

-1: Maul-Carson for land cells only-

OCD mixing height overwater

2: Batchvarova and Gryning for land and water cells

-2: Batchvarova and Gryning for land cells only

OCD mixing height overwater

Threshold buoyancy flux required to

sustain convective mixing height growth

overland (THRESHL) Default: 0.0 ! THRESHL = 0.05 !

(expressed as a heat flux units: W/m3

per meter of boundary layer)

Threshold buoyancy flux required to

sustain convective mixing height growth

overwater (THRESHW) Default: 0.05 ! THRESHW = 0.05 !

(expressed as a heat flux units: W/m3

per meter of boundary layer)

Flag to allow relaxation of convective mixing height

to equilibrium value when 0<QH<THRESHL (overland)

or 0<QH<THRESHW (overwater)

(IZICRLX) Default: 1 ! IZICRLX = 1 !

0 : do NOT use convective mixing height relaxation

to equilibrium value (treatment identical to CALMET v5.8)

1 : use convective mixing height relaxation

to equilibrium value

Relaxation time of convective mixing height to

equilibrium value when 0<QH<THRESHL (overland)

or 0<QH<THRESHW (overwater)

(Used only if IZICRLX = 1 and TZICRLX must be >= 1.)

(TZICRLX) Default: 800. ! TZICRLX = 800. !

Units: seconds

Option for overwater lapse rates used

in convective mixing height growth

(ITWPROG) Default: 0 ! ITWPROG = 0 !

0 : use SEA.DAT lapse rates and deltaT (or assume neutral

conditions if missing)

1 : use prognostic lapse rates (only if IPROG>2)

and SEA.DAT deltaT (or neutral if missing)

2 : use prognostic lapse rates and prognostic delta T

(only if iprog>12 and 3D.DAT version# 2.0 or higher)

Land Use category ocean in 3D.DAT datasets

(ILUOC3D) Default: 16 ! ILUOC3D = 16 !

Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16

if MM4.DAT, typically iluoc3d = 7

OTHER MIXING HEIGHT VARIABLES

Minimum potential temperature lapse

rate in the stable layer above the

current convective mixing ht. Default: 0.001 ! DPTMIN = 0.001 !

(DPTMIN) Units: deg. K/m

Depth of layer above current conv.

mixing height through which lapse Default: 200. ! DZZI = 200. !

rate is computed (DZZI) Units: meters

Minimum overland mixing height Default: 50. ! ZIMIN = 50. !

(ZIMIN) Units: meters

Maximum overland mixing height Default: 3000. ! ZIMAX = 2500. !

(ZIMAX) Units: meters

Minimum overwater mixing height Default: 50. ! ZIMINW = 50. !

(ZIMINW)-- (Not used if observed Units: meters

overwater mixing hts. are used)

Maximum overwater mixing height Default: 3000. ! ZIMAXW = 3000. !

(ZIMAXW)-- (Not used if observed Units: meters

overwater mixing hts. are used)

OVERWATER SURFACE FLUXES METHOD and PARAMETERS

(ICOARE) Default: 10 ! ICOARE = 10 !

0: original deltaT method (OCD)

10: COARE with no wave parameterization (jwave=0, Charnock)

11: COARE with wave option jwave=1 (Oost et al.)

and default wave properties

-11: COARE with wave option jwave=1 (Oost et al.)

and observed wave properties (must be in SEA.DAT files)

12: COARE with wave option 2 (Taylor and Yelland)

and default wave properties

-12: COARE with wave option 2 (Taylor and Yelland)

and observed wave properties (must be in SEA.DAT files)

Note: When ICOARE=0, similarity wind profile stability PSI functions
based on Van Ulden and Holtslag (1985) are substituted for
later formulations used with the COARE module, and temperatures
used for surface layer parameters are obtained from either the
nearest surface station temperature or prognostic model 2D
temperatures (if ITPROG=2).

Coastal/Shallow water length scale (DSHELF)
(for modified z0 in shallow water)
(COARE fluxes only)
Default : 0.   ! DSHELF = 0. !
units: km

COARE warm layer computation (IWARM)   ! IWARM = 0   !
1: on - 0: off (must be off if SST measured with
IR radiometer)   Default: 0

COARE cool skin layer computation (ICOOL)   ! ICOOL = 0   !
1: on - 0: off (must be off if SST measured with
IR radiometer)   Default: 0

RELATIVE HUMIDITY PARAMETERS

3D relative humidity from observations or
from prognostic data? (IRHPROG)   Default:0   ! IRHPROG = 0   !

0 = Use RH from SURF.DAT file

(only if NOOBS = 0,1)

1 = Use prognostic RH

(only if NOOBS = 0,1,2)

TEMPERATURE PARAMETERS

3D temperature from observations or

from prognostic data? (ITPROG) Default:0 ! ITPROG = 0 !

0 = Use Surface and upper air stations

(only if NOOBS = 0)

1 = Use Surface stations (no upper air observations)

Use MM5/3D.DAT for upper air data

(only if NOOBS = 0,1)

2 = No surface or upper air observations

Use MM5/3D.DAT for surface and upper air data

(only if NOOBS = 0,1,2)

Interpolation type

(1 = 1/R ; 2 = 1/R**2) Default:1 ! IRAD = 1 !

Radius of influence for temperature

interpolation (TRADKM) Default: 500. ! TRADKM = 10. !

Units: km

Maximum Number of stations to include

in temperature interpolation (NUMTS) Default: 5 ! NUMTS = 4 !

Conduct spatial averaging of temperatures (IAVET) (0=no, 1=yes) Default: 1 ! IAVET = 1 !

(will use mixing ht MNMDAV,HAFANG

so make sure they are correct)

Default temperature gradient Default: -.0098 ! TGDEFB = -0.0098 !

below the mixing height over Units: K/m

water (TGDEFB)

Default temperature gradient Default: -.0045 ! TGDEFA = -0.0045 !

above the mixing height over Units: K/m

water (TGDEFA)

Beginning (JWAT1) and ending (JWAT2)

land use categories for temperature ! JWAT1 = 999 !

interpolation over water -- Make ! JWAT2 = 999 !

bigger than largest land use to disable

PRECIP INTERPOLATION PARAMETERS

Method of interpolation (NFLAGP) Default: 2 ! NFLAGP = 2 !

(1=1/R,2=1/R**2,3=EXP/R**2)

Radius of Influence (SIGMAP) Default: 100.0 ! SIGMAP = 100. !

(0.0 => use half dist. btwn Units: km

nearest stns w & w/out

precip when NFLAGP = 3)

Minimum Precip. Rate Cutoff (CUTP) Default: 0.01 ! CUTP = 0.01 !

(values < CUTP = 0.0 mm/hr) Units: mm/hr

!END!

INPUT GROUP: 7 -- Surface meteorological station parameters

SURFACE STATION VARIABLES

(One record per station -- 1 records in all)

	1	2				
	Name	ID	X coord. (km)	Y coord. (km)	Time zone	Anem. Ht.(m)
! SS1 =	'BATH'	1	746.802	6299.899	-10	10 !
* SS2 =	'WILL'	2	391.047	6370.956	-10	10 *

----

1 Four character string for station name (MUST START IN COLUMN 9)

2 Six digit integer for station ID

!END!

--------------- --

```
INPUT GROUP: -8 Upper air meteorological station parameters

--------------



   UPPER AIR STATION VARIABLES

   (One record per station--  1  records in all)



         1     2

      Name    ID      X coord.   Y coord.  Time zone

                    (km)       (km)

     -----------------------------------------------

! US1  ='BATH'   54321  746.802   6299.899   - 10  !

* US2  ='WILL'   54322    391.047   6370.956 - 10  *



-------------------

    1

     Four character string for station name

     (MUST START IN COLUMN 9)



    2

     Five digit integer for station ID



!END!




-- ------------------------------------------------------------------------------



INPUT GROUP: -9 Precipitation station parameters

--------------
```

PRECIPITATION STATION VARIABLES

(One record per station-- 0 records in all)

(NOT INCLUDED IF NPSTA = 0)

1 2

Name Station X coord. Y coord.

Code (km) (km)

1

Four character string for station name

(MUST START IN COLUMN 9)

2

Six digit station code composed of state

code (first 2 digits) and station ID (last

4 digits)

!END!

CALPUFF example input file

CALPUFF.INP 2.0 File version record

Middle Creek Quarry Stage1

---------------- Run title (3 lines) --

CALPUFF MODEL CONTROL FILE

INPUT GROUP: 0 Input and Output File Names

Default Name Type File Name

------------ ---- ---------

CALMET.DAT input * METDAT = *

or

ISCMET.DAT input * ISCDAT = *

or

PLMMET.DAT input * PLMDAT = *

or

PROFILE.DAT input * PRFDAT = *

SURFACE.DAT input * SFCDAT = *

RESTARTB.DAT input * RSTARTB= *

CALPUFF.LST output ! PUFLST =PUFF1.LST !

CONC.DAT output ! CONDAT =PUFF1.CON !

DFLX.DAT output ! DFDAT =PUFF1.DEP !

WFLX.DAT output * WFDAT = *

VISB.DAT output * VISDAT = *

TK2D.DAT output * T2DDAT = *

RHO2D.DAT output * RHODAT = *

RESTARTE.DAT output * RSTARTE= *

------------------ ---

Emission Files

PTEMARB.DAT input * PTDAT = *

VOLEMARB.DAT input ! VOLDAT =EMISS1.VOL !

BAEMARB.DAT input * ARDAT = *

LNEMARB.DAT input * LNDAT = *

Other Files

OZONE.DAT input * OZDAT = *

VD.DAT input * VDDAT = *

CHEM.DAT input * CHEMDAT= *

AUX input ! AUXEXT =AUX !

(Extension added to METDAT filename(s) for files

with auxiliary 2D and 3D data)

H2O2.DAT input * H2O2DAT= *

NH3Z.DAT input * NH3ZDAT= *

HILL.DAT input * HILDAT= *

HILLRCT.DAT input * RCTDAT= *

COASTLN.DAT input * CSTDAT= *

FLUXBDY.DAT input * BDYDAT= *

BCON.DAT input * BCNDAT= *

DEBUG.DAT output * DEBUG = *

MASSFLX.DAT output * FLXDAT= *

MASSBAL.DAT output * BALDAT= *

FOG.DAT output * FOGDAT= *

RISE.DAT output * RISDAT= *

------------------------------------- --

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = F !

F = UPPER CASE

NOTE: (1) file/path names can be up to 132 characters in length

Provision for multiple input files

Number of Modeling Domains (NMETDOM)

Default: 1 ! NMETDOM = 1 !

Number of CALMET.DAT files for run (NMETDAT)

Default: 1 ! NMETDAT = 12 !

Number of PTEMARB.DAT files for run (NPTDAT)

Default: 0 ! NPTDAT = 0 !

Number of BAEMARB.DAT files for run (NARDAT)

Default: 0 ! NARDAT = 0 !

Number of VOLEMARB.DAT files for run (NVOLDAT)

Default: 0 ! NVOLDAT = 0 !

!END!

Subgroup (0a)

Provide a name for each CALMET domain if NMETDOM > 1

Enter NMETDOM lines.

a,b

Default Name Domain Name

------------ ------------

none * DOMAIN1= * *END*

none * DOMAIN2= * *END*

none * DOMAIN3= * *END*

The following CALMET.DAT filenames are processed in sequence

if NMETDAT > 1

Enter NMETDAT lines, 1 line for each file name.

a,c,d

Default Name Type File Name

------------ ---- ---------

none input ! METDAT1 = ..\..\CALMET\MET01.DAT ! !END!

none input ! METDAT1= ..\..\CALMET\MET02.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET03.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET04.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET05.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET06.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET07.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET08.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET09.DAT ! !END!

```
none        input    ! METDAT1 = ..\CALMET\MET10.DAT    !  !END!

none        input    ! METDAT1 = ..\CALMET\MET11.DAT    !  !END!

none        input    ! METDAT1 = ..\CALMET\MET12.DAT    !  !END!


-------------

  a

   The name for each CALMET domain and each CALMET.DAT file is treated

   as a separate input subgroup and therefore must end with an input

   group terminator.

  b

   Use DOMAIN1= to assign the name for the outermost CALMET domain.

   Use DOMAIN2= to assign the name for the next inner CALMET domain.

   Use DOMAIN3= to assign the name for the next inner CALMET domain, etc.

    --------------------------------------------------------------------

    |  When inner domains with equal resolution (grid-cell size)       |

    |  overlap, the data from the FIRST such domain in the list will   |

    |  be used if all other criteria for choosing the controlling      |

    |  grid domain are inconclusive.                                   |

    --------------------------------------------------------------------

  c

   Use METDAT1= to assign the file names for the outermost CALMET domain.

   Use METDAT2= to assign the file names for the next inner CALMET domain.

   Use METDAT3= to assign the file names for the next inner CALMET domain, etc.

  d

   The filenames for each domain must be provided in sequential order


-------------

Subgroup (0b)

-------------
```

The following PTEMARB.DAT filenames are processed if NPTDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type   File Name

------------   ----   ---------

none   input   * PTDAT=   *   *END*

Subgroup (0c)

The following BAEMARB.DAT filenames are processed if NARDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type   File Name

------------   ----   ---------

none   input   * ARDAT=   *   *END*

Subgroup (0d)

The following VOLEMARB.DAT filenames are processed if NVOLDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type   File Name

```
---------   ---  ----         ---------

 none        input      * VOLDAT=EMISS1.VOL     *   *END*




--------------------------------------------------------------------------------


INPUT GROUP: 1 -- General run control parameters

--------------


   Option to run all periods found

   in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !


       METRUN = 0 - Run period explicitly defined below

       METRUN = 1 - Run all periods in met. file


    Starting date:    Year   (IBYR) --    No default    ! IBYR  =  2021  !

                   Month  (IBMO) --    No default    ! IBMO  =  1  !

                   Day    (IBDY) --    No default    ! IBDY  =  1  !

    Starting time:    Hour   (IBHR) --    No default    ! IBHR  =  0  !

                   Minute (IBMIN) --    No default    ! IBMIN =  0  !

                   Second (IBSEC) --    No default    ! IBSEC =  0  !


    Ending date:      Year   (IEYR) --    No default    ! IEYR  =  2022  !

                   Month  (IEMO) --    No default    ! IEMO  =  1  !

                   Day    (IEDY) --    No default    ! IEDY  =  1  !

    Ending time:      Hour   (IEHR) --    No default    ! IEHR  =  0  !

                   Minute (IEMIN) --    No default    ! IEMIN =  0  !

                   Second (IESEC) --    No default    ! IESEC =  0  !
```

(These are only used if METRUN = 0)

Base time zone: (ABTZ) -- No default ! ABTZ= UTC+1000 !

(character*8)

The modeling domain may span multiple time zones. ABTZ defines the

base time zone used for the entire simulation. This must match the

base time zone of the meteorological data.

Examples:

Los Angeles, USA = UTC-0800

New York, USA = UTC-0500

Santiago, Chile = UTC-0400

Greenwich Mean Time (GMT) = UTC+0000

Rome, Italy = UTC+0100

Cape Town, S.Africa = UTC+0200

Sydney, Australia = UTC+1000

Length of modeling time-step (seconds)

Equal to update period in the primary

meteorological data files, or an

integer fraction of it (1/2, 1/3 ...)

Must be no larger than 1 hour

(NSECDT) Default:3600 ! NSECDT = 3600 !

Units: seconds

Number of chemical species (NSPEC)

Default: 5 ! NSPEC = 3 !

Number of chemical species

to be emitted (NSE) Default: 3 ! NSE = 0 !

Flag to stop run after

SETUP phase (ITEST) Default: 2 ! ITEST = 2 !

(Used to allow checking

of the model inputs, files, etc.)

ITEST = 1 - STOPS program after SETUP phase

ITEST = 2 - Continues with execution of program

after SETUP

Restart Configuration:

Control flag (MRESTART) Default: 0 ! MRESTART = 0 !

0 = Do not read or write a restart file

1 = Read a restart file at the beginning of

the run

2 = Write a restart file during run

3 = Read a restart file at beginning of run

and write a restart file during run

Number of periods in Restart

output cycle (NRESPD) Default: 0 ! NRESPD = 0 !

0 = File written only at last period

>0 = File updated every NRESPD periods

Meteorological Data Format (METFM)

Default: 1 ! METFM = 1 !

METFM = 1- CALMET binary file (CALMET.MET)

METFM = 2- ISC ASCII file (ISCMET.MET)

METFM = 3- AUSPLUME ASCII file (PLMMET.MET)

METFM = 4- CTDM plus tower file (PROFILE.DAT) and

surface parameters file (SURFACE.DAT)

METFM = 5- AERMET tower file (PROFILE.DAT) and

surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)

(used only for METFM = 1, 2, 3)

Default: 1 ! MPRFFM = 1 !

MPRFFM = 1- CTDM plus tower file (PROFILE.DAT)

MPRFFM = 2- AERMET tower file (PROFILE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2

Averaging Time (minutes) (AVET)

Default: 60.0 ! AVET = 60. !

PG Averaging Time (minutes) (PGTIME)

Default: 60.0 ! PGTIME = 60. !

Output units for binary concentration and flux files

written in Dataset v2.2 or later formats

(IOUTU) Default: 1 ! IOUTU = 1 !

1 = mass - g/m3 (conc) or g/m2/s (dep)

2 = odour - odour_units (conc)

3 = radiation - Bq/m3 (conc) or Bq/m2/s (dep)

Output Dataset format for binary concentration

and flux files (e.g., CONC.DAT)

(IOVERS) Default: 2 ! IOVERS = 2 !

1 = Dataset Version 2.1

2 = Dataset Version 2.2

!END!

INPUT GROUP: 2 -- Technical options

Vertical distribution used in the

near field (MGAUSS) Default: 1 ! MGAUSS = 1 !

0 = uniform

1 = Gaussian

Terrain adjustment method

(MCTADJ) Default: 3 ! MCTADJ = 3 !

0 = no adjustment

1 = ISC-type of terrain adjustment

2 = simple, CALPUFF-type of terrain

adjustment

3 = partial plume path adjustment

Subgrid-scale complex terrain

flag (MCTSG) Default: 0 ! MCTSG = 0 !

0 = not modeled

1 = modeled

Near-field puffs modeled as

elongated slugs? (MSLUG) Default: 0 ! MSLUG = 0 !

0 = no

1 = yes (slug model used)

Transitional plume rise modeled?

(MTRANS) Default: 1 ! MTRANS = 1 !

0 = no (i.e., final rise only)

1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP) Default: 1 ! MTIP = 1 !

0 = no (i.e., no stack tip downwash)

1 = yes (i.e., use stack tip downwash)

Method used to compute plume rise for

point sources not subject to building

downwash? (MRISE) Default: 1 ! MRISE = 1 !

1 = Briggs plume rise

2 = Numerical plume rise

Method used to simulate building

downwash? (MBDW) Default: 1 ! MBDW = 2 !

1 = ISC method

2 = PRIME method

Vertical wind shear modeled above

stack top (modified Briggs plume rise)?

(MSHEAR) Default: 0 ! MSHEAR = 0 !

0 = no (i.e., vertical wind shear not modeled)

1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT) Default: 0 ! MSPLIT =! 0

0 = no (i.e., puffs not split)

1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM) Default: 1 ! MCHEM = 0 !

0 = chemical transformation not

modeled

1 = transformation rates computed

internally (MESOPUFF II scheme)

2 = user-specified transformation

rates used

3 = transformation rates computed

internally (RIVAD/ARM3 scheme)

4 = secondary organic aerosol formation

computed (MESOPUFF II scheme for OH)

5 = user-specified half-life with or

without transfer to child species

6 = transformation rates computed

internally (Updated RIVAD scheme with

ISORROPIA equilibrium)

7 = transformation rates computed

internally (Updated RIVAD scheme with

ISORROPIA equilibrium and CalTech SOA)

Aqueous phase transformation flag (MAQCHEM)

(Used only if MCHEM = 6, or 7) Default: 0 ! MAQCHEM = 0 !

0 = aqueous phase transformation

not modeled

1 = transformation rates and wet

scavenging coefficients adjusted

for in-cloud aqueous phase reactions

(adapted from RADM cloud model

implementation in CMAQ/SCICHEM)

Liquid Water Content flag (MLWC)

(Used only if MAQCHEM = 1) Default: 1 ! MLWC = 1 !

0 = water content estimated from cloud cover

and presence of precipitation

1 = gridded cloud water data read from CALMET

water content output files (filenames are

the CALMET.DAT names PLUS the extension

AUXEXT provided in Input Group 0)

Wet removal modeled ? (MWET) Default: 1 ! MWET = 0 !

0 = no

1 = yes

Dry deposition modeled ? (MDRY) Default: 1 ! MDRY = 1 !

0 = no

1 = yes

(dry deposition method specified

for each species in Input Group 3)

Gravitational settling (plume tilt)

modeled ? (MTILT) Default: 0 ! MTILT = 0 !

0 = no

1 = yes

(puff center falls at the gravitational

settling velocity for 1 particle species)

Restrictions:

- MDRY = 1

- NSPEC = 1 (must be particle species as well)

- sg = 0 GEOMETRIC STANDARD DEVIATION in Group 3 is

set to zero for a single particle diameter

Method used to compute dispersion

coefficients (MDISP) Default: 3 ! MDISP = 2 !

1 = dispersion coefficients computed from measured values

of turbulence, sigma v, sigma w

2 = dispersion coefficients from internally calculated

sigma v, sigma w using micrometeorological variables

(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using

the ISCST multi-segment approximation) and MP coefficients in

urban areas

4 = same as 3 except PG coefficients computed using

the MESOPUFF II eqns.

5 = CTDM sigmas used for stable and neutral conditions.

For unstable conditions, sigmas are computed as in

MDISP = 3, described above. MDISP = 5 assumes that

measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)

(Used only if MDISP = 1 or 5) Default: 3 ! MTURBVW = 3 !

1 = use sigma-v or sigma-theta measurements

from PROFILE.DAT to compute sigma-y

(valid for METFM = 1, 2, 3, 4, 5)

2 = use sigma-w measurements

from PROFILE.DAT to compute sigma-z

(valid for METFM = 1, 2, 3, 4, 5)

3 = use both sigma-(v/theta) and sigma-w

from PROFILE.DAT to compute sigma-y and sigma-z

(valid for METFM = 1, 2, 3, 4, 5)

4 = use sigma-theta measurements

from PLMMET.DAT to compute sigma-y

(valid only if METFM = 3)

Back-up method used to compute dispersion

when measured turbulence data are

missing (MDISP2) Default: 3 ! MDISP2 = 3 !

(used only if MDISP = 1 or 5)

2 = dispersion coefficients from internally calculated

sigma v, sigma w using micrometeorological variables

(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using

the ISCST multi-segment approximation) and MP coefficients in

urban areas

4 = same as 3 except PG coefficients computed using

the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]

Method used for Lagrangian timescale for Sigma-y

(used only if MDISP=1,2 or MDISP2=1,2)

(MTAULY)   Default: 0   ! MTAULY = 0 !

0 = Draxler default 617.284 (s)

1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF

10 < Direct user input (s)   -- e.g., 306.9

[DIAGNOSTIC FEATURE]

Method used for Advective-Decay timescale for Turbulence

(used only if MDISP=2 or MDISP2=2)

(MTAUADV)   Default: 0   ! MTAUADV = 0 !

0 = No turbulence advection

1 = Computed (OPTION NOT IMPLEMENTED)

10 < Direct user input (s) -- e.g., 800

Method used to compute turbulence sigma-v &

sigma-w using micrometeorological variables

(Used only if MDISP = 2 or MDISP2 = 2)

(MCTURB)   Default: 1   ! MCTURB = 1 !

1 = Standard CALPUFF subroutines

2 = AERMOD subroutines

PG sigma-y,z adj. for roughness? Default: 0 ! MROUGH = 0 !

(MROUGH)

0 = no

1 = yes

Partial plume penetration of Default: 1 ! MPARTL = 1 !

elevated inversion modeled for

point sources?

(MPARTL)

0 = no

1 = yes

Partial plume penetration of Default: 1 ! MPARTLBA = 1 !

elevated inversion modeled for

buoyant area sources?

(MPARTLBA)

0 = no

1 = yes

Strength of temperature inversion Default: 0 ! MTINV = 0 !

provided in PROFILE.DAT extended records?

(MTINV)

0 = no (computed from measured/default gradients)

1 = yes

PDF used for dispersion under convective conditions?

Default: 0 ! MPDF = 0 !

(MPDF)

0 = no

1 = yes

Sub-Grid TIBL module used for shore line?

Default: 0 ! MSGTIBL = 0 !

(MSGTIBL)

0 = no

1 = yes

Boundary conditions (concentration) modeled?

Default: 0 ! MBCON = 0 !

(MBCON)

0 = no

1 = yes, using formatted BCON.DAT file

2 = yes, using unformatted CONC.DAT file

Note: MBCON > 0 requires that the last species modeled

be 'BCON'. Mass is placed in species BCON when

generating boundary condition puffs so that clean

air entering the modeling domain can be simulated

in the same way as polluted air. Specify zero

emission of species BCON for all regular sources.

Individual source contributions saved?

Default: 0 ! MSOURCE = 0 !

(MSOURCE)

0 = no

1 = yes

Analyses of fogging and icing impacts due to emissions from

arrays of mechanically-forced cooling towers can be performed

using CALPUFF in conjunction with a cooling tower emissions

processor (CTEMISS) and its associated postprocessors. Hourly

emissions of water vapor and temperature from each cooling tower

cell are computed for the current cell configuration and ambient

conditions by CTEMISS. CALPUFF models the dispersion of these

emissions and provides cloud information in a specialized format

for further analysis. Output to FOG.DAT is provided in either

'plume mode' or 'receptor mode' format.

Configure for FOG Model output?

Default: 0   ! MFOG = 0   !

(MFOG)

0 = no

1 = yes - report results in PLUME Mode format

2 = yes - report results in RECEPTOR Mode format

Test options specified to see if

they conform to regulatory

values? (MREG)   Default: 1   ! MREG = 0   !

0 = NO checks are made

1 = Technical options must conform to USEPA

Long Range Transport (LRT) guidance

METFM   1 or 2

AVET   60. (min)

PGTIME 60. (min)

MGAUSS 1

MCTADJ 3

MTRANS 1

MTIP 1

MRISE 1

MCHEM 1 or 3 (if modeling SOx, NOx)

MWET 1

MDRY 1

MDISP 2 or 3

MPDF 0 if MDISP=3

1 if MDISP=2

MROUGH 0

MPARTL 1

MPARTLBA 0

SYTDEP 550. (m)

MHFTSZ 0

SVMIN 0.5 (m/s)

!END!

INPUT GROUP: 3a, 3b Species list

```
Subgroup (3a)

------------

  The following species are modeled:

! CSPEC =        TSP !       !END!

! CSPEC =       PM10 !       !END!

! CSPEC =       PM25 !       !END!

                                  Dry                OUTPUT GROUP

   SPECIES     MODELED        EMITTED      DEPOSITED            NUMBER

    NAME       (0=NO, 1=YES)   (0=NO, 1=YES)   (0=NO,              (0=NONE,

  (Limit: 12                          1=COMPUTED-GAS       1=1st CGRUP,

   Characters                           2=COMPUTED-PARTICLE   2=2nd CGRUP,

   in length)                          3=USER-SPECIFIED)     3= etc.)

!        TSP  =        1,             1,          2,              0   !

!       PM10=        1,             1,          2,              0   !

!       PM25  =        1,             1,          2,              0   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the

       boundary condition option (MBCON > 0).  Species BCON should

       typically be modeled as inert (no chem transformation or

       removal).

-------------
```

Subgroup (3b)

The following names are used for Species-Groups in which results

for certain species are combined (added) prior to output. The

CGRUP name will be used as the species name in output files.

Use this feature to model specific particle-size distributions

by treating each size-range as a separate species.

Order must be consistent with 3(a) above.

INPUT GROUP: 4 -- Map Projection and Grid control parameters

Projection for all (X,Y):

------------------------ -

Map projection

(PMAP) Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator

TTM : Tangential Transverse Mercator

LCC : Lambert Conformal Conic

PS : Polar Stereographic

EM : Equatorial Mercator

LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin

(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 0.000 !

(FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 55 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = S !

N : Northern hemisphere projection

S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin

(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = 0N !

(RLON0) No Default ! RLON0 = 0E !

TTM : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

LCC : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

PS : RLON0 identifies central (grid N/S) meridian of projection

RLAT0 selected for convenience

EM : RLON0 identifies central meridian of projection

RLAT0 is REPLACED by 0.0N (Equator)

LAZA: RLON0 identifies longitude of tangent-point of mapping plane

RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection

(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 0N !

(XLAT2) No Default ! XLAT2 = 0N !

LCC : Projection cone slices through Earth's surface at XLAT1 and XLAT2

PS : Projection plane slices through Earth at XLAT1

(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a

letter N,S,E, or W indicating north or south latitude, and

east or west longitude. For example,

35.9 N Latitude = 35.9N

118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character

string. Many mapping products currently available use the model of the

Earth known as the World Geodetic System 1984 (WGS-84). Other local

models may be in use, and their selection in CALMET will make its output

consistent with local mapping products. The list of Datum-Regions with

official transformation parameters is provided by the National Imagery and

Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)

NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)

NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)

NWS-84 NWS 6370KM Radius, Sphere

ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates

(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

METEOROLOGICAL Grid:

Rectangular grid defined for projection PMAP,

with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 103 !

No. Y grid cells (NY) No default ! NY = 103 !

No. vertical layers (NZ) No default ! NZ = 9 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = .1 !

Units: km

Cell face heights

(ZFACE(nz+1)) No defaults

Units: m

! ZFACE = .0, 20.0, 40.0, 80.0, 160.0, 320.0, 700.0, 1200.0, 1500.0, 2000.0 !

Reference Coordinates

of SOUTHWEST corner of

grid cell(1, 1):

X coordinate (XORIGKM) No default ! XORIGKM = 754.850 !

Y coordinate (YORIGKM) No default ! YORIGKM = 6261.850 !

Units: km

COMPUTATIONAL Grid:

The computational grid is identical to or a subset of the MET. grid.

The lower left (LL) corner of the computational grid is at grid point

(IBCOMP, JBCOMP) of the MET. grid. The upper right (UR) corner of the

computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.

The grid spacing of the computational grid is the same as the MET. grid.

X index of LL corner (IBCOMP) No default ! IBCOMP = 1 !

(1 <= IBCOMP <= NX)

Y index of LL corner (JBCOMP) No default ! JBCOMP = 1 !

(1 <= JBCOMP <= NY)

X index of UR corner (IECOMP) No default ! IECOMP = 103 !

(1 <= IECOMP <= NX)

Y index of UR corner (JECOMP)   No default   ! JECOMP = 103   !

(1 <= JECOMP <= NY)

SAMPLING Grid (GRIDDED RECEPTORS):

The lower left (LL) corner of the sampling grid is at grid point (IBSAMP, JBSAMP) of the MET. grid. The upper right (UR) corner of the sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid. The sampling grid must be identical to or a subset of the computational grid. It may be a nested grid inside the computational grid. The grid spacing of the sampling grid is DGRIDKM/MESHDN.

Logical flag indicating if gridded

receptors are used (LSAMP)   Default: T   ! LSAMP = F !

(T=yes, F=no)

X index of LL corner (IBSAMP)   No default   ! IBSAMP = 1   !

(IBCOMP <= IBSAMP <= IECOMP)

Y index of LL corner (JBSAMP)   No default   ! JBSAMP = 1   !

(JBCOMP <= JBSAMP <= JECOMP)

X index of UR corner (IESAMP)   No default   ! IESAMP = 50   !

(IBCOMP <= IESAMP <= IECOMP)

Y index of UR corner (JESAMP)   No default   ! JESAMP = 50   !

(JBCOMP <= JESAMP <= JECOMP)

Nesting factor of the sampling

grid (MESHDN)   Default: 1   ! MESHDN = 1 !

(MESHDN is an integer >= 1)

!END!

INPUT GROUP: 5 Output Options

----

*   *

FILE   DEFAULT VALUE   VALUE THIS RUN

----   -------------   --------------

Concentrations (ICON)   1   ! ICON = 1   !

Dry Fluxes (IDRY)   1   ! IDRY = 1   !

Wet Fluxes (IWET)   1   ! IWET = 0   !

2D Temperature (IT2D)   0   ! IT2D = 0   !

2D Density (IRHO)   0   ! IRHO = 0   !

Relative Humidity (IVIS)   1   ! IVIS = 0   !

(relative humidity file is

required for visibility

analysis)

Use data compression option in output file?

(LCOMPRS) Default: T ! LCOMPRS = T !

*

0 = Do not create file, 1 = create file

QA PLOT FILE OUTPUT OPTION:

Create a standard series of output files (e.g.

locations of sources, receptors, grids ...)

suitable for plotting?

(IQAPLOT) Default: 1 ! IQAPLOT = 1 !

0 = no

1 = yes

DIAGNOSTIC PUFF-TRACKING OUTPUT OPTION:

Puff locations and properties reported to

PFTRAK.DAT file for postprocessing?

(IPFTRAK) Default: 0 ! IPFTRAK = 0 !

0 = no

1 = yes, update puff output at end of each timestep

2 = yes, update puff output at end of each sampling step

DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

Mass flux across specified boundaries

for selected species reported?

(IMFLX) Default: 0 ! IMFLX = 0 !

0 = no

1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames

are specified in Input Group 0)

Mass balance for each species

reported?

(IMBAL)   Default: 0   ! IMBAL = 0 !

0 = no

1 = yes (MASSBAL.DAT filename is

specified in Input Group 0)

NUMERICAL RISE OUTPUT OPTION:

Create a file with plume properties for each rise

increment, for each model timestep?

This applies to sources modeled with numerical rise

and is limited to ONE source in the run.

(INRISE)   Default: 0   ! INRISE = 0 !

0 = no

1 = yes (RISE.DAT filename is

specified in Input Group 0)

LINE PRINTER OUTPUT OPTIONS:

Print concentrations (ICPRT)   Default: 0   ! ICPRT = 0   !

Print dry fluxes (IDPRT)   Default: 0   ! IDPRT = 0   !

Print wet fluxes (IWPRT)   Default: 0   ! IWPRT = 0   !

(0 = Do not print, 1 = Print)

Concentration print interval

(ICFRQ) in timesteps Default: 1 ! ICFRQ = 92 !

Dry flux print interval

(IDFRQ) in timesteps Default: 1 ! IDFRQ = 92 !

Wet flux print interval

(IWFRQ) in timesteps Default: 1 ! IWFRQ = 1 !

Units for Line Printer Output

(IPRTU) Default: 1 ! IPRTU = 3 !

for for

Concentration Deposition

1 = g/m**3 g/m**2/s

2 = mg/m**3 mg/m**2/s

3 = ug/m**3 ug/m**2/s

4 = ng/m**3 ng/m**2/s

5 = Odour Units

Messages tracking progress of run

written to the screen ?

(IMESG) Default: 2 ! IMESG = 2 !

0 = no

1 = yes (advection step, puff ID)

2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)

SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

```
     ----  CONCENTRATIONS-   ------  DRY FLUXES----   ------  WET FLUXES----   --  MASS FLUX-

 SPECIES

 /GROUP      PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON DISK?

 -------      ------------------------      ------------------------      ------------------------      ---------------

!       TSP =     0,          1,          0,          1,          0,          0,          0   !

!       PM10 =    0,          1,    0,          1,          0,          0,          0   !

!       PM25 =    0,          1,          0,          1,          0,          0,          0   !


 Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.



   OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)


     Logical for debug output

     (LDEBUG)                         Default: F     ! LDEBUG = F !


     First puff to track

     (IPFDEB)                        Default: !1IPFDEB =  1  !


     Number of puffs to track

     (NPFDEB)                         Default: 1     ! NPFDEB =  1  !


     Met. period to start output

     (NN1)                            Default: 1     ! NN1 =  1   !


     Met. period to end output

     (NN2)                            Default: 10    ! NN2 =  10  !


!END!
```

INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs

----

Subgroup (6a)

Number of terrain features (NHILL) Default: 0 ! NHILL = 0 !

Number of special complex terrain

receptors (NCTREC) Default: 0 ! NCTREC = 0 !

Terrain and CTSG Receptor data for

CTSG hills input in CTDM format ?

(MHILL) No Default ! MHILL = 2 !

1 = Hill and Receptor data created

by CTDM processors & read from

HILL.DAT and HILLRCT.DAT files

2 = Hill data created by OPTHILL &

input below in Subgroup (6b);

Receptor data in Subgroup (6c)

Factor to convert horizontal dimensions Default: 1.0 ! XHILL2M = 1.0 !

to meters (MHILL=1)

Factor to convert vertical dimensions Default: 1.0 ! ZHILL2M = 1.0 !

to meters (MHILL=1)

X-origin of CTDM system relative to No Default ! XCTDMKM = 0 !

CALPUFF coordinate system, in Kilometers (MHILL=1)

Y-origin of CTDM system relative to No Default ! YCTDMKM = 0 !

CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

Subgroup (6b)

----

1 **

HILL information

HILL	XC	YC	THETAH	ZGRID	RELIEF	EXPO 1	EXPO 2	SCALE 1	SCALE 2	AMAX1	AMAX2
NO.	(km)	(km)	(deg.)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
----	----	----	------	-----	------	------	------	-------	-------	-----	-----

----

Subgroup (6c)

------- --------

COMPLEX TERRAIN RECEPTOR INFORMATION

XRCT YRCT ZRCT XHH

(km) (km) (m)

------ ----- ------ ----

1

Description of Complex Terrain Variables:

XC, YC = Coordinates of center of hill

THETAH = Orientation of major axis of hill (clockwise from

North)

ZGRID = Height of the 0 of the grid above mean sea

level

RELIEF = Height of the crest of the hill above the grid elevation

EXPO 1 = Hill-shape exponent for the major axis

EXPO 2 = Hill-shape exponent for the major axis

SCALE 1 = Horizontal length scale along the major axis

SCALE 2 = Horizontal length scale along the minor axis

AMAX = Maximum allowed axis length for the major axis

BMAX = Maximum allowed axis length for the major axis

XRCT, YRCT = Coordinates of the complex terrain receptors

ZRCT = Height of the ground (MSL) at the complex terrain

Receptor

XHH = Hill number associated with each complex terrain receptor

(NOTE: MUST BE ENTERED AS A REAL NUMBER)

**

NOTE: DATA for each hill and CTSG receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

-- -----------------------------------

INPUT GROUP: ~~7~~ Chemical parameters for dry deposition of gases

----

SPECIES DIFFUSIVITY ALPHA STAR REACTIVITY MESOPHYLL RESISTANCE HENRY'S LAW COEFFICIENT

NAME (cm**2/s) (s/cm) (dimensionless)

------- ----------- ---------- ---------- -------------------- -----------------------

!END!

INPUT GROUP: ~~8~~ Size parameters for dry deposition of particles

----

For SINGLE SPECIES, the mean and standard deviation are used to

compute a deposition velocity for NINT (see group 9) size-ranges,

and these are then averaged to obtain a mean deposition velocity.

For GROUPED SPECIES, the size distribution should be explicitly

specified (by the 'species' in the group), and the standard deviation

for each should be entered as 0. The model will then use the deposition velocity for the stated mean diameter.

SPECIES GEOMETRIC MASS MEAN GEOMETRIC STANDARD

NAME DIAMETER DEVIATION

(microns) (microns)

------- ------------------- ------------------

! TSP = 17.3, 2.0 !

! PM10 = 5.0, 2.0 !

! PM25 = 1.0, 1.0 !

!END!

-- --

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters

Reference cuticle resistance (s/cm)

(RCUTR) Default: 30 ! RCUTR = 30.0 !

Reference ground resistance (s/cm)

(RGR) Default: 10 ! RGR = 10.0 !

Reference pollutant reactivity

(REACTR) Default: 8 ! REACTR = 8.0 !

Number of particle-size intervals used to

evaluate effective particle deposition velocity

(NINT) Default: 9 ! NINT = 9 !

Vegetation state in unirrigated areas

(IVEG) Default: 1 ! IVEG = 1 !

IVEG=1 for active and unstressed vegetation

IVEG=2 for active and stressed vegetation

IVEG=3 for inactive vegetation

!END!

INPUT GROUP: 10 -- Wet Deposition Parameters

Scavenging Coefficient -- Units: (sec)**(-1)

Pollutant Liquid Precip. Frozen Precip.

--------- -------------- --------------

!END!

INPUT GROUP: 11a, 11b -- Chemistry Parameters

Subgroup (11a)

Several parameters are needed for one or more of the chemical transformation

mechanisms. Those used for each mechanism are:

```
                M        B
                A B R R R   C B    N
              B  V C N N N M K OC  D
              C M G K I I I H H K F V E
            M K N N N T T T 2 2 P R C C
            O O H H H E E E O O M A N A
Mechanism (MCHEM)   23 3 3 3 1 2 3 2 2 F C X Y
--------------------   -------------------------------------------
0 None              . . . . . . . . . . . . . .
1 MESOPUFF II         X X . . X X X X . . . . . .
2 User Rates          . . . . . . . . . . . . . .
3 RIVAD             X X . . X . . . . . . . . .
4 SOA               X X . . . . . . . . X X X .
5 Radioactive Decay   . . . . . . . . . . . . . X
6 RIVAD/ISORRPIA       X X X X X X . . X X . . . .
7 RIVAD/ISORRPIA/SOA    X X X X X X . . X X X X . .
```

Ozone data input option (MOZ)   Default: 1   ! MOZ = 0   !

(Usedonly if MCHEM = 1, 3, 4, 6, or 7)

0 = use a monthly background ozone value

1 = read hourly ozone concentrations from

the OZONE.DAT data file

Monthly ozone concentrations in ppb (BCKO3)

(Used only if MCHEM = 1,3,4,6, or 7 and either

MOZ = 0, or

MOZ = 1 and all hourly O3 data missing)

Default: 12*80.

! BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00 !

Ammonia data option (MNH3) Default: 0 ! MNH3 = 0 !

(Used only if MCHEM = 6 or 7)

0 = use monthly background ammonia values (BCKNH3) - no vertical variation

1 = read monthly background ammonia values for each layer from

the NH3Z.DAT data file

Ammonia vertical averaging option (MAVGNH3)

(Used only if MCHEM = 6 or 7, and MNH3 = 1)

0 = use NH3 at puff center height (no averaging is done)

1 = average NH3 values over vertical extent of puff

Default: 1 ! MAVGNH3 = 1 !

Monthly ammonia concentrations in ppb (BCKNH3)

(Used only if MCHEM = 1 or 3, or

if MCHEM = 6 or 7, and MNH3 = 0)

Default: 12*10.

! BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00 !

Nighttime SO2 loss rate in %/hour (RNITE1)

(Used only if MCHEM = 1, 6 or 7)

This rate is used only at night for MCHEM=1

and is added to the computed rate both day

and night for MCHEM=6,7 (heterogeneous reactions)

Default: 0.2 ! RNITE1 = .2 !

Nighttime NOx loss rate in %/hour (RNITE2)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE2 = 2.0 !

Nighttime HNO3 formation rate in %/hour (RNITE3)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE3 = 2.0 !

H2O2 data input option (MH2O2) Default: 1 ! MH2O2 = 1 !

(Used only if MCHEM = 6 or 7, and MAQCHEM = 1)

0 = use a monthly background H2O2 value

1 = read hourly H2O2 concentrations from

the H2O2.DAT data file

Monthly H2O2 concentrations in ppb (BCKH2O2)

(Used only if MQACHEM = 1 and either

MH2O2 = 0 or

MH2O2 = 1 and all hourly H2O2 data missing)

Default: 12*1.

! BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

--- Data for SECONDARY ORGANIC AEROSOL (SOA) Options

(used only if MCHEM = 4 or 7)

The MCHEM = 4 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

VOC / NOX ratio (after reaction) (VCNX)

The MCHEM = 7 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

These characterize the air mass when computing

the formation of SOA from VOC emissions.

Typical values for several distinct air mass types are:

Month 1 2 3 4 5 6 7 8 9 10 11 12

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Clean Continental

BCKPMF 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.

OFRAC .15 .15 .20 .20 .20 .20 .20 .20 .20 .20 .20 .15

VCNX 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.

Clean Marine (surface)

BCKPMF .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5

OFRAC .25 .25 .30 .30 .30 .30 .30 .30 .30 .30 .30 .25

VCNX 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.

Urban - low biogenic (controls present)

BCKPMF 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30.

OFRAC .20 .20 .25 .25 .25 .25 .25 .25 .20 .20 .20 .20

VCNX 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4.

Urban - high biogenic (controls present)

BCKPMF 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60.

OFRAC .25 .25 .30 .30 .30 .55 .55 .55 .35 .35 .35 .25

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Regional Plume

BCKPMF 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20.

OFRAC .20 .20 .25 .35 .25 .40 .40 .40 .30 .30 .30 .20

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Urban - no controls present

BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.

OFRAC .30 .30 .35 .35 .35 .55 .55 .55 .35 .35 .35 .30

VCNX 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.

Default: Clean Continental

! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

! OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !

! VCNX = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !

--- End Data for SECONDARY ORGANIC AEROSOL (SOA) Option

Number of half-life decay specification blocks provided in Subgroup 11b

(Used only if MCHEM = 5)

```
   (NDECAY)                        Default: 0     ! NDECAY = 0 !

!END!



--------------
Subgroup (11b)
--------------

   Each species modeled may be assigned a decay half-life (sec), and the associated
   mass lost may be assigned to one or more other modeled species using a mass yield
   factor. This information is used only for MCHEM=5.

   Provide NDECAY blocks assigning the half-life for a parent species and mass yield
   factors for each child species (if any) produced by the decay.
   Set HALF_LIFE=0.0 for NO decay (infinite half-life).


                     a            b
     SPECIES      Half-Life   Mass Yield
      NAME          (sec)       Factor
     -------      ---------   ----------

   *  SPEC1   =    3600.,    -1.0   *    (Parent)
   *  SPEC2   = -1.0,         0.0   *    (Child)
  *END*

--------
  a
```

Specify a half life that is greater than or equal to zero for 1 parent species

in each block, and set the yield factor for this species to -1

b

Specify a yield factor that is greater than or equal to zero for 1 or more child

species in each block, and set the half-life for each of these species to -1

NOTE: Assignments in each block are treated as a separate input

subgroup and therefore must end with an input group terminator.

If NDECAY=0, no assignments and input group terminators should appear.

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters

----

Horizontal size of puff (m) beyond which

time-dependent dispersion equations (Heffter)

are used to determine sigma-y and

sigma-z (SYTDEP) Default: 550. ! SYTDEP = 5.5E02 !

Switch for using Heffter equation for sigma z

as above (0 = Not use Heffter; 1 = use Heffter

(MHFTSZ) Default: 0 ! MHFTSZ = 0 !

Stability class used to determine plume

growth rates for puffs above the boundary

layer (JSUP) Default: 5 ! JSUP = 5 !

Vertical dispersion constant for stable

conditions (k1 in Eqn. 2.7-3) (CONK1) Default: 0.01 ! CONK1 = .01 !

Vertical dispersion constant for neutral/

unstable conditions (k2 in Eqn. 2.7-4)

(CONK2) Default: 0.1 ! CONK2 = .1 !

Factor for determining Transition-point from

Schulman-Scire to Huber-Snyder Building Downwash

scheme (SS used for Hs < Hb + TBD * HL)

(TBD) Default: 0.5 ! TBD = 1.5 !

TBD < 0 ==> always use Huber-Snyder

TBD = 1.5 ==> always use Schulman-Scire

TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which

urban dispersion is assumed

(IURB1, IURB2) Default: 10 ! IURB1 = 10 !

19 ! IURB2 =19 !

Site characterization parameters for single-point Met data files---------

(needed for METFM = 2,3,4,5)

Land use category for modeling domain

(ILANDUIN) Default: 20 ! ILANDUIN = 100 !

Roughness length (m) for modeling domain

(Z0IN) Default: 0.25 ! Z0IN = .5 !

Leaf area index for modeling domain

(XLAIIN) Default: 3.0 ! XLAIIN = .2 !

Elevation above sea level (m)

(ELEVIN) Default: 0.0 ! ELEVIN = 61.0 !

Latitude (degrees) for met location

(XLATIN) Default: -999. ! XLATIN = -33.80905 !

Longitude (degrees) for met location

(XLONIN) Default: -999. ! XLONIN = 151.30422 !

Specialized information for interpreting single-point Met data files-----

Anemometer height (m) (Used only if METFM = 2,3)

(ANEMHT) Default: 10. ! ANEMHT = 10.0 !

Form of lateral turbulance data in PROFILE.DAT file

(Used only if METFM = 4,5 or MTURBVW = 1 or 3)

(ISIGMAV) Default: 1 ! ISIGMAV = 1 !

0 = read sigma-theta

1 = read sigma-v

Choice of mixing heights (Used only if METFM = 4)

(IMIXCTDM) Default: 0 ! IMIXCTDM = 0 !

0 = read PREDICTED mixing heights

1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)

(XMXLEN) Default: 1.0 ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in

grid units) during one sampling step

(XSAMLEN) Default: 1.0 ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from

one source during one time step

(MXNEW) Default: 99 ! MXNEW = 99 !

Maximum Number of sampling steps for

one puff/slug during one time step

(MXSAM) Default: 99 ! MXSAM = 99 !

Number of iterations used when computing

the transport wind for a sampling step

that includes gradual rise (for CALMET

and PROFILE winds)

(NCOUNT) Default: 2 ! NCOUNT = 2 !

Minimum sigma y for a new puff/slug (m)

(SYMIN) Default: 1.0 ! SYMIN = 1.0 !

Minimum sigma z for a new puff/slug (m)

(SZMIN) Default: 1.0 ! SZMIN = 1.0 !

Maximum sigma z (m) allowed to avoid

numerical problem in calculating virtual

time or distance. Cap should be large

enough to have no influence on normal events.

Enter a negative cap to disable.

(SZCAP_M) Default: 5.0e06 ! SZCAP_M = 5.0E06 !

Default minimum turbulence velocities sigma-v and sigma-w

for each stability class over land and over water (m/s)

(SVMIN(12) and SWMIN(12))

```
          ----------   LAND ----------        ---------   WATER----------
  Stab Class :  A    B    C    D    E    F        A    B    C    D    E    F
          ---   ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03, .016
```

! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370!

! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

Divergence criterion for dw/dz across puff

used to initiate adjustment for horizontal

convergence (1/s)

Partial adjustment starts at CDIV(1), and

full adjustment is reached at CDIV(2)

(CDIV(2)) Default: 0.0,0.0 ! CDIV = .0, .0 !

Search radius (number of cells) for nearest

land and water cells used in the subgrid

TIBL module

(NLUTIBL) Default: 4 ! NLUTIBL = 4 !

Minimum wind speed (m/s) allowed for

non-calm conditions. Also used as minimum

speed returned when using power-law

extrapolation toward surface

(WSCALM) Default: 0.5 ! WSCALM = .5 !

Maximum mixing height (m)

(XMAXZI) Default: 3000. ! XMAXZI = 3000.0 !

Minimum mixing height (m)

(XMINZI) Default: 50. ! XMINZI = 50.0 !

Default wind speed classes --

5 upper bounds (m/s) are entered;

the 6th class has no upper limit

(WSCAT(5)) Default :

ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

Wind Speed Class : 1 2 3 4 5

--- --- --- --- ---

! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law

exponents for stabilities 1-6

(PLX0(6)) Default : ISC RURAL values

ISC RURAL : .07, .07, .10, .15, .35, .55

ISC URBAN : .15, .15, .20, .25, .30, .30

Stability Class : A B C D E F

--- --- --- --- --- ---

! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient

for stable classes E, F (degK/m)

(PTG0(2)) Default: 0.020, 0.035

! PTG0 = 0.020, 0.035 !

Default plume path coefficients for

each stability class (used when option

for partial plume height terrain adjustment

is selected -- MCTADJ=3)

(PPC(6)) Stability Class : A B C D E F

Default PPC : .50, .50, .50, .50, .35, .35

--- --- --- --- --- ---

! PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor

equal to sigma-y/length of slug

(SL2PF) Default: 10. ! SL2PF = 10.0 !

Puff-splitting control variables ------------------------

VERTICAL SPLIT

Number of puffs that result every time a puff

is split - nsplit=2 means that 1 puff splits

into 2

(NSPLIT) Default: 3 ! NSPLIT = 3 !

Time(s) of a day when split puffs are eligible to

be split once again; this is typically set once

per day, around sunset before nocturnal shear develops.

24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)

0=do not re-split 1=eligible for re-split

(IRESPLIT(24)) Default: Hour 17 = 1

! IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

Split is allowed only if last hour's mixing

height (m) exceeds a minimum value

(ZISPLIT) Default: 100. ! ZISPLIT = 100.0 !

Split is allowed only if ratio of last hour's

mixing ht to the maximum mixing ht experienced

by the puff is less than a maximum value (this

postpones a split until a nocturnal layer develops)

(ROLDMAX) Default: 0.25 ! ROLDMAX = 0.25 !

HORIZONTAL SPLIT

Number of puffs that result every time a puff

is split - nsplith=5 means that 1 puff splits

into 5

(NSPLITH) Default: 5 ! NSPLITH = 5 !

Minimum sigma -y (Grid Cells Units) of puff

before it may be split

(SYSPLITH) Default: 1.0 ! SYSPLITH = 1.0 !

Minimum puff elongation rate (SYSPLITH/hr) due to

wind shear, before it may be split

(SHSPLITH) Default: 2. ! SHSPLITH = 2.0 !

Minimum concentration (g/m^3) of each

species in puff before it may be split

Enter array of NSPEC values; if a single value is

entered, it will be used for ALL species

(CNSPLITH) Default: 1.0E-07 ! CNSPLITH = 1.0E-07 !

Integration control variables ------------ ------------

Fractional convergence criterion for numerical SLUG

sampling integration

(EPSSLUG) Default: 1.0e-04 ! EPSSLUG = 1.0E-04 !

Fractional convergence criterion for numerical AREA

source integration

(EPSAREA) Default: 1.0e-06 ! EPSAREA = 1.0E-06 !

Trajectory step-length (m) used for numerical rise

integration

(DSRISE) Default: 1.0 ! DSRISE = 1.0 !

Boundary Condition (BC) Puff control variables------------------------

Minimum height (m) to which BC puffs are mixed as they are emitted

(MBCON=2 ONLY). Actual height is reset to the current mixing height

at the release point if greater than this minimum.

(HTMINBC) Default: 500. ! HTMINBC = 500.0 !

Search radius (km) about a receptor for sampling nearest BC puff.

BC puffs are typically emitted with a spacing of one grid cell

length, so the search radius should be greater than DGRIDKM.

(RSAMPBC) Default: 10. ! RSAMPBC = 10.0 !

Near-Surface depletion adjustment to concentration profile used when

sampling BC puffs?

(MDEPBC) Default: 1 ! MDEPBC = 1 !

0 = Concentration is NOT adjusted for depletion

1 = Adjust Concentration for depletion

!END!

---------------------------------- ---

INPUT GROUPS: 13a, 13b, 13c, 13d Point source parameters

Subgroup (13a)

Number of point sources with

parameters provided below (NPT1) No default ! NPT1 = 0 !

Units used for point source

emissions below (IPTU) Default: 1 ! IPTU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with

variable emission parameters

provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point

source emissions are read from

the file: PTEMARB.DAT)

!END!

Subgroup (13b)

----

a

POINT SOURCE: CONSTANT DATA

----

b c

```
 Source    X       Y      Stack   Base   Stack    Exit  Exit    Bldg.  Emission
  No.   Coordinate Coordinate Height Elevation Diameter Vel. Temp.  Dwash   Rates
          (km)     (km)     (m)     (m)     (m)  (m/s) (deg. K)
 ------  ----------  ----------  ------  ------  --------  -----  --------  -----  --------
```

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source

(No default)

X is an array holding the source data listed by the column headings

(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)

(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent

the effect of rain-caps or other physical configurations that

reduce momentum rise associated with the actual exit velocity.

(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated

structure that has a significant open area between the surface

and the bulk of the structure, such as an offshore oil platform.

The Base Elevation is that of the surface (ground or ocean),

and the Stack Height is the release height above the Base (not

above the platform). Building heights entered in Subgroup 13c

must be those of the buildings on the platform, measured from

the platform deck. ZPLTFM is used only with MBDW=1 (ISC

downwash method) for sources with building downwash.

(Default: 0.0)

b

0. = No building downwash modeled

1. = Downwash modeled for buildings resting on the surface

2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)

NOTE: must be entered as a REAL number (i.e., with decimal point)

c

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IPTU

(e.g. 1 for g/s).

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

Source a

No. Effective building height, width, length and X/Y offset (in meters)

every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for

MBDW=2 (PRIME downwash option)

------ --

----

a

Building height, width, length, and X/Y offset from the source are treated

as a separate input subgroup for each source and therefore must end with

an input group terminator. The X/Y offset is the position, relative to the

stack, of the center of the upwind face of the projected building, with the

x-axis pointing along the flow direction.

Subgroup (13d)

----

a

POINT SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 13b. Factors entered multiply the rates in 13b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

------- -

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with

parameters specified below (NAR1)   No default ! NAR1 = 0   !

Units used for area source

emissions below   (IARU)   Default: 1 ! IARU =   1 !

1 =   g/m**2/s

2 =   kg/m**2/hr

3 =   lb/m**2/hr

4 =   tons/m**2/yr

5 =   Odour Unit * m/s (vol. flux/m**2 of odour compound)

6 =   Odour Unit * m/min

7 =   metric tons/m**2/yr

8 =   Bq/m**2/s (Bq = becquerel = disintegrations/s)

9 =   GBq/m**2/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (14d)   (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources

with variable location and emission

parameters (NAR2)   No default ! NAR2 = 0   !

(If NAR2 > 0, ALL parameter data for

these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

----

a

AREA SOURCE: CONSTANT DATA

----

b

```
Source       Effect.   Base      Initial    Emission
 No.         Height   Elevation  Sigma z     Rates
              (m)       (m)       (m)
-------      ------    ------    --------   ---------
```

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IARU

(e.g. 1 for g/m**2/s).

Subgroup (14c)

COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON

Source a

No. Ordered list of X followed by list of Y, grouped by source

------ ------------------------------------ ------------------------

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

Subgroup (14d)

----

a

AREA SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 14b. Factors entered multiply the rates in 14b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters

Subgroup (15a)

Number of buoyant line sources

with variable location and emission

parameters (NLN2) No default ! NLN2 = 0 !

(If NLN2 > 0, ALL parameter data for

these sources are read from the file: LNEMARB.DAT)

Number of buoyant line sources (NLINES) No default ! NLINES = 0 !

Units used for line source

emissions below (ILNU) Default: 1 ! ILNU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (15c) (NSLN1) Default: 0 ! NSLN1 = 0 !

Maximum number of segments used to model each line (MXNSEG) Default: 7 ! MXNSEG = 7 !

The following variables are required only if NLINES > 0. They are

used in the buoyant line source plume rise calculations.

Number of distances at which Default: 6 ! NLRISE = 6 !

transitional rise is computed

Average building length (XL) No default ! XL = .0 !

(in meters)

Average building height (HBL) No default ! HBL = .0 !

(in meters)

Average building width (WBL) No default ! WBL = .0 !

(in meters)

Average line source width (WML) No default ! WML = .0 !

(in meters)

Average separation between buildings (DXL) No default ! DXL =!.0

(in meters)

Average buoyancy parameter (FPRIMEL) No default ! FPRIMEL = .0 !

(in m**4/s**3)

!END!

Subgroup (15b)

BUOYANT LINE SOURCE: CONSTANT DATA

----

a

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Elevation (m)	Emission Rates

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by ILNTU

(e.g. 1 for g/s).

Subgroup (15c)

----

a

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 15b. Factors entered multiply the rates in 15b.

Skip sources here that have constant emissions.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 16a, 16b, 16c Volume source parameters

Subgroup (16a)

Number of volume sources with

parameters provided in 16b,c (NVL1) No default ! NVL1 = 0 !

Units used for volume source

emissions below in 16b (IVLU) Default: 1 ! IVLU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (16c) (NSVL1) Default: 0 ! NSVL1 = 0 !

Number of volume sources with

variable location and emission

parameters (NVL2) No default ! NVL2 = 94 !

(If NVL2 > 0, ALL parameter data for

these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

----

a

VOLUME SOURCE: CONSTANT DATA

----

b

X Y Effect. Base Initial Initial Emission

Coordinate Coordinate Height Elevation Sigma y Sigma z Rates

(km) (km) (m) (m) (m) (m)

---------- ---------- ------ ------ -------- -------- --------

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IVLU

(e.g. 1 for g/s).

Subgroup (16c)

----

a

VOLUME SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 16b. Factors entered multiply the rates in 16b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b Non-gridded (discrete) receptor information

----

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 867 !

!END!

Subgroup (17b)

----

a

NON-GRIDDED (DISCRETE) RECEPTOR DATA

X Y Ground Height b

Receptor Coordinate Coordinate Elevation Above Ground

No. (km) (km) (m) (m)

-------- ---------- ---------- --------- ------------

1! X = 756.58601984809,6270.223912,1010.663153,0! !End!

2! X = 761.34455790653,6266.599675,1125.182862,0! !End!

3! X = 761.24843114217,6266.537618,1131.066125,0! !End!

4! X = 761.2545151146,6266.664165,1122.896048,0! !End!

5! X = 758.54685129635,6269.398252,1039.610083,0! !End!

6! X = 761.94652115632,6266.839138,1123.85551,0! !End!

7! X = 761.478593 73737,6266.7327,1119.164459,0! !End!

8! X = 761.86026663693,6266.057236,1144.159827,0! !End!

9! X = 760.71951243601,6265.932031,1154.576207,0! !End!

10! X = 760.55242260606,6265.803724,1146.996313,0! !End!

11! X = 760.19622532109,6265.8 57373,1152.020355,0! !End!

12! X = 759.6989360996,6266.208561,1125.858047,0! !End!

13! X = 758.65783978418,6267.073753,1102.913426,0! !End!

14! X = 758.71125393998,6267.593348,1079.563118,0! !End!

15! X = 758.12435910291,6267.04186,1051 .364808,0! !End!

16! X = 758.45611217745,6267.277304,1065.610961,0! !End!

17! X = 759.51543858091,6266.45154,1109.871544,0! !End!

18! X = 759.62726044685,6266.440891,1111.32377,0! !End!

19! X = 759.62193559609,6266.558037,1109.747196,0! !End!

20! X = 759.53673798395,6266.632585,1116.34313,0! !End!

21! X = 759.64855984989,6266.707133,1130.609669,0! !End!

22! X = 759.62193559609,6266.808305,1120.87738,0! !End!

23! X = 759.56336223774,6266.898828,1116.11592,0! !End!

24! X = 759.67518410369,6266.973376,1123.083753,0! !End!

25! X = 759.72310776052,6267.074548,1133.749654,0! !End!

26! X = 759.8296047757,6267.090522,1146.362235,0! !End!

27! X =759.91480238785,6267.106497,1145.789992,0! !End!

28! X = 759.90415268633,6267.223644,1145.060746,0! !End!

29! X = 759.9733757462,6267.16507,1153.979124,0! !End!

30! X = 760.06922305987,6267.159746,1151.321343,0! !End!

31! X = 760.015974 55228,6267.266243,1146.499702,0! !End!

32! X = 759.97870059696,6267.314166,1143.508351,0! !End!

33! X = 760.06922305987,6267.441963,1150.271317,0! !End!

34! X = 760.02129940304,6267.505861,1141.82916,0! !End!

35! X = 760.0266242538,6267 .569759,1137.641245,0! !End!

36! X = 760.09584731367,6267.654957,1135.644878,0! !End!

37! X = 760.09052246291,6267.793403,1139.489119,0! !End!

38! X = 760.13312126898,6267.745479,1143.883888,0! !End!

39! X = 760.09052246291,6267.910549, 1140.02294,0! !End!

40! X = 760.18636977657,6267.995747,1135.807005,0! !End!

41! X = 760.14909582126,6267.894575,1141.129581,0! !End!

42! X = 760.2609176872,6268.006397,1127.970389,0! !End!

43! X = 760.32481589631,6268.06497,1112.750371 ,0! !End!

44! X = 760.38338925466,6267.969123,1123.628125,0! !End!

45! X = 760.42066320998,6267.905225,1127.983862,0! !End!

46! X = 760.5218353744,6267.820027,1117.531426,0! !End!

47! X = 760.41533835922,6267.782753,1136.838289,0! !End!

48! X = 760.4313129115,6267.686906,1128.791692,0! !End!

49! X = 760.36208985163,6267.607033,1130.846065,0! !End!

50! X = 760.38871410542,6267.543135,1120.995704,0! !End!

51! X = 760.41533835922,6267.484561,1119.156613,0! !End!

52! X = 760.27156738872,6267.447287,1143.446251,0! !End!

53! X = 760.35676500087,6267.415338,1127.540208,0! !End!

54! X = 760.287541941,6267.34079,1139.678794,0! !End!

55! X =760.24494313492,6267.260918,1150.849946,0! !End!

56! X = 760.29819164252,6267.228969,1145.389819,0! !End!

57! X = 760.25559283644,6267.143771,1142.840436,0! !End!

58! X = 760.30884134404,6267.095847,1144.36376,0! !End!

59! X = 760.22896 858265,6267,1146.843129,0! !End!

60! X = 760.20766917961,6266.936102,1135.774478,0! !End!

61! X = 760.1437709705,6266.893503,1132.178922,0! !End!

62! X = 760.09052246291,6266.829605,1128.931123,0! !End!

63! X = 759.98935029848,6266.8029 81,1135.724622,0! !End!

64! X = 759.89882783557,6266.765707,1145.377423,0! !End!

65! X = 759.82427992495,6266.65921,1132.274125,0! !End!

66! X = 759.73375746204,6266.653885,1132.982321,0! !End!

67! X = 759.72310776052,6266.558037,1114.1 14964,0! !End!

68! X = 759.78168111887,6266.488814,1117.540723,0! !End!

69! X = 759.73375746204,6266.408942,1116.055267,0! !End!

70! X = 759.83492962646,6266.371668,1124.055897,0! !End!

71! X = 759.88817813406,6266.510114,1129.421133,0! !End!

72! X = 759.87220358178,6266.547388,1128.547281,0! !End!

73! X = 759.98402544772,6266.616611,1126.841857,0! !End!

74! X = 759.96805089544,6266.712458,1136.599554,0! !End!

75! X = 760.07454791063,6266.728433,1127.015638,0! !End!

76! X = 760.1703952243,6266.733757,1130.540385,0! !End!

77! X = 760.27689223948,6266.882853,1128.000138,0! !End!

78! X = 760.287541941,6266.962726,1133.985353,0! !End!

79! X = 760.38871410542,6267.026624,1141.084251,0! !End!

80! X =760.4046886577,6267.197019,1135.512168,0! !End!

81! X = 760.35676500087,6267.282217,1142.922074,0! !End!

82! X = 760.44728746378,6267.356765,1136.810191,0! !End!

83! X = 760.51118567289,6267.489886,1117.810155,0! !End!

84! X =760.49521112061,6267.585734,1114.936971,0! !End!

85! X = 760.56975903124,6267.665606,1107.418678,0! !End!

86! X = 760.60170813579,6267.734829,1106.924134,0! !End!

87! X = 760.55378447896,6267.905225,1102.1572,0! !End!

88! X = 760.553784 47896,6267.995747,1097.386588,0! !End!

89! X = 760.45793716529,6268.091594,1097.371952,0! !End!

90! X = 760.46326201605,6268.033021,1104.385496,0! !End!

91! X = 760.56443418048,6268.118219,1096.244374,0! !End!

92! X = 760.33014074707,62 68.187442,1099.699773,0! !End!

93! X = 760.26624253796,6268.128868,1116.750907,0! !End!

94! X = 760.15442067202,6268.128868,1127.117722,0! !End!

95! X = 760.1171467167,6268.033021,1139.641404,0! !End!

96! X = 760.03727395531,6267.990422 ,1138.224363,0! !End!

97! X = 760.4313129115,6268.182117,1090.080129,0! !End!

98! X = 760.36208985163,6268.25134,1091.450319,0! !End!

99! X = 759.9733757462,6267.825352,1134.590888,0! !End!

100! X = 760.0266242538,6267.72418,1129.520171 ,0! !End!

101! X = 759.94675149241,6267.660281,1129.532291,0! !End!

102! X = 759.95207634317,6267.521835,1140.509678,0! !End!

103! X = 759.98402544772,6267.404689,1146.124368,0! !End!

104! X = 759.92012723861,6267.367415,1142.572347,0! !End!

105! X = 760.06922305987,6267.34079,1155.717933,0! !End!

106! X = 759.84557932798,6267.266243,1135.176629,0! !End!

107! X = 759.81363022343,6267.18637,1142.100296,0! !End!

108! X = 759.69115865596,6267.17572,1128.303297,0! !End!

109! X = 759.65388470065,6267.069223,1126.600712,0! !End!

110! X = 759.47283977484,6267.026624,1128.731039,0! !End!

111! X = 759.49413917787,6266.866879,1113.52643,0! !End!

112! X = 759.39296701345,6266.733757,1103.049878,0! !End!

113! X = 759.52608828243,6266.749732,1114.650607,0! !End!

114! X = 759.45686522256,6266.685834,1117.020826,0! !End!

115! X = 759.424916118,6266.520763,1105.785547,0! !End!

116! X = 759.44621552104,6266.382317,1115.5596,0! !End!

117! X = 759.58466164078,6266.376992,1114.531677,0! !End!

118! X = 759.712458059,6266.323744,1121.4174,0! !End!

119! X = 759.97870059696,6266.382317,1138.34659,0! !End!

120! X = 760.0266242538,6266.504789,1124.561273,0! !End!

121! X = 760.1437 709705,6266.600636,1132.251022,0! !End!

122! X = 760.25559283644,6266.63791,1134.815786,0! !End!

123! X = 760.35676500087,6266.792331,1136.293755,0! !End!

124! X = 760.46326201605,6266.914802,1153.093597,0! !End!

125! X = 759.7177829097 6,6266.866879,1133.93309,0! !End!

126! X = 759.84557932798,6266.914802,1150.213298,0! !End!

127! X = 759.87220358178,6267,1138.059379,0! !End!

128! X = 759.78168111887,6266.856229,1147.905837,0! !End!

129! X = 759.98402544772,6266.96805 1,1157.028532,0! !End!

130! X = 760.07454791063,6267.063898,1149.72256,0! !End!

131! X = 760.17572007505,6267.127796,1151.838412,0! !End!

132! X = 760.13312126898,6267.292867,1160.937799,0! !End!

133! X = 760.18636977657,6267.388714,115 3.759518,0! !End!

134! X = 760.20766917961,6267.457937,1157.680357,0! !End!

135! X = 760.1703952243,6267.607033,1150.131775,0! !End!

136! X = 760.22896858265,6267.654957,1154.497754,0! !End!

137! X = 760.2609176872,6267.788078,1160.3526 55,0! !End!

138! X = 760.27689223948,6267.851976,1151.866952,0! !End!

139! X = 760.33546559783,6267.830677,1148.814118,0! !End!

140! X = 760.287541941,6267.708205,1160.294482,0! !End!

141! X = 760.2609176872,6266.776356,1130.60739,0! !End!

142! X = 760.43663776226,6267.090522,1135.86156,0! !End!

143! X = 760.5484596282,6267.149096,1128.708328,0! !End!

144! X = 760.51651052364,6267.330141,1130.242925,0! !End!

145! X =760.55378447896,6267.420663,1120.729737,0! !End!

146! X = 760.63898209111,6267.505861,1109.845585,0! !End!

147! X = 760.65495664338,6267.766779,1103.296778,0! !End!

148! X = 759.98701500469,6267.094141,1143.521235,0! !End!

149! X = 759.88962753986,6266.928583,1156.660505,0! !End!

150! X = 759.80197882151,6267,1139.233296,0! !End!

151! X = 760.63301852142,6267.88298,1103.863118,0! !End!

152! X = 760.63626477024,6268.029061,1089.629537,0! !End!

153! X = 760.27060829853, 6268.274478,1102.621172,0! !End!

154! X = 760.01745859991,6268.152268,1143.32396,0! !End!

155! X = 759.96508280019,6268.056245,1136.311473,0! !End!

156! X = 759.87778980066,6267.759449,1126.254729,0! !End!

157! X = 759.74685030138,6267. 698344,1133.060408,0! !End!

158! X = 759.78176750119,6267.515029,1142.751933,0! !End!

159! X = 759.62464010204,6267.384089,1136.652159,0! !End!

160! X = 759.59845220218,6267.349172,1133.924918,0! !End!

161! X = 759.75557960133,6267.3928 18,1150.646446,0! !End!

162! X = 759.64209870195,6267.549946,1139.931711,0! !End!

163! X = 759.4849713028,6267.200774,1128.594134,0! !End!

164! X = 759.29292670385,6267.139669,1134.863623,0! !End!

165! X = 759.35403180351,6267,1126.7114 33,0! !End!

166! X = 759.22309230422,6266.869061,1102.592319,0! !End!

167! X = 759.26673880399,6266.738121,1107.843273,0! !End!

168! X = 759.17071650451,6266.607182,1090.490673,0! !End!

169! X = 759.31038530375,6266.563535,1093.234243,0 ! !End!

170! X = 759.31038530375,6266.397678,1106.431534,0! !End!

171! X = 759.38894900332,6266.266739,1106.735944,0! !End!

172! X = 759.47624200285,6266.196904,1109.227773,0! !End!

173! X = 759.75557960133,6266.196904,1127.397851,0! !End!

174! X = 759.96508280019,6266.118341,1151.221079,0! !End!

175! X = 760,6266.223092,1141.640763,0! !End!

176! X = 760.183315299,6266.362761,1136.386518,0! !End!

177! X = 760.1658566991,626 6.476242,1129.975089,0! !End!

178! X = 760.14839809919,6266.310385,1135.948434,0! !End!

179! X = 760.32298409824,6266.467513,1136.451377,0! !End!

180! X = 760.34044269815,6266.598452,1134.878307,0! !End!

181! X = 760.46265289748,6266.65 0828,1142.968785,0! !End!

182! X = 760.54121659706,6266.799226,1139.858865,0! !End!

183! X = 760.6808853963,6266.930166,1125.276996,0! !End!

184! X = 760.56740449691,6266.991271,1138.004552,0! !End!

185! X = 760.6808853963,6267.157127,1 117.43208,0! !End!

186! X = 760.61105099668,6267.270608,1120.427135,0! !End!

187! X = 760.75071979592,6267.384089,1110.229578,0! !End!

188! X = 760.75071979592,6267.672156,1096.832469,0! !End!

189! X = 760.8467420954,6267.776908,1094.80 009,0! !End!

190! X = 760.8467420954,6268.11735,1077.799535,0! !End!

191! X = 760.73326119601,6267.925306,1095.815694,0! !End!

192! X = 760.73326119601,6268.178455,1081.512331,0! !End!

193! X = 760.58486309682,6268.440334,1070.318511,0! !End!

194! X = 760.54994589701,6268.300666,1093.513784,0! !End!

195! X = 760.38408919791,6268.510169,1076.19761,0! !End!

196! X = 760.27933759848,6268.353041,1094.301404,0! !End!

197! X = 760.15712739915,6268.3705,1105.850781,0! !End!

198! X = 759.96508280019,6268.431605,1121.61387,0! !End!

199! X = 760.20950319886,6268.527627,1094.204192,0! !End!

200! X = 760.02618789986,6268.300666,1130.106818,0! !End!

201! X = 760.04364649976,6268.518898,1109.191759,0! !End!

202! X = 759.85160190081,6268.274478,1134.270252,0! !End!

203! X = 759.79922610109,6268.064975,1138.548857,0! !End!

204! X = 759.75557960133,6267.916576,1119.281105,0! !End!

205! X = 759.89524840057,6267.916576,1125.791132,0! !End!

206! X = 759.6508280019,6267.759449,1129.808354,0! !End!

207! X = 759.53734710252,6267.584863,1128.06607,0! !End!

208! X = 759.37149040342,6267.480111,1121.110253,0! !End!

209! X = 759.450054 10299,6267.401548,1122.9482,0! !End!

210! X = 759.33657320361,6267.24442,1137.642806,0! !End!

211! X = 759.1532579046,6267.157127,1128.386777,0! !End!

212! X = 759.14452860465,6266.938895,1108.273926,0! !End!

213! X = 759.00485980541,62 66.834143,1094.887121,0! !End!

214! X = 759.08342350498,6266.685745,1085.823829,0! !End!

215! X = 759.00485980541,6266.493701,1080.567685,0! !End!

216! X = 759.16198720456,6266.450054,1094.62946,0! !End!

217! X = 759.21436300427,6266.28 4197,1095.330776,0! !End!

218! X = 759.3191146037,6266.100882,1112.601799,0! !End!

219! X = 759.50242990271,6266.118341,1112.701026,0! !End!

220! X = 759.79049680114,6266.00486,1128.117672,0! !End!

221! X = 759.6508280019,6265.987401,11 30.563504,0! !End!

222! X = 759.99127070005,6265.987401,1146.814792,0! !End!

223! X = 760.14839809919,6265.996131,1146.570793,0! !End!

224! X = 760.15712739915,6266.196904,1142.03185,0! !End!

225! X = 760.29679619839,6266.231822,1146.47 5361,0! !End!

226! X = 760.46265289748,6266.450054,1139.381942,0! !End!

227! X = 760.6983439962,6266.580994,1136.168302,0! !End!

228! X = 760.66342679639,6266.773038,1132.441713,0! !End!

229! X = 760.58486309682,6266.642099,1136.676341,0! !End!

230! X = 760.85547139535,6266.973812,1113.924854,0! !End!

231! X = 760.78563699573,6267.226962,1110.156148,0! !End!

232! X = 760.95149369483,6267.410277,1102.569718,0! !End!

233! X = 760.91657649502,6267.25315,1105.450882,0! !End!

234! X = 760.8642006953,6267.523758,1101.373189,0! !End!

235! X = 761.01259879449,6267.768178,1091.936976,0! !End!

236! X = 760.94276439487,6268.012599,1087.784628,0! !End!

237! X = 760.899117 89511,6267.934035,1088.873003,0! !End!

238! X = 761.06497459421,6267.968952,1085.320115,0! !End!

239! X = 760.92530579497,6268.344312,1073.239233,0! !End!

240! X = 760.75944909587,6268.038787,1091.054468,0! !End!

241! X = 760.7419904959 7,6268.326854,1081.755168,0! !End!

242! X = 760.6983439962,6268.61492,1087.274045,0! !End!

243! X = 760.47138219744,6268.431605,1077.261639,0! !End!

244! X = 760.42773569767,6268.649838,1063.304806,0! !End!

245! X = 759.99127070005,6268 .693484,1075.497044,0! !End!

246! X = 760.27060829853,6268.702213,1074.248112,0! !End!

247! X = 759.84287260085,6268.571274,1100.504245,0! !End!

248! X = 759.79922610109,6268.387959,1121.039486,0! !End!

249! X = 759.6508280019,6268.2570 19,1114.946376,0! !End!

250! X = 759.65955730185,6267.99514,1114.951754,0! !End!

251! X = 759.47624200285,6267.899118,1118.262939,0! !End!

252! X = 759.51115920266,6267.733261,1125.038867,0! !End!

253! X = 759.3016560038,6267.698344,110 3.705993,0! !End!

254! X = 759.26673880399,6267.49757,1123.27424,0! !End!

255! X = 759.19690440437,6267.340443,1131.943502,0! !End!

256! X = 759.05723560513,6267.24442,1125.751456,0! !End!

257! X = 759.00485980541,6266.982541,1114.26996 1,0! !End!

258! X = 758.88264960608,6266.860331,1100.298656,0! !End!

259! X = 758.89137890603,6266.642099,1069.495999,0! !End!

260! X = 758.93502540579,6266.397678,1081.194653,0! !End!

261! X = 759.08342350498,6266.179446,1087.878772,0! !End!

262! X = 759.28419740389,6265.917567,1112.966505,0! !End!

263! X = 759.45005410299,6265.935025,1129.462484,0! !End!

264! X = 759.6508280019,6265.830274,1130.476349,0! !End!

265! X = 759.93016560038,6265.812815,1145.781083,0! !End!

266! X = 760.35790129805,6265.978672,1149.068289,0! !End!

267! X = 760.62850959658,6266.354032,1140.94936,0! !End!

268! X = 760.5150286972,6266.231822,1142.88037,0! !End!

269! X = 760.73326119 601,6266.266739,1145.643527,0! !End!

270! X = 760.80309559563,6266.546076,1134.744527,0! !End!

271! X = 760.87292999525,6266.781768,1122.350267,0! !End!

272! X = 761.07370389416,6267.017459,1105.081507,0! !End!

273! X = 760.98641089464, 6267.113481,1102.751746,0! !End!

274! X = 761.15226759373,6267.436465,1094.429961,0! !End!

275! X = 761.0475159943,6267.584863,1092.879434,0! !End!

276! X = 761.17845549359,6267.785637,1082.052741,0! !End!

277! X = 761.11735039392,6268. 178455,1084.0534,0! !End!

278! X = 761.03878669435,6268.571274,1071.674901,0! !End!

279! X = 760.70444684553,6268.933482,1068.649365,0! !End!

280! X = 760.40468223041,6268.858541,1056.799961,0! !End!

281! X = 760.23981169209,6269.038399 ,1054.854174,0! !End!

282! X = 760.02997646151,6268.873529,1043.348189,0! !End!

283! X = 759.55035307732,6268.723647,1100.292287,0! !End!

284! X = 759.8651059232,6269.053388,1070.820611,0! !End!

285! X = 759.61030600035,6268.543788,1101 .794917,0! !End!

286! X = 759.80515300017,6268.843552,1093.661411,0! !End!

287! X = 759.4904001543,6268.318964,1094.952152,0! !End!

288! X = 759.3555060775,6268.064164,1106.756736,0! !End!

289! X = 759.08571792389,6268.049176,1089.846963,0! !End!

290! X = 759.37049430825,6268.378917,1088.038162,0! !End!

291! X = 759.23560023145,6268.513811,1086.447867,0! !End!

292! X = 759.20562376994,6268.0192,1092.886876,0! !End!

293! X = 759.02576500086,6267.659482,1125.339732,0! !End!

294! X = 758.9808003086,6267.449647,1112.91367,0! !End!

295! X = 758.80094153953,6267.224823,1112.082891,0! !End!

296! X = 758.86089446255,6267.059953,1107.900546,0! !End!

297! X = 758.59110630 894,6266.925059,1103.133954,0! !End!

298! X = 758.62108277045,6266.685247,1068.20313,0! !End!

299! X = 758.66604746272,6266.460424,1069.030257,0! !End!

300! X = 758.69602392423,6266.190636,1073.662194,0! !End!

301! X = 758.92084738557,6 265.965812,1082.190228,0! !End!

302! X = 759.17564730842,6265.681036,1104.3071,0! !End!

303! X = 759.40047076976,6265.785953,1125.609905,0! !End!

304! X = 759.56534130808,6265.636071,1128.750727,0! !End!

305! X = 759.95503530773,6265.57 6118,1146.843149,0! !End!

306! X = 760.17985876907,6265.516165,1145.513197,0! !End!

307! X = 760.43465869192,6265.591106,1136.765862,0! !End!

308! X = 760.89929384536,6265.681036,1139.069558,0! !End!

309! X = 760.8843056146,6266.040753, 1151.148474,0! !End!

310! X = 761.15409376821,6266.2356,1145.118141,0! !End!

311! X = 760.95924676838,6266.430447,1137.031504,0! !End!

312! X = 761.2590113835,6266.820141,1120.326242,0! !End!

313! X = 761.36392899879,6267.149882,1095.20 1111,0! !End!

314! X = 761.13910553745,6267.239812,1098.736502,0! !End!

315! X = 761.46884661408,6267.539576,1087.160311,0! !End!

316! X = 761.27399961425,6267.824353,1081.175534,0! !End!

317! X = 761.40889369106,6268.169082,1082.78382,0! !End!

318! X = 761.28898784501,6268.588752,1077.148176,0! !End!

319! X = 761.42388192181,6268.963458,1077.714288,0! !End!

320! X = 761.06416438367,6268.993435,1077.067473,0! !End!

321! X = 761.06416438367,6268.843552,1066.376093,0! !End!

322! X = 760.73442330704,6269.173293,1076.185675,0! !End!

323! X = 760.49461161495,6269.083364,1072.912316,0! !End!

324! X = 760.23981169209,6269.218258,1065.702472,0! !End!

325! X = 759.68524 715413,6269.293199,1082.507532,0! !End!

326! X = 759.47541192354,6268.918494,1105.175693,0! !End!

327! X = 759.37049430825,6268.678682,1097.342906,0! !End!

328! X = 759.02576500086,6268.69367,1093.469878,0! !End!

329! X = 759.0707296931 3,6268.393905,1075.829474,0! !End!

330! X = 758.80094153953,6268.199058,1068.326577,0! !End!

331! X = 758.95082384709,6267.959247,1095.947135,0! !End!

332! X = 758.65105923197,6267.839341,1073.004896,0! !End!

333! X = 758.63607100121,62 67.329741,1083.093384,0! !End!

334! X = 758.35129461685,6266.775177,1083.660071,0! !End!

335! X = 758.42623577063,6266.475412,1053.03934,0! !End!

336! X = 758.3662828476,6266.115694,1053.705118,0! !End!

337! X = 758.56112984743,6265.905 859,1079.581329,0! !End!

338! X = 758.9808003086,6265.636071,1098.082628,0! !End!

339! X = 759.10070615464,6265.411248,1109.257454,0! !End!

340! X = 759.44543546203,6265.486189,1125.301494,0! !End!

341! X = 759.68524715413,6265.351295,1 139.889657,0! !End!

342! X = 760.1348940768,6265.336306,1145.351861,0! !End!

343! X = 760.67447038402,6265.351295,1106.477373,0! !End!

344! X = 761.10912907594,6265.426236,1087.662127,0! !End!

345! X = 761.31896430652,6265.935836,1123.711993,0! !End!

346! X = 761.5287995371,6266.160659,1132.938616,0! !End!

347! X = 761.33395253728,6266.370494,1134.196866,0! !End!

348! X = 761.58875246013,6267.059953,1097.863647,0! !End!

349! X = 761.69367007542,6267.67447,1084.1335,0! !End!

350! X = 761.64870538315,6268.124117,1083.424884,0! !End!

351! X = 761.70865830618,6268.603741,1088.293444,0! !End!

352! X = 761.3939054603,6268.783599,1081.048942,0! !End!

353! X = 761.543787767 86,6268.498823,1087.011187,0! !End!

354! X = 761.61872892164,6268.918494,1077.644388,0! !End!

355! X = 761.33395253728,6269.413105,1077.696693,0! !End!

356! X = 761.00421146065,6269.308188,1086.668986,0! !End!

357! X = 760.56955276873,6 269.443082,1070.027581,0! !End!

358! X = 759.95503530773,6269.488046,1027.732105,0! !End!

359! X = 760.29976461512,6269.488046,1057.29128,0! !End!

360! X = 759.29555315447,6269.173293,1081.790147,0! !End!

361! X = 758.86089446255,6269.0 23411,1088.6199,0! !End!

362! X = 758.80094153953,6268.558776,1068.452601,0! !End!

363! X = 759.13068261616,6268.933482,1105.240583,0! !End!

364! X = 758.6060945397,6268.468847,1058.281916,0! !End!

365! X = 758.32131815534,6268.274,1053 .7514,0! !End!

366! X = 758.3662828476,6267.869317,1042.093853,0! !End!

367! X = 758.15644761702,6267.7644,1035.819993,0! !End!

368! X = 758.21640054004,6267.41967,1046.637867,0! !End!

369! X = 757.8566830019,6267.209835,1019.124127,0! !End!

370! X = 758.12647115551,6266.715224,1060.274102,0! !End!

371! X = 758.03654177097,6266.430447,1035.197199,0! !End!

372! X = 758.06651823249,6266.055741,1045.806299,0! !End!

373! X = 758.44122400138,6265.681036,1074.520784,0! !End!

374! X = 758.71101215499,6265.56113,1092.453651,0! !End!

375! X = 758.95082384709,6265.381271,1108.465894,0! !End!

376! X = 759.41545900052,6265.156448,1130.914293,0! !End!

377! X = 760.10491761529,6265.096495,1142.680785,0! !End!

378! X = 760.46463515343,6264.991577,1106.319229,0! !End!

379! X = 760.95924676838,6265.201412,1093.337589,0! !End!

380! X = 761.37891722955,6265.126471,1073.175753,0! !End!

381! X = 761.6337171524,6265.576118,1078.902343,0! !End!

382! X = 761.73863476769,6265.800942,1102.055819,0! !End!

383! X = 762.1433169981,6265.860894,1104.208935,0! !End!

384! X = 761.903505306,6266.355506,1127.83352,0! !End!

385! X = 761.768611229 2,6266.505388,1125.82115,0! !End!

386! X = 762.11334053659,6266.58033,1126.999035,0! !End!

387! X = 761.903505306,6267.194847,1102.193718,0! !End!

388! X = 761.37891722955,6266.970024,1109.322842,0! !End!

389! X = 761.72364653693,6267.4 49647,1088.653085,0! !End!

390! X = 762.05338761356,6267.7644,1091.59474,0! !End!

391! X = 762.08336407507,6268.318964,1084.53591,0! !End!

392! X = 761.91849353676,6268.768611,1089.062714,0! !End!

393! X = 761.73863476769,6269.36814,108 5.46161,0! !End!

394! X = 761.85854061373,6269.637929,1088.478174,0! !End!

395! X = 761.40889369106,6269.697882,1086.433568,0! !End!

396! X = 760.91428207611,6269.96767,1087.610226,0! !End!

397! X = 760.95924676838,6269.637929,1124.2500 92,0! !End!

398! X = 760.53957630721,6269.907717,1072.923936,0! !End!

399! X = 759.92505884622,6269.847764,1030.157089,0! !End!

400! X = 759.52037661581,6269.817787,1035.680508,0! !End!

401! X = 759.14567084691,6269.413105,1088.834028,0 ! !End!

402! X = 758.81592977028,6269.518023,1060.494443,0! !End!

403! X = 758.48618869365,6269.083364,1052.758715,0! !End!

404! X = 758.11148292475,6268.978446,1043.722312,0! !End!

405! X = 758.096494694,6268.498823,1052.491782,0! !End!

406! X = 757.97658884795,6268.169082,1070.017554,0! !End!

407! X = 758.3662828476,6268.618729,1068.819863,0! !End!

408! X = 757.84169477115,6268.0192,1058.488098,0! !End!

409! X = 757.45200 077149,6267.899294,1035.634957,0! !End!

410! X = 757.7217889251,6267.599529,1047.120264,0! !End!

411! X = 757.39204784847,6267.284776,1034.765493,0! !End!

412! X = 757.73677715586,6267,1018.554363,0! !End!

413! X = 757.43701254074,6266. 685247,1011.192597,0! !End!

414! X = 757.91663592493,6266.115694,1037.154847,0! !End!

415! X = 757.63185954056,6266.415459,1026.268303,0! !End!

416! X = 757.79673007888,6266.7452,1040.213701,0! !End!

417! X = 757.19720084864,6266.955035 ,999.7910113,0! !End!

418! X = 757.10727146411,6266.385483,1025.196798,0! !End!

419! X = 757.54193015603,6266.2356,1039.684515,0! !End!

420! X = 757.87167123266,6265.740989,1048.895323,0! !End!

421! X = 758.15644761702,6265.336306,1078. 715055,0! !End!

422! X = 758.87588269331,6265.186424,1105.275783,0! !End!

423! X = 759.19063553918,6264.886659,1124.250785,0! !End!

424! X = 759.83512946168,6264.811718,1147.843318,0! !End!

425! X = 760.47962338419,6264.706801,1106.0738 4,0! !End!

426! X = 760.95924676838,6264.571907,1078.917238,0! !End!

427! X = 761.03418792216,6264.901648,1080.432105,0! !End!

428! X = 761.69367007542,6264.79673,1066.97821,0! !End!

429! X = 761.88851707525,6265.336306,1067,0! !End!

430! X = 762.2782110749,6265.501177,1081.657094,0! !End!

431! X = 762.60795215153,6265.965812,1113.569963,0! !End!

432! X = 762.45806984397,6266.445435,1154.996051,0! !End!

433! X = 762.62294038229,6266.820141,1140.95818,0! !End!

434! X = 762.32317576717,6267.449647,1096.843054,0! !End!

435! X = 762.20326992112,6266.985012,1119.566603,0! !End!

436! X = 762.57797569002,6267.299765,1121.29841,0! !End!

437! X = 761.94846999827,6267.404682,1094.080087,0! !End!

438! X = 761.94846999827,6268.079153,1081.822071,0! !End!

439! X = 762.53301099775,6268.0192,1092.936315,0! !End!

440! X = 762.30818753641,6268.633717,1084.940164,0! !End!

441! X = 762.62294038 229,6268.978446,1090.564861,0! !End!

442! X = 762.20326992112,6269.128329,1076.258215,0! !End!

443! X = 762.05338761356,6269.577976,1077.855607,0! !End!

444! X = 762.47305807473,6269.577976,1073.797852,0! !End!

445! X = 761.94846999827, 6268.993435,1091.548417,0! !End!

446! X = 761.85854061373,6270.027623,1101.713563,0! !End!

447! X = 760.94425853762,6270.162517,1073.593787,0! !End!

448! X = 760.40468223041,6270.372352,1059.136169,0! !End!

449! X = 760.23981169209,6270 .147528,1066.81627,0! !End!

450! X = 759.53536484657,6270.432305,1000.307705,0! !End!

451! X = 759.41545900052,6270.162517,1029.394709,0! !End!

452! X = 759.23560023145,6270.027623,1036.184969,0! !End!

453! X = 758.54614161668,6269.9376 93,1019.735973,0! !End!

454! X = 758.35129461685,6269.832776,1018.081425,0! !End!

455! X = 757.90164769417,6269.533011,1018.209192,0! !End!

456! X = 757.8566830019,6269.188282,1044.202085,0! !End!

457! X = 757.5868948483,6268.783599,104 2.816094,0! !End!

458! X = 757.42202430998,6268.753623,1030.016753,0! !End!

459! X = 757.37705961771,6268.453858,1026.429047,0! !End!

460! X = 757.7217889251,6268.408894,1040.805922,0! !End!

461! X = 756.89743623352,6268.079153,1033.4417,0! !End!

462! X = 757.12225969486,6267.539576,1005.7665,0! !End!

463! X = 756.85247154126,6267.449647,990.7012195,0! !End!

464! X = 756.91242446428,6267.164871,996.669835,0! !End!

465! X = 756.91242 446428,6266.445435,1023.316366,0! !End!

466! X = 757.22717731015,6265.860894,1061.855534,0! !End!

467! X = 757.52694192527,6265.456212,1064.659422,0! !End!

468! X = 757.88665946341,6265.336306,1070.492889,0! !End!

469! X = 758.441224001 38,6265.021554,1096.212312,0! !End!

470! X = 758.81592977028,6264.616871,1107.179289,0! !End!

471! X = 759.26557669296,6264.511954,1134.988464,0! !End!

472! X = 759.97002353849,6264.302118,1093.18005,0! !End!

473! X = 760.14988230756,62 64.586895,1106.606857,0! !End!

474! X = 760.71943507628,6264.317107,1080.845813,0! !End!

475! X = 761.21404669123,6264.12226,1082.825241,0! !End!

476! X = 761.40889369106,6264.182213,1088.357924,0! !End!

477! X = 762.12832876734,6264.52 6942,1075.661104,0! !End!

478! X = 762.2782110749,6264.736777,1076.098611,0! !End!

479! X = 762.23324638263,6265.111483,1067,0! !End!

480! X = 762.6529168438,6265.261365,1081.493223,0! !End!

481! X = 762.81778738211,6265.291342,1088.967 243,0! !End!

482! X = 762.87774030514,6265.56113,1089.063478,0! !End!

483! X = 763.31239899706,6266.355506,1130.229578,0! !End!

484! X = 763.23745784328,6267.044965,1148.81621,0! !End!

485! X = 763.0276226127,6266.385483,1124.889535,0! !End!

486! X = 763.1625166895,6265.905859,1099.435345,0! !End!

487! X = 762.75783445909,6267.059953,1127.409547,0! !End!

488! X = 763.13254022799,6267.479623,1118.58406,0! !End!

489! X = 762.86275207438,6268.199058,1092.932218,0! !End!

490! X = 762.71286976682,6268.708658,1098.644784,0! !End!

491! X = 763.31239899706,6268.408894,1107.488851,0! !End!

492! X = 763.0276226127,6269.218258,1087.807594,0! !End!

493! X =762.75783445909,6269.697882,1091.97898,0! !End!

494! X = 762.21825815188,6270.777034,1045.997225,0! !End!

495! X = 761.48383484484,6270.64214,1073.69372,0! !End!

496! X = 762.42809338246,6270.147528,1069.246062,0! !End!

497! X = 762.533 01099775,6270.462281,1073.088789,0! !End!

498! X = 762.03839938281,6270.38734,1083.705686,0! !End!

499! X = 760.96233846438,6270.95628,1056.001509,0! !End!

500! X = 760.23523829129,6270.849354,1055.237059,0! !End!

501! X = 759.593679315 04,6271.148748,1014.011412,0! !End!

502! X = 758.95212033878,6270.699657,1032.167794,0! !End!

503! X = 758.26779076411,6270.678271,994.5333651,0! !End!

504! X = 757.86147007915,6270.22918,1017.625702,0! !End!

505! X = 758.84519384274,62 70.400263,1017.082478,0! !End!

506! X = 758.39610255936,6271.383986,992.6715464,0! !End!

507! X = 757.54069059102,6270.934895,972.5472604,0! !End!

508! X = 756.92051691397,6270.336107,993.8027951,0! !End!

509! X = 757.13436990606,6269.5 87621,1009.850985,0! !End!

510! X = 756.17203144168,6269.288227,1008.327995,0! !End!

511! X = 756.64250802426,6268.988833,1028.683953,0! !End!

512! X = 755.91540785117,6268.347274,975.683528,0! !End!

513! X = 756.21480204009,6267.748485 ,1008.026143,0! !End!

514! X = 755.87263725276,6267.149697,1004.333422,0! !End!

515! X = 756.45004033139,6266.764762,995.796281,0! !End!

516! X = 755.82986665434,6266.144588,1001.338326,0! !End!

517! X = 756.68527862268,6265.781038,1019 .143587,0! !End!

518! X = 755.74432545751,6264.989782,1048.953094,0! !End!

519! X = 756.00094904801,6264.348223,1086.896273,0! !End!

520! X = 756.79220511872,6264.262682,1079.387179,0! !End!

521! X = 756.53558152822,6265.139479,1052.276517,0! !End!

522! X = 757.34822289814,6265.096708,1072.921594,0! !End!

523! X = 757.86147007915,6264.412379,1126.15556,0! !End!

524! X = 756.70666392189,6263.663893,1048.531876,0! !End!

525! X = 756.30034323693,6262.808481,1006.051194,0! !End!

526! X = 755.57324306384,6263.749435,1066.735723,0! !End!

527! X = 755.42354596938,6262.658784,1053.298559,0! !End!

528! X = 756.17203144168,6263.321729,1034.384872,0! !End!

529! X = 757.09159 930764,6262.573243,1015.263792,0! !End!

530! X = 757.81869948073,6263.364499,1062.331646,0! !End!

531! X = 758.37471726015,6262.530472,1052.527161,0! !End!

532! X = 757.92562597677,6262.487702,1042.727856,0! !End!

533! X = 757.219911102 89,6263.343114,1039.864845,0! !End!

534! X = 757.39099349656,6264.262682,1110.671866,0! !End!

535! X = 758.90934974037,6263.621123,1170.908971,0! !End!

536! X = 758.4816437562,6264.284067,1120.900104,0! !End!

537! X = 759.35844102374,62 64.091599,1131.731711,0! !End!

538! X = 759.87168820475,6263.107876,1094.632773,0! !End!

539! X = 760.68432957467,6263.535582,1097.941498,0! !End!

540! X = 759.89307350396,6264.048829,1108.730335,0! !End!

541! X = 759.23012922849,6263.0 00949,1090.289362,0! !End!

542! X = 759.97861470079,6262.573243,1085.244361,0! !End!

543! X = 759.31567042533,6262.444931,1080.966428,0! !End!

544! X = 761.24034735409,6262.380775,1096.796137,0! !End!

545! X = 760.72710017309,6262.89402 3,1103.983689,0! !End!

546! X = 760.23523829129,6263.556967,1097.698345,0! !End!

547! X = 761.53974154301,6263.193417,1083.503131,0! !End!

548! X = 762.30961231452,6264.048829,1070.820144,0! !End!

549! X = 762.86563009394,6262.936793,1095.774064,0! !End!

550! X = 762.2668417161,6262.444931,1075.021493,0! !End!

551! X = 763.95628035357,6262.444931,1129.162316,0! !End!

552! X = 764.66199522746,6262.444931,1106.343315,0! !End!

553! X = 764.23428924329,6263.749435,1129.467135,0! !End!

554! X = 764.72615112508,6264.583461,1066.810866,0! !End!

555! X = 764.55506873141,6265.58857,1089.222846,0! !End!

556! X = 763.99905095199,6265.716882,1081.811306,0! !End!

557! X = 764.020436 2512,6264.690388,1067,0! !End!

558! X = 763.42164787336,6265.032552,1066.808328,0! !End!

559! X = 763.14363898365,6264.155755,1084.023069,0! !End!

560! X = 763.18640958207,6263.257573,1108.27154,0! !End!

561! X = 763.87073915674,6263.00 0949,1165.038432,0! !End!

562! X = 764.5336834322,6263.150646,1078.651304,0! !End!

563! X = 763.12225368444,6262.380775,1133.694775,0! !End!

564! X = 762.43792410977,6263.08649,1084.749073,0! !End!

565! X = 762.03160342481,6263.621123,1 066.999134,0! !End!

566! X = 761.24034735409,6263.663893,1086.823894,0! !End!

567! X = 763.59273026703,6263.899132,1089.232007,0! !End!

568! X = 764.34121573933,6265.22502,1067,0! !End!

569! X = 764.40537163695,6264.198526,1097.095576,0 ! !End!

570! X = 764.44814223537,6266.615065,1104.423108,0! !End!

571! X = 764.04182155041,6266.379826,1108.187075,0! !End!

572! X = 763.57134496782,6266.828918,1120.574809,0! !End!

573! X = 764.21290394408,6267.342165,1104.88085,0! !End!

574! X = 763.87073915674,6268.496971,1107.257212,0! !End!

575! X = 763.69965676307,6268.09065,1113.591299,0! !End!

576! X = 764.17013334566,6267.791256,1107.782711,0! !End!

577! X = 764.66199522746,6268.240347,1101.611647,0! !End!

578! X = 764.74753642429,6267.577403,1099.201883,0! !End!

579! X = 764.34121573933,6268.796365,1100.772413,0! !End!

580! X = 764.38398633774,6269.566236,1095.84357,0! !End!

581! X = 764.66199522746,6270.18641,1096.639068,0! !End!

582! X = 764.512298133,6271.448142,1086.320851,0! !End!

583! X = 763.5285743694,6271.619225,1057.525074,0! !End!

584! X = 762.86563009394,6271.170133,1040.417564,0! !End!

585! X = 763.977665652 78,6271.063207,1072.123855,0! !End!

586! X = 763.37887727494,6270.54996,1080.699675,0! !End!

587! X = 763.44303317257,6270.122254,1083.045018,0! !End!

588! X = 763.59273026703,6269.651777,1094.036873,0! !End!

589! X = 763.80658325911,62 69.181301,1095.626836,0! !End!

590! X = 764.06320684962,6269.929786,1086.963273,0! !End!

591! X = 764.23428924329,6270.485804,1083.348118,0! !End!

592! X = 764.68338052666,6270.785198,1097.511542,0! !End!

593! X = 764.70476582587,6269.4 16539,1098.177047,0! !End!

594! X = 764.23428924329,6269.13853,1101.274283,0! !End!

595! X = 763.63550086545,6270.91351,1068.85712,0! !End!

596! X = 763.22918018049,6271.105977,1053.742626,0! !End!

597! X = 762.71593299948,6271.64061,10 31.252644,0! !End!

598! X = 761.92467692877,6271.298445,1044.258476,0! !End!

599! X = 761.11203555884,6271.704766,1017.296947,0! !End!

600! X = 764.10597744803,6271.64061,1071.058449,0! !End!

601! X = 761.47558564539,6271.298445,1044.75 0383,0! !End!

602! X = 762.0102181256,6271.64061,1037.488729,0! !End!

603! X = 762.48069470819,6271.31983,1038.743746,0! !End!

604! X = 760.17108239367,6271.597839,1094.496217,0! !End!

605! X = 760.66294427546,6271.298445,1045.072946,0! !End!

606! X = 760.96233846438,6271.426757,1028.968704,0! !End!

607! X = 759.12320273245,6271.704766,978.2789147,0! !End!

608! X = 758.82380854353,6271.148748,1013.349575,0! !End!

609! X = 757.81869948073,6271.619225,958.8844339,0! !End!

610! X = 756.66389332347,6271.490913,1011.678127,0! !End!

611! X = 755.38077537096,6271.619225,1032.073849,0! !End!

612! X = 755.93679315038,6271.341216,1068.044005,0! !End!

613! X = 755.38077537096,6271.084592,1073.994196,0! !End!

614! X = 756.00094904801,6270.699657,1056.001097,0! !End!

615! X = 756.57835212664,6270.849354,996.2563148,0! !End!

616! X = 757.17714050448,6271.683381,962.5666243,0! !End!

617! X = 755.4449 3126859,6270.250565,1076.142941,0! !End!

618! X = 756.25757263851,6269.822859,1042.04324,0! !End!

619! X = 755.63739896146,6269.416539,1028.49319,0! !End!

620! X = 755.76571075671,6268.839136,972.1792476,0! !End!

621! X = 755.4235459693 8,6268.561127,952.2724678,0! !End!

622! X = 756.42865503218,6268.261733,1017.584668,0! !End!

623! X = 755.55185776463,6267.834027,978.1350113,0! !End!

624! X = 756.4714256306,6267.342165,984.107074,0! !End!

625! X = 755.44493126859,6266 .828918,981.7022359,0! !End!

626! X = 756.19341674089,6266.401212,994.8344378,0! !End!

627! X = 755.4663165678,6265.738267,993.1190027,0! !End!

628! X = 756.17203144168,6265.58857,1040.445606,0! !End!

629! X = 755.44493126859,6264.92562 6,1028.130336,0! !End!

630! X = 756.30034323693,6264.797314,1061.582631,0! !End!

631! X = 755.59462836305,6264.155755,1080.446804,0! !End!

632! X = 756.02233434722,6263.706664,1079.666812,0! !End!

633! X = 755.487701867,6263.150646,1081 .627881,0! !End!

634! X = 755.89402255197,6262.616014,1001.036949,0! !End!

635! X = 757.19852580369,6263.065105,1022.511005,0! !End!

636! X = 758.5030290554,6262.765711,1046.905039,0! !End!

637! X = 758.35333196094,6263.599737,1103.516673,0! !End!

638! X = 758.11809366965,6263.941902,1145.020049,0! !End!

639! X = 757.92562597677,6264.840085,1094.973717,0! !End!

640! X = 756.77081981951,6264.711773,1055.678349,0! !End!

641! X = 757.11298460685,6265.5458,1050.226389,0! !End!

642! X = 761.7535945351,6262.487702,1080.881253,0! !End!

643! X = 760.66294427546,6262.402161,1103.902393,0! !End!

644! X = 762.09575932243,6262.958178,1070.884448,0! !End!

645! X = 763.7210420 6228,6263.214802,1160.63276,0! !End!

646! X = 763.93489505437,6265.032552,1067,0! !End!

647! X = 763.54995966861,6265.716882,1094.53489,0! !End!

648! X = 764.10597744803,6267.021385,1110.813747,0! !End!

649! X = 764.5336834322,6266.2515 15,1125.358871,0! !End!

650! X = 761.58251214143,6265.139479,1066.998207,0! !End!

651! X = 761.79636513351,6264.219911,1066.97913,0! !End!

652! X = 761.36865914934,6263.578352,1088.081113,0! !End!

653! X = 760.57740307863,6263.899132,10 88.553644,0! !End!

654! X = 758.93073503957,6263.941902,1160.993565,0! !End!

655! X = 757.62623178786,6264.49792,1103.511456,0! !End!

656! X = 756.96328751239,6265.075323,1043.044706,0! !End!

657! X = 756.64250802426,6265.845194,1015.16 1357,0! !End!

658! X = 756.59973742585,6266.615065,1007.819292,0! !End!

659! X = 756.64250802426,6268.133421,1053.132909,0! !End!

660! X = 757.07021400843,6268.796365,1014.32299,0! !End!

661! X = 757.04882870923,6269.266842,1008.525069, 0! !End!

662! X = 757.11298460685,6270.421648,985.5174917,0! !End!

663! X = 759.08043213403,6270.892124,1022.590719,0! !End!

664! X = 758.2464054649,6271.063207,983.7087455,0! !End!

665! X = 757.92562597677,6270.827969,997.5484861,0! !End!

666! X = 758.75965264591,6270.314721,1008.951232,0! !End!

667! X = 758.11809366965,6270.207795,1020.063684,0! !End!

668! X = 757.56207589023,6269.887015,987.1619146,0! !End!

669! X = 757.41237879577,6269.245456,1004.973775,0! !End!

670! X = 755.89402255197,6267.427706,1000.770187,0! !End!

671! X = 755.44493126859,6267.427706,998.1663293,0! !End!

672! X = 759.74874673526,6265.228664,1146.971962,0! !End!

673! X = 760,6265 .165851,1144.113111,0! !End!

674! X = 758.19097649387,6268.18089,1051.321958,0! !End!

675! X = 758.47991774832,6268.846711,1059.238648,0! !End!

676! X = 759.00754960428,6268.93465,1104.509887,0! !End!

677! X = 758.91961096162,6269.23615 4,1086.829442,0! !End!

678! X = 758.39197910566,6269.525095,1022.13531,0! !End!

679! X = 758.15328850416,6269.386906,1022.010621,0! !End!

680! X = 758.39197910566,6269.148215,1046.908356,0! !End!

681! X = 757.96484855561,6267.741197,104 6.795249,0! !End!

682! X = 758.00253654532,6267.389443,1026.309995,0! !End!

683! X = 757.67590730115,6267.138189,1014.310722,0! !End!

684! X = 757.61309398497,6266.912061,1013.734057,0! !End!

685! X = 757.7261579541,6266.535181,1028.547 938,0! !End!

686! X = 758.24122714682,6266.120614,1049.099539,0! !End!

687! X = 759.77387206173,6265.718608,1138.982523,0! !End!

688! X = 759.37186683815,6265.957299,1120.670153,0! !End!

689! X = 759.19598955283,6265.932174,1106.072427, 0! !End!

690! X = 759.23367754254,6265.706046,1106.460236,0! !End!

691! X = 759.45980548081,6265.567856,1122.970766,0! !End!

692! X = 759.52261879699,6265.49248,1131.932065,0! !End!

693! X = 759.74874673526,6265.580419,1143.325484,0! !End!

694! X = 760.06281331619,6265.668358,1150.049125,0! !End!

695! X = 760.25125326474,6265.542731,1146.137623,0! !End!

696! X = 760.46481853977,6265.354291,1117.741815,0! !End!

697! X = 760.76632245746,6265.592982,1127.610426,0! !End!

698! X = 760.99245039572,6265.831672,1128.599153,0! !End!

699! X = 760.52763185595,6266.120614,1147.169327,0! !End!

700! X = 760.89194908983,6266.19599,1145.080606,0! !End!

701! X = 761.05526 371191,6266.321616,1141.252926,0! !End!

702! X = 761.14320235457,6266.836685,1112.97023,0! !End!

703! X = 761.2562663237,6267.113064,1102.229948,0! !End!

704! X = 761.40701828254,6267.502507,1088.978605,0! !End!

705! X = 761.38189295607 ,6267.854261,1079.138579,0! !End!

706! X = 761.26882898694,6268.293954,1093.826524,0! !End!

707! X = 761.55777024139,6268.407018,1080.838053,0! !End!

708! X = 761.9346501385,6268.381893,1088.521432,0! !End!

709! X = 762.60047129006,6268 .331642,1087.622128,0! !End!

710! X = 762.97735118717,6268.608021,1093.679682,0! !End!

711! X = 763.07785249307,6269.085402,1097.434135,0! !End!

712! X = 763.50498304312,6268.984901,1099.424844,0! !End!

713! X = 763.81904962405,6268.947 213,1092.35177,0! !End!

714! X = 763.21604178867,6269.625597,1091.720457,0! !End!

715! X = 763.07785249307,6270.077852,1092.165194,0! !End!

716! X = 762.91453787098,6270.555234,1064.243569,0! !End!

717! X = 764.02005223584,6270.504983,1 077.20128,0! !End!

718! X = 763.7687989711,6269.776349,1091.806699,0! !End!

719! X = 764.07030288879,6269.449719,1090.317528,0! !End!

720! X = 763.88186294023,6267.577883,1111.749325,0! !End!

721! X = 763.90698826671,6267.263816,1113.37 9028,0! !End!

722! X = 764.15824153145,6266.095488,1120.434892,0! !End!

723! X = 763.56779635931,6265.115601,1073.154799,0! !End!

724! X = 762.78891123861,6264.713595,1067,0! !End!

725! X = 762.65072194301,6264.663345,1067,0! !End!

726! X = 762.72609792243,6263.796521,1080.92404,0! !End!

727! X = 762.67584726948,6263.281452,1099.363535,0! !End!

728! X = 761.39445561931,6263.143262,1089.234454,0! !End!

729! X = 760.74119713 098,6262.979948,1105.367614,0! !End!

730! X = 760.35175457064,6263.168388,1096.006051,0! !End!

731! X = 759.29649085873,6263.74627,1146.410912,0! !End!

732! X = 758.90704829838,6264.160838,1140.775328,0! !End!

733! X = 758.10303785121,6 264.814097,1098.951578,0! !End!

734! X = 757.47490468936,6264.952286,1082.06623,0! !End!

735! X = 757.12315011873,6264.675907,1066.026219,0! !End!

736! X = 756.68345690543,6264.185963,1074.684952,0! !End!

737! X = 756.49501695688,6265.3 41728,1037.507988,0! !End!

738! X = 755.91713444797,6265.731171,1006.195654,0! !End!

739! X = 755.94225977445,6265.06535,1049.532171,0! !End!

740! X = 756.35682766127,6263.959835,1056.897579,0! !End!

741! X = 756.85933419075,6263.080449 ,1011.897505,0! !End!

742! X = 756.52014228335,6262.464879,1023.204405,0! !End!

743! X = 757.90203523942,6263.005073,1037.030847,0! !End!

744! X = 758.56785639098,6263.306577,1110.354721,0! !End!

745! X = 760.15075195884,6263.909585,109 8.253531,0! !End!

746! X = 761.23114099723,6262.904572,1101.04923,0! !End!

747! X = 762.28640470913,6262.791508,1066.986642,0! !End!

748! X = 762.91453787098,6262.364377,1112.673159,0! !End!

749! X = 763.36679374752,6262.766382,1132.650 179,0! !End!

750! X = 764.43462012266,6262.703569,1088.537191,0! !End!

751! X = 763.98236424613,6263.457329,1157.704489,0! !End!

752! X = 763.36679374752,6263.758833,1106.151487,0! !End!

753! X = 762.71353525919,6264.223651,1084.102253,0! !End!

754! X = 762.07283943411,6264.537718,1079.277059,0! !End!

755! X = 761.21857833399,6265.706046,1093.993466,0! !End!

756! X = 762.42459400474,6266.786435,1135.438178,0! !End!

757! X = 762.26127938266,6266.309054,1141.524196,0! !End!

758! X = 761.98490079145,6266.585432,1121.71812,0! !End!

759! X = 761.84671149584,6267.050251,1115.243761,0! !End!

760! X = 762.18590340324,6266.886936,1123.159284,0! !End!

761! X = 761.57033 290463,6266.43468,1125.097919,0! !End!

762! X = 756.96539318843,6270.048215,989.7539831,0! !End!

763! X = 756.74766355173,6269.408634,1024.555167,0! !End!

764! X = 756.32581238062,6270.061823,1034.004428,0! !End!

765! X = 755.6590153682 1,6269.816877,1074.048245,0! !End!

766! X = 756.48910960814,6270.551715,1008.051919,0! !End!

767! X = 756.80209596091,6270.646971,986.4555745,0! !End!

768! X = 756.78848785861,6269.857701,996.8165985,0! !End!

769! X = 756.65240683567,62 69.599148,1015.349926,0! !End!

770! X = 757.42806866643,6269.844093,990.3752309,0! !End!

771! X = 757.59136589396,6270.483674,998.3207453,0! !End!

772! X = 758.04043326966,6271.449849,973.4416751,0! !End!

773! X = 758.72083838436,6271.7 49228,988.9875548,0! !End!

774! X = 759.68754576781,6271.561832,1042.935644,0! !End!

775! X = 760.06249084644,6271.061905,1056.669696,0! !End!

776! X = 760.59366304116,6270.843187,1051.715293,0! !End!

777! X = 760.6561538876,6271.686813 ,1044.942379,0! !End!

778! X = 761.09358981266,6270.577601,1055.623194,0! !End!

779! X = 761.51540302612,6270.811942,1050.499753,0! !End!

780! X = 762.03095250923,6270.952546,1077.278458,0! !End!

781! X = 762.67148368521,6270.936923,1061.602215,0! !End!

782! X = 762.32778402981,6269.874579,1064.850097,0! !End!

783! X = 762.9839379174,6270.34326,1071.311138,0! !End!

784! X = 756.59424886914,6267.765513,1018.116773,0! !End!

785! X = 755.79749057706,6267.999854,966.3864528,0! !End!

786! X = 755.46941363326,6269.062198,995.4200149,0! !End!

787! X = 757.60972512376,6262.406923,1021.31852,0! !End!

788! X = 762.57774741556,6262.21945,1093.081716,0! !End!

789! X = 755.95371769 315,6262.360055,1005.039487,0! !End!

790! X = 757.14104377547,6262.235073,1026.865098,0! !End!

791! X = 755.34443194039,6264.437875,1047.423686,0! !End!

792! X = 755.25069567073,6266.375092,992.9329275,0! !End!

793! X = 755.29756380556, 6268.046722,973.6953466,0! !End!

794! X = 755.23507295912,6269.780843,1079.367462,0! !End!

795! X = 755.29756380556,6270.640092,1051.713409,0! !End!

796! X = 755.92247226994,6271.061905,1083.481653,0! !End!

797! X = 756.21930379051,6271 .718059,1009.470186,0! !End!

798! X = 756.40677632983,6271.108773,1038.665226,0! !End!

799! X = 757.48474343088,6271.311868,962.8252914,0! !End!

800! X = 758.03153833721,6270.999414,996.5394059,0! !End!

801! X = 759.12512814987,6271.327 491,989.2921207,0! !End!

802! X = 759.73441390264,6270.796319,997.6568159,0! !End!

803! X = 762.34340674142,6271.077528,1048.766956,0! !End!

804! X = 763.79631892109,6271.249378,1067.115793,0! !End!

805! X = 764.49934094352,6270.983791, 1093.11848,0! !End!

806! X = 764.7961724641,6270.390128,1100.531526,0! !End!

807! X = 764.81179517571,6269.733975,1098.073612,0! !End!

808! X = 764.7961724641,6268.874725,1099.065685,0! !End!

809! X =764.53058636674,6267.906117,1103.920993,0! !End!

810! X = 764.70243619444,6266.812527,1104.097184,0! !End!

811! X = 764.65556805961,6266.25011,1121.825525,0! !End!

812! X = 764.53058636674,6265.125275,1067,0! !End!

813! X = 764.04628230 685,6263.953571,1098.529737,0! !End!

814! X = 763.45261926569,6264.266025,1070.505468,0! !End!

815! X = 762.51525656912,6265.000293,1067,0! !End!

816! X = 761.34355319841,6264.640971,1066.758177,0! !End!

817! X = 760.84362642691,6263.79 7344,1092.409576,0! !End!

818! X = 761.04672167783,6263.391154,1095.945854,0! !End!

819! X = 761.8278572583,6263.109945,1083.007952,0! !End!

820! X = 761.76536641187,6263.82859,1072.661392,0! !End!

821! X = 761.9840843744,6262.313187,10 82.479739,0! !End!

822! X = 761.67163014221,6262.781868,1087.75861,0! !End!

823! X = 760.92173998496,6263.094322,1099.222057,0! !End!

824! X = 758.47037286505,6265.322344,1077.812762,0! !End!

825! X = 761.24590597282,6264.939938,1078.53 6766,0! !End!

826! X = 763.91041775628,6265.310009,1067.084457,0! !End!

827! X = 763.81173213467,6266.062487,1099.780798,0! !End!

828! X = 763.52801097255,6266.56825,1128.590935,0! !End!

829! X = 762.86188302668,6267.468757,1115.69818,0 ! !End!

830! X = 763.0592542699,6268.048535,1097.480921,0! !End!

831! X = 763.25662551312,6268.171892,1103.765639,0! !End!

832! X = 763.12093278341,6269.516483,1086.969697,0! !End!

833! X = 762.63984037806,6269.257434,1084.063292,0! !End!

834! X = 758.39635864884,6270.24429,1005.945665,0! !End!

835! X = 758.61840129746,6270.811732,1008.189863,0! !End!

836! X = 759.91365008109,6270.194947,1054.482282,0! !End!

837! X = 760.07401421621,6270.602025,1027.120056,0! !End!

838! X = 760.6809751602,6266.141043,1146.741527,0! !End!

839! X = 760.58811491108,6265.537451,1126.640387,0! !End!

840! X = 760.92086413709,6265.413637,1102.143051,0! !End!

841! X =761.16849146807,6266.032706,1129.015373,0! !End!

842! X = 761.49350233998,6266.288071,1129.187323,0! !End!

843! X = 761.56314752682,6266.605344,1113.49994,0! !End!

844! X = 761.82625156599,6266.690466,1115.429285,0! !End!

845! X = 762.17447750018,6266.791064,1124.076658,0! !End!

846! X = 761.55540917273,6266.914878,1106.419129,0! !End!

847! X = 761.69469954641,6267.201197,1095.06884,0! !End!

848! X = 761.46254892361,6267.332749,1089.861411,0! !End!

849! X = 762.097093 95925,6267.255366,1100.414537,0! !End!

850! X = 761.97328029376,6267.054168,1116.510539,0! !End!

851! X = 762.34472129023,6267.108337,1110.50099,0! !End!

852! X = 762.27507610339,6266.674989,1130.543219,0! !End!

853! X = 762.25186104112 ,6266.489269,1131.841235,0! !End!

854! X = 758.70769486644,6266.783326,1075.793129,0! !End!

855! X = 758.34399222406,6266.938093,1072.740282,0! !End!

856! X = 758.04993476852,6266.852971,1041.920164,0! !End!

857! X = 757.87969097847,626 6.938093,1030.662881,0! !End!

858! X = 757.87969097847,6267.379179,1025.291596,0! !End!

859! X = 758.03445806033,6267.294057,1027.504308,0! !End!

860! X = 758.19696349629,6267.588115,1037.012757,0! !End!

861! X = 757.41538973288,6267.43 3348,1037.640968,0! !End!

862! X = 757.65527870977,6267.325011,1028.836653,0! !End!

863! X = 757.33800619195,6267.023215,1007.72946,0! !End!

864! X = 758.72928692847,6269.093552,1076.582318,0! !End!

865! X = 758.54180467201,6269.67683,1 025.187378,0! !End!

866! X = 759.02092599406,6269.874728,1029.464183,0! !End!

867! X = 759.35422778332,6269.635167,1048.546587,0! !End!

----

a

Data for each receptor are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

Receptor height above ground is optional. If no value is entered,

the receptor is placed on the ground.

APPENDIX 10

Noise Impact Assessment

Noise Impact Assessment

Middle Creek Quarries - Modification
Oberon, NSW

Prepared for: Oberon Earthmoving Pty Ltd
July 2022
MAC190984-01RP1

Muller Acoustic Consulting

Document Information

Noise Impact Assessment

Middle Creek Quarries - Modification

Oberon, NSW

Prepared for: Umwelt (Australia) Pty Limited

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

Document ID	Date	Prepared By	Signed	Reviewed By	Signed
MAC190984-01RP1	4 July 2022	Louis Abell		Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving Pty Ltd (Oberon Earthmoving) to complete a Noise Impact Assessment (NIA) for a modification of the existing operations at Middle Creek Quarries (the 'Quarry') located at Oberon, NSW.

The NIA has been undertaken to quantify potential acoustic impacts to the surrounding community and has been prepared to accompany the Environmental Assessment (EA) for the development consent modification of DA-10.2016.38.1 that is being prepared by Umwelt for submission to Oberon Shire Council (OSC).

This NIA has also considered and applied the following policy, guidelines and standards where relevant:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment and Climate Change (DECCW), NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), March 2011;
- Noise Monitoring Assessment, Middle Creek Quarries, Muller Acoustic Consulting Pty Ltd, 2022, (MAC, 2022);
- Noise and Vibration Impact Assessment, Proposed Middle Creek Quarries Extension, Muller Acoustic Consulting Pty Ltd, 2016, (MAC, 2016);
- Acoustic Management Plan (AMP 4432/R06), Middle Creek Quarries, Umwelt (Australia) Pty Limited, 2019;
- Development Application (DA) # DA-10.2016.38.1;and
- NSW Environment Protection Authority (EPA), Environmental Protection Licence (EPL) #21098.

This report has not included an assessment of blasting, as there are no proposed changes to existing blast locations as a result of the modification.

A glossary of terms, definitions and abbreviations used in this report, along with a list of common noise sources and their typical sound level is provided in **Appendix A**.

1.1 Background

Middle Creek Quarry is located approximately 4km to the west of Oberon, NSW and is operated by Oberon Earthmoving. The Quarry is classed as a Designated Development and operates under development consent DA-10.2016.38.1, permitting the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and Excavated Natural Material (ENM).

The existing development consent for the Quarry allows for a total extraction of no greater than 5,000,000 tonnes of material over the life of the quarry, from an area of approximately 15ha. The layout of the approved Quarry site is shown in **Figure 1**. Key features of the approved Quarry operations are as follows:

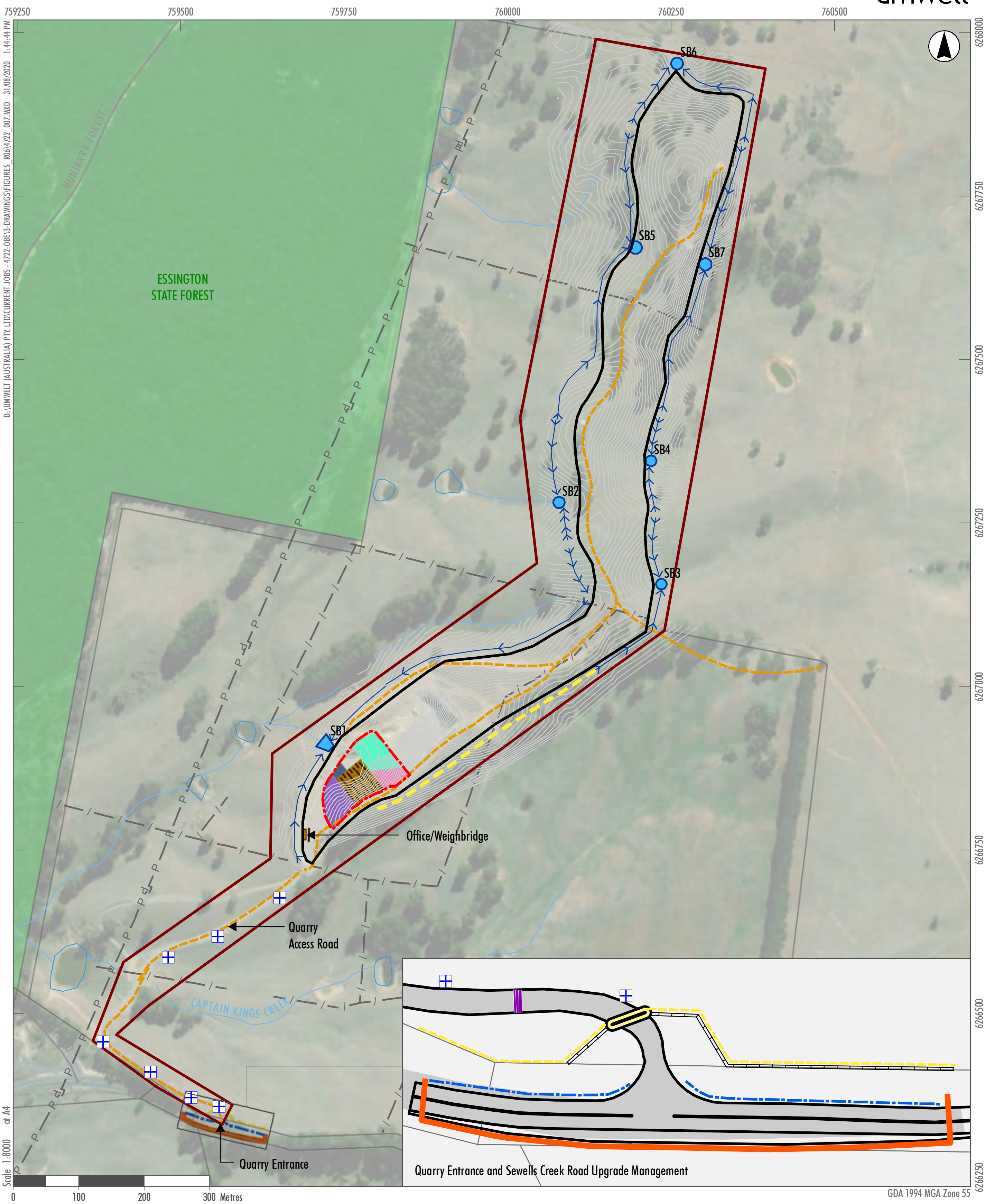
- Extraction of up to 150,000 tonnes per annum (tpa);
- Combined production of all products of up to 250,000 tpa;
- On-site crushing, screening and stockpiling of extracted material to produce a range of aggregate and crushed rock products;
- Importation of mulch and clean fill material for application to land, composting or other processing to produce composts and other specialty products; and
- Rehabilitation of a final landform that will be geotechnically stable and will be suitable for a final land use of intermittent grazing, consistent with the current land use.

1.2 Project Description

The modification to DA-10.2016.38.1 proposes the following amendments:

- Construction and operation of an out of pit processing and stockpile area;
- Importation of waste concrete for crushing and sale;
- Addition of washing circuit;
- Combined production rate of up to 315,000 tpa (increase of 65,000 tpa); and
- Increase in road truck movements.

No change is proposed for the hours of operation, the workforce number or extraction area for the Quarry. The layout of proposed modifications to the Quarry site is shown in **Figure 2**.



Legend

- Quarry Site Boundary
- Extraction Area
- Initial Processing Resource Recovery and Processing Area
- Office
- Weighbridge
- Collection Sump (900mm @ 1 x 10^{-9} m/s)
- Compost and Mulch Product Storage
- Windrow Composting
- Mulch Storage
- VENM, ENM and Treated Drilling Mud Storage
- Existing Roads
- Mire Drain
- Diversion Drains
- Sediment Fence
- Sediment Basin
- Fence
- Power Line and Staunchion
- Contours (1m)
- Watercourse / drainage line
- Dam

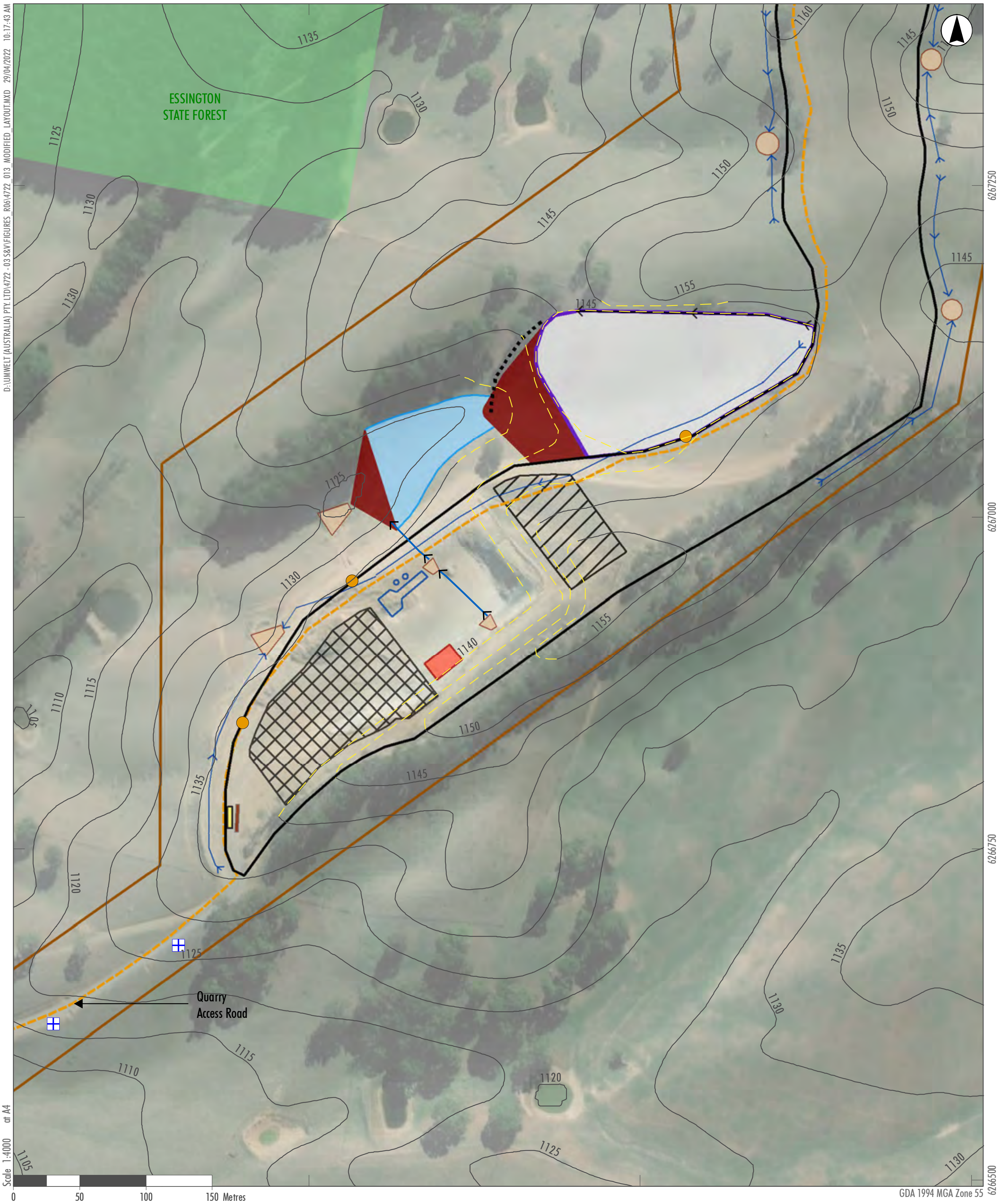
Inset Legend

- Construction zone
- Sediment Fence
- Table Drain
- New Fence
- Stabilised Acces
- Shaker Grid

FIGURE 2.1

Approved Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)



Legend

- Project Site Boundary Extent
- Extraction Area
- Batter Slope
- Composting Area
- Crushing Unit
- Office
- Pollution Control Dam
- Sediment Basin
- VENM, ENM and Treated Drilling Mud Storage
- Wash Plant
- Weighbridge
- Quarry Sales Product Stockpiles
- Access Roads
- Mire Drain
- Spillway
- Dirty (sediment) Water Drain
- Contaminated Water Drain
- Gravity Pipe
- Access Points
- Contours
- Modified Contours

FIGURE 3.1

Modified Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

2 Noise Policy and Guidelines

2.1 Current Operational Noise Criteria

Table 1 reproduces the hours of operation for the quarry as per Condition L6.3 of EPL (21098).

Table 1 Hours of Operations

Days	Hours
Monday to Friday	7.00am to 6.00pm
Saturday	8.00am to 2.00pm
Sunday	No Works Permitted

Table 2 reproduces the noise criteria for the quarry as per Condition L4.1 of EPL (21098) and Condition 4.1 of the AMP (4432/R06). It is noted that the quarry operates during the daytime period only, however, evening and night periods have been presented in accordance with the AMP (4432/R06).

Table 2 Project Specific Noise Criteria[1]

Receiver	Day	Evening[2]	Night[2]
All Residential	39	35	35

Note 1: Noise limits presented do not apply at any sensitive receivers where the licensee has written agreement with the sensitive receiver to exceed the noise limits.

Note 2: Currently no operations during the evening or night time are permitted.

It is noted that Condition L4.3 of EPL 21098 states that the noise criteria in Table 2 of schedule 3 are to apply under all meteorological conditions except the following applicable meteorological conditions:

The noise limits set out in conditions L4.1 apply under all meteorological conditions except for any one of the following:

(a) Wind speeds greater than 3 meters/second at 10 meters above ground level; or

(b) Stability category F temperature inversion conditions and wind speeds greater than 2 meters/second at 10 meters above ground level; or

(c) Stability category G temperature inversion conditions.

2.1.1 Differences Between INP and NPI Noise Assessment Criteria

The existing Project Approval and Consent Conditions are based on the historic assessment (MAC, 2016) completed in accordance with the NSW Industrial Noise Policy 2000 (INP). The INP methodology to determine the noise assessment criteria has since been superseded by the NSW Noise Policy for Industry (NPI). The EPA released the NPI in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The most significant difference in noise assessment criteria from the implementation of the NPI is the change in the minimum applicable daytime Rating Background Level (RBL). The minimum applicable daytime RBL in the INP was established at 30dB $L_{A90(daytime)}$ and is now instituted as 35dB $L_{A90(daytime)}$ in the NPI. It is noted that the minimum applicable daytime RBLs for evening and night periods has remained at 30dB L_{A90} in the NPI.

2.1.2 Proposed Contemporary Criteria

The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.

In consideration of the preceding discussion of the contemporary noise criteria in accordance with the NPI, the assessment has adopted the minimum assumed Rating Background Noise Levels (RBLs) outlined in Section 2.3 of the Noise Policy for Industry (NPI, 2017) to establish Project Noise Trigger Levels (PNTLs) (RBL+5) with project intrusiveness levels adopted as the most stringent criteria for the assessment of Middle Creek Quarry Operations. This criteria is reproduced in **Table 3**.

Table 3 Project Noise Trigger Levels[1]

Receiver	Day	Evening[2]	Night[2]
All Residential	40	35	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Currently no operations during the evening or night time are permitted.

2.2 Construction Noise Management Levels

Construction activities within the proposed quarry include upgrade of the site entrance intersection and construction of an out of pit stockpiling area. Noise associated with construction activities for extractive industries are often assessed as operational noise, as the emissions from plant and associated construction equipment are similar. Therefore, this assessment has adopted a construction noise management level (NML) of 40dB $L_{Aeq(15min)}$.

2.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (2011).

The 'Freeway/arterial/sub-arterial road' categories as specified in the RNP are adopted for Sewells Creek Road and Abercrombie Road for this assessment. **Table 4** presents the road traffic noise assessment criteria reproduced from the RNP relevant for this road type.

Table 4 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/development	Assessment Criteria - dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial road	Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments	60dBA $L_{Aeq(15hr)}$	55dBA $L_{Aeq(9hr)}$

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level. In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered.

Receivers experiencing increases in total traffic noise levels above those presented in **Table 5** due to the addition of quarry vehicles on the roads surrounding the project should be considered for mitigation.

Table 5 Increase Criteria for Residential Land Uses

Road Category	Type of Project/Development	Total Traffic Noise Level Increase - dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq(15hr)}$ +12dB (external)	Existing traffic $L_{Aeq(9hr)}$ + 12dB (external)

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3 Receiver Review

The Quarry is located in a rural area on the northern side of Sewells Creek Road, approximately 3.5km west of Oberon, NSW. Receivers in the locality surrounding the quarry are primarily rural/residential. **Figure 3** provides a locality plan identifying the position of receivers in relation to the quarry. The receiver addresses, MGA(56) coordinates and approximate distance to the project are summarised in **Table 6**.

Table 6 Receiver Locations

Receivers	Description	Coordinates (GDA94/MGA56)		Distance to Extraction Area (m)
		Easting, m	Northing, m	
R2	278 Abercrombie Road	204083	6265044	1130
R4	280 Abercrombie Road	205386	6265776	1760
R6	278 Abercrombie Road	205238	6265622	1330
R9	349 Abercrombie Road	205116	6265592	1260
R11	353 Abercrombie Road	204673	6264945	1240
R12	153 Sewells Creek Road	204517	6264803	1020
R13	79 Sewells Creek Road	203640	6265164	610
R16	1006 Mayfield Road	202593	6265951	1040
R17	979 Mayfield Road	202603	6266454	1240
R18	310 Sewells Creek Road	202129	6265925	1520
R19	1002 Mayfield Road	202378	6266133	1300

FIGURE 3

Locality Plan

MAC190984-01

Middle Creek Quarry

KEY

Receiver

Quarry Site Boundary

0 100 200 300 400 500 m

N

MAC

Muller Acoustic Consulting

4 Noise Assessment Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2022.1) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics – Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

4.1 Construction Noise Modelling Parameters

The modification would involve the construction of an out of pit stockpiling area (composting area, and VENM,ENM/treated drilling mud storage area), water diversion, and the establishment of ancillary infrastructure and upgrades to the Quarry Access Road.

MAC understands that construction activities associated with the stockpile areas, water diversion and the installation of the wash plant and associated fines settling ponds would be undertaken within the existing disturbance area and would occur concurrently with operational activities during periods of reduced production. Earth moving equipment to be used for the construction activities would generally be consistent with earth moving equipment used on site.

The construction noise assessment has therefore considered Quarry Access Road upgrade works only, which involves the upgrade of the intersection of Quarry Access Road with Sewells Creek Road (nearest to receivers R13 and R12).

4.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the Quarry, as derived from the current quarry layout and the surrounding land base topography, superimposed on each other. Plant and equipment were modelled at various locations and heights, representative of proposed operating conditions for the proposed modification. The two following scenarios were adopted for this assessment:

> **Scenario 1:** This modelling scenario was adopted to represent noise emissions during operation at the quarry within Cell 1, this is the closest cell to surrounding receivers and is a worst case scenario with drill, dozer and haul truck operating at surface of existing topography.
>
> **Scenario 2:** Was completed to represent noise emissions during operation at the quarry within Cell 2 was also assessed as receivers to the west (R16 - R19) may experience source to receiver winds under prevailing meteorology (east and northeast winds).

4.3 Road Traffic Noise Modelling Parameters

Predicted noise levels from project related traffic at the nearest receiver (15m from Majors Creek Road) has been calculated using the United States Department of Transport, Federal Highway Administration Traffic Noise Model (TNM) Low Volume Calculation Tool.

The majority of truck movements from the project would be to and from the east, via Sewells Creek Road and Abercrombie Road, towards Oberon and beyond. It is indicated that current operations facilitate a maximum of 100 truck movements per day. For the proposed modification, it has been indicated that a maximum of 180 proposed daily truck movements associated with product dispatch from the quarry will occur per day. The road noise calculations assume that all trucks travel along Sewells Creek Road to and from the east. The calculations have adopted a worst case scenario assuming a minimum receiver setback of 15m from the road.

4.4 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source. As the strength of the wind increases, the noise produced by the wind will mask the audibility of most industrial sources.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for potential enhancements, the NPI specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions.

To determine the prevailing conditions for the Quarry, weather data during the period November 2018 to November 2020 was obtained from the Bureau of Meteorology's (BOM) Mount Boyce (ID:063292) Automatic Weather Station. The data was analysed using the EPA's Noise Enhancement Wind Analysis (NEWA) program in order to determine the frequency of occurrence of winds of speeds up to 3m/s in each season. Table 7 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season. The results of the detailed analysis of meteorological data are presented in Appendix B.

Table 7 Seasonal Frequency of Occurrence Wind Speed Intervals			
Season	Period	Wind Direction ±(45°)	% Wind Speeds (m/s) 0.5 to 3 m/s
Summer	Day	NE (45°)	42
Autumn	Day	E (90°)	36
Winter	Day	ENE, E (67.5°, 90°)	20
Spring	Day	NE, ENE (45°,67.5°)	26

Based on the results of this analysis, prevailing winds are applicable for the assessment. The relevant meteorological conditions adopted are summarised in **Table 8**.

Table 8 Modelled Site Specific Meteorological Parameters				
Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Calm - Day	20°C	n/a	60%	n/a
Prevailing wind day – Summer	20°C	3m/s @ 45°	60%	n/a
Prevailing wind day - Autumn	20°C	3m/s @ 90°	60%	n/a

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

4.5 Sound Power Levels

Mobile plant noise emissions used in modelling for this assessment were obtained via direct measurement of onsite plant or the MAC database of sources. The noise emission levels used in modelling are summarised in **Table 9**.

Table 9 Single Octave Equipment Sound Power Levels, dB LAeq(15min) *(re10^{-12}W)*

Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dBA
	63	125	250	500	1000	2000	4000	8000	
Operational Equipment									
Bulldozer (Komatsu D155) (x1)	84	93	97	105	101	100	98	88	108
Excavator (30t) (x1)	76	90	90	97	96	94	90	83	102
Loader (x1)	76	94	93	99	100	97	92	89	105
Haul Truck (40t) (x1)	92	96	102	102	103	100	93	84	108
Road Trucks (x1)	88	94	89	88	92	96	91	84	101
Wash Plant (x1)	82	90	93	102	101	100	96	89	107
Crusher & Screening Plant (x1)	99	98	99	111	108	106	100	92	114
Drill Rig (x1)	81	103	104	106	109	108	100	92	114
Construction Equipment									
Bulldozer (Komatsu D155) (x1)	84	93	97	105	101	100	98	88	108
Excavator (30t) (x1)	76	90	90	97	96	94	90	83	102
Road Trucks (x1)	88	94	89	88	92	96	91	84	101
Loader (x1)	76	94	93	99	100	97	92	89	105

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Truck movements per 15 minute period from pit.

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5 Noise Modelling Results and Discussion

5.1 Operational Noise Results

The predicted noise levels at each assessed receiver for the meteorologic conditions (refer **Table 8**) for proposed operations for Scenario 1 and Scenario 2 are provided in **Table 10**. **Appendix C** presents the noise contours for these scenarios. Results of modelling identify the proposed operations will satisfy relevant criteria at all assessed receivers under calm and prevailing meteorological conditions.

Table 10 Predicted Operational Noise Levels (by receiver), dB $L_{Aeq(15min)}$

Receiver	Calm - Day		Predictions for Worst Case Meteorology[2]		Day Criteria
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	
R2	29	34	29	34	40
R4	27	33	27	33	40
R6	29	33	29	33	45
R9	30	32	30	35	40
R11	30	32	31	34	40
R12	33	33	35	35	40
R13	37	35	39	36	40
R16	36	32	38	34	40
R17	33	28	35	30	40
R18	28	25	30	26	40
R19	30	26	32	28	40

Note 1: Day period is 7am to 6pm, evening is 6pm to 10pm, night period is 10pm to 7am.

Note 2: Based on the highest predicted noise levels during either prevailing winds or inversion meteorological conditions.

5.2 Construction Noise Results

Noise associated with construction activities for extractive industries are often assessed as operational noise, as the emissions from plant and associated equipment are similar.

This assessment has quantified potential noise emissions from the proposed construction of the access/haul road and potential intersection upgrade which, if completed will be conducted during daytime hours (ie. standard hours).

Table 11 provides a summary of the project construction NML for worst case prevailing meteorological conditions.

Table 11 Predicted Noise Levels from Construction, dB $LA_{eq(15min)}$

Receiver	Worst Case Construction Predictions[1]	NML
R2	<30	40
R4	<30	40
R6	<30	40
R9	<30	40
R11	<30	40
R12	32	40
R13	50	40
R16	30	40
R17	<30	40
R18	<30	40
R19	<30	40

Note1: Includes assessment of noise emissions during prevailing meteorological conditions.

The results of the analysis demonstrate that noise levels associated with construction activities are anticipated to exceed the relevant NMLs during Quarry Access Road upgrades at the closest receiver (R13). It is therefore recommended that during Quarry Access Road upgrade construction activities, noise management strategies as per the ICNG should be implemented to minimise noise emissions from the works to the surrounding area. Where standard noise management strategies are implemented, it is conservatively considered that a up to a 10dB reduction of received noise levels could be achieved. Noise management strategies outlined in the ICNG are detailed in **Section 5.2.1**.

5.2.1 Construction Noise Management Recommendations

During construction activities, the following mitigation strategies (see **Table 12**) may be employed to manage noise.

Table 12 Construction Noise Mitigation Measures

Mitigation Level	Mitigation Measures
Standard Mitigation	▪ Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers; ▪ Training (of employees to conduct quieter work practices); ▪ Equipment which is used intermittently is to be shut down when not in use; ▪ Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers; ▪ Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers; ▪ The quietest suitable machinery reasonably available will be selected for each work activity; ▪ Avoid queuing of vehicles adjacent to any receivers; ▪ Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers; ▪ Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm; ▪ Minimising the need for reversing or movement alarms.
Level 1 Mitigation (Including Standard Mitigation Level)	▪ Scheduling of construction activities to minimise the number of work fronts and simultaneous activities occurring along the northern boundary to minimise noise; ▪ Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise noise impacts; ▪ Where vehicle queuing is required, for example due to safety reasons, engines are to be switched off to reduce their overall noise impacts on receivers; ▪ Notification of OOH works;
Level 2 Mitigation (Including Mitigation Level 1)	▪ optimise the positioning of plant and equipment to minimise line of site to receivers or substitute noisy equipment to reduce the noise level at nearby receivers for these activities; ▪ Respite periods;

Employing these strategies could potentially result in the following noise level reductions:

- Standard Mitigation – up to 10dBA in instances where space requirements place limitations on the attenuation options available;
- Level 1 Mitigation – potentially up to 20dBA depending on mixture of measures and noise sources in operation, location and proximity to receivers; and
- Level 2 Mitigation - potentially over 20dBA where the use of enclosures, silencers, etc) can be combined with noise barriers and management techniques (eg avoidance of clustering). Level 2 mitigation is not expected to be feasible to due the duration and scale of the constructions works.

Given that the predicted noise levels are expected to exceed the established NMLs during worst case conditions at the closest receiver, standard mitigation measures should be considered to manage exceedances for this phase of the project.

5.3 Road Traffic Noise Results

The results of the traffic noise calculations are presented in **Table 13** and demonstrate the noise levels from quarry road trucks would remain below the relevant criteria for receivers at a distance of 15m from the roadway.

Table 13 Operational Road Traffic Noise Levels, Day dB $LA_{eq(15hr)}$

Distance to Nearest Receiver(m)	Assessment Criteria	Current (100 movements)	Proposed (180 movements)	Relative Increase
15	60	47.5	50.1	2.6

Results indicate that the relative increase in road traffic noise contributions from proposed quarry operations will be below 12dBA and therefore mitigation of road traffic noise is not considered for the modification.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Noise Impact Assessment (NIA) of potential impacts associated with the proposed modification of the existing operations at Middle Creek Quarries located at Oberon, NSW. The assessment has quantified potential construction and operational noise emissions pertaining to extraction, processing and dispatch of Quarry products via road trucks.

The results of the assessment demonstrate that noise levels associated with construction activities are anticipated to exceed the NMLs at receiver R13 during Quarry Access Road upgrades works. It is therefore recommended that standard noise management strategies as per the ICNG are implemented. Where the standard noise management strategies are implemented, it is anticipated that a up to 10dB reduction in noise emissions could be achieved, and construction noise levels would remain below the relevant NMLs at all receiver locations.

The results of the NIA demonstrate that operational noise levels (including minor construction activities) comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

Additionally, the NIA demonstrates that the road noise criteria as specified in the RNP will be satisfied at the nearest potentially affected receivers for worst case operational road traffic.

Based on the NIA results, there are no noise related issues which would prevent the approval of the extension of the Quarry. The results of the assessment show compliance with the relevant operational and road noise criteria.

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Appendix A – Glossary of Terms

Table A1 provides a number of technical terms have been used in this report.

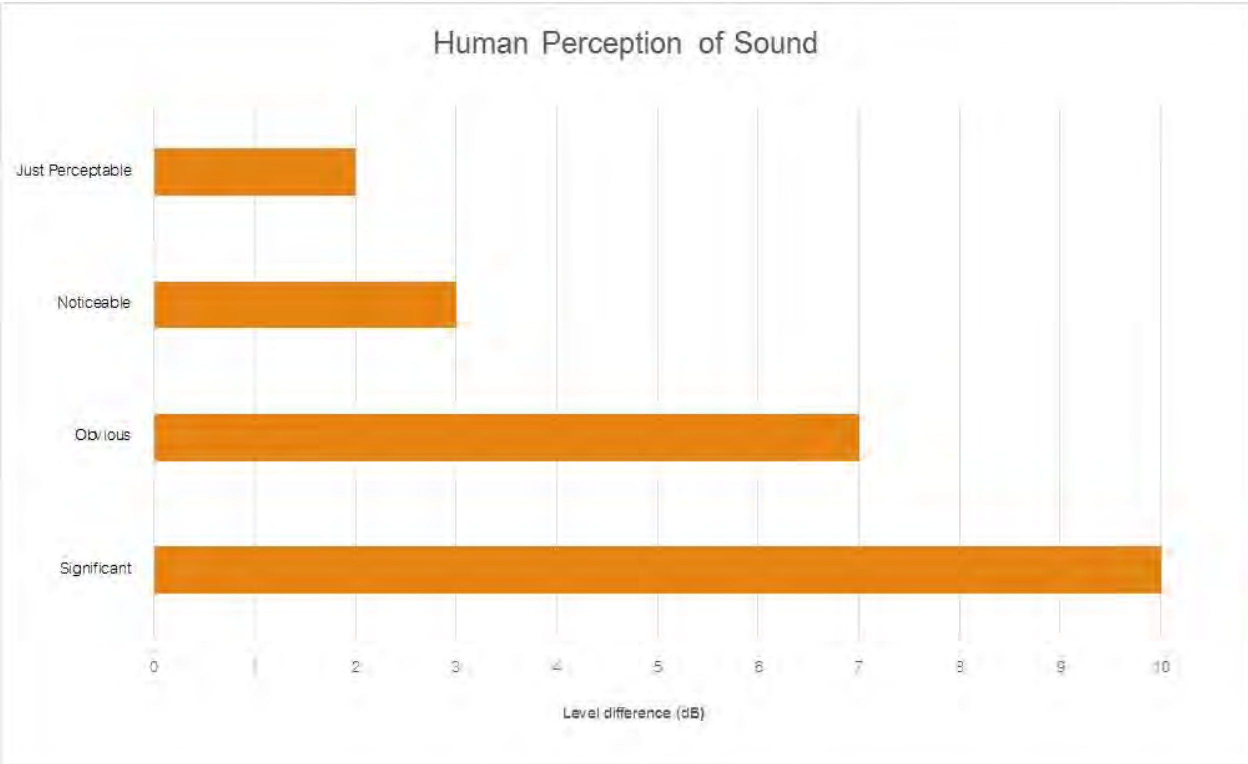
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by: = 10.log10 (W/Wo) Where: W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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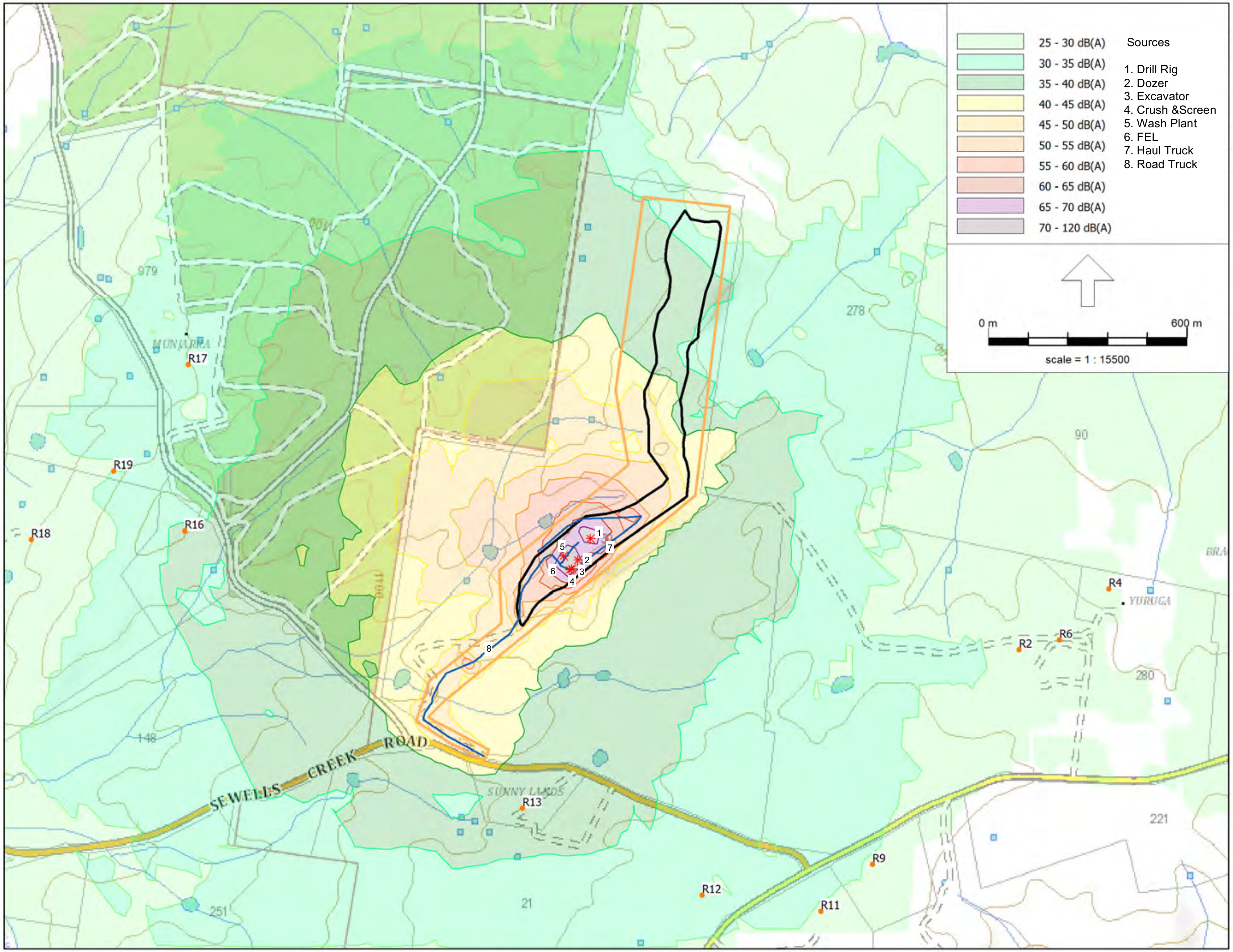
Appendix B – Assessment of Noise Enhancing Conditions

Table B1 NEWA Analysed Daytime Meteorological Conditions, Mount Boyce AWS NSW 2018-2022					
Direction ± 45°	Season	Day Percentage Occurrence %	Direction	Season	Day Percentage Occurrence %
0	Summer	5	180	Summer	2
0	Autumn	6	180	Autumn	3
0	Winter	4	180	Winter	5
0	Spring	4	180	Spring	4
22.5	Summer	19	202.5	Summer	3
22.5	Autumn	17	202.5	Autumn	4
22.5	Winter	10	202.5	Winter	5
22.5	Spring	13	202.5	Spring	5
45	Summer	42	225	Summer	9
45	Autumn	34	225	Autumn	10
45	Winter	18	225	Winter	12
45	Spring	26	225	Spring	10
67.5	Summer	39	247.5	Summer	10
67.5	Autumn	36	247.5	Autumn	13
67.5	Winter	20	247.5	Winter	14
67.5	Spring	25	247.5	Spring	11
90	Summer	41	270	Summer	10
90	Autumn	36	270	Autumn	13
90	Winter	20	270	Winter	13
90	Spring	24	270	Spring	11
112.5	Summer	32	292.5	Summer	11
112.5	Autumn	24	292.5	Autumn	14
112.5	Winter	16	292.5	Winter	14
112.5	Spring	18	292.5	Spring	11
135	Summer	6	315	Summer	8
135	Autumn	7	315	Autumn	10
135	Winter	7	315	Winter	10
135	Spring	5	315	Spring	6
157.5	Summer	3	337.5	Summer	4
157.5	Autumn	3	337.5	Autumn	5
157.5	Winter	4	337.5	Winter	4
157.5	Spring	2	337.5	Spring	3

Appendix C – Noise Contours

Proposed Operations Scenario 1

Calm, LAeq(15-min), dBA



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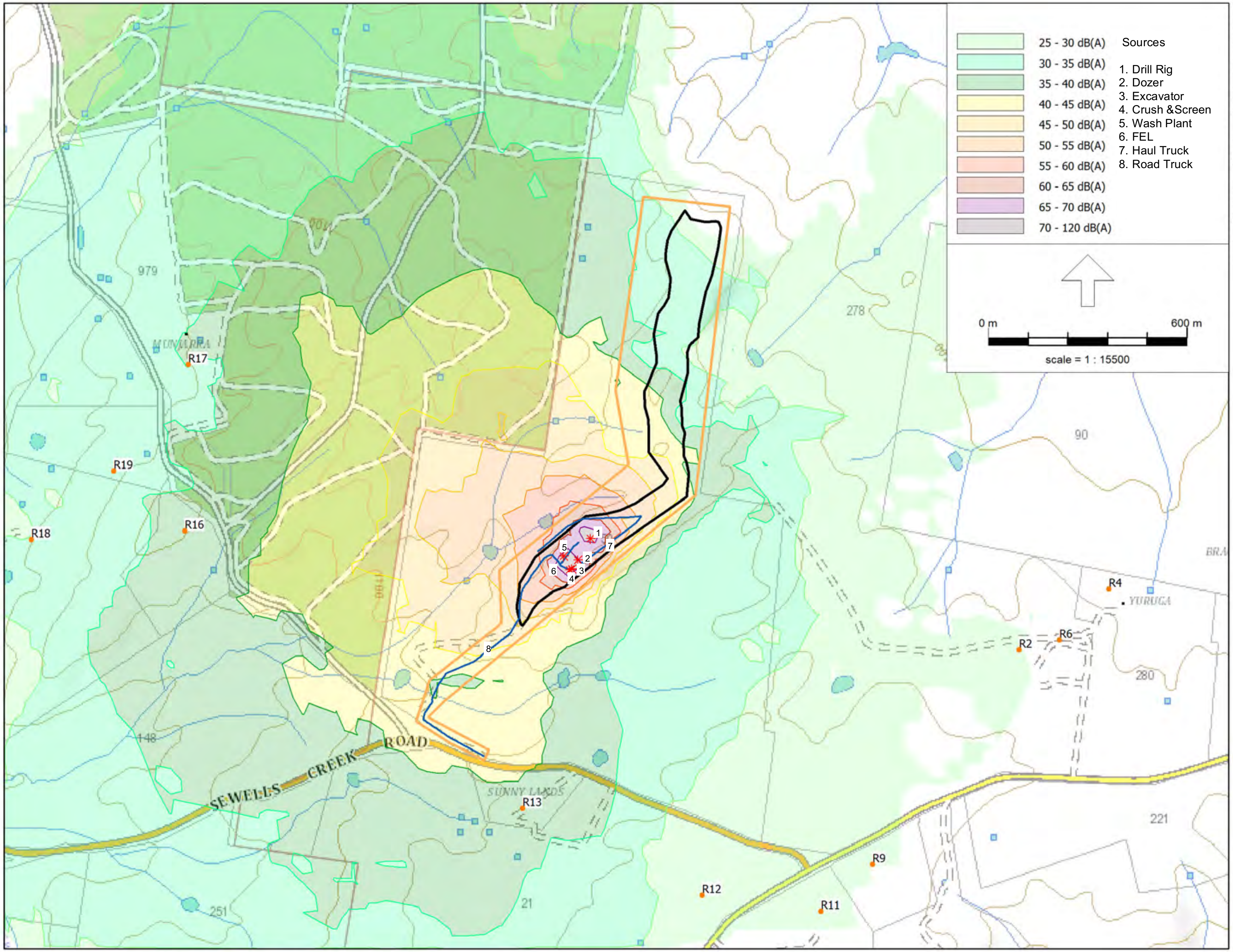
Proposed Operations Scenario 1
E winds@3m/s, LAeq(15-min), dBA



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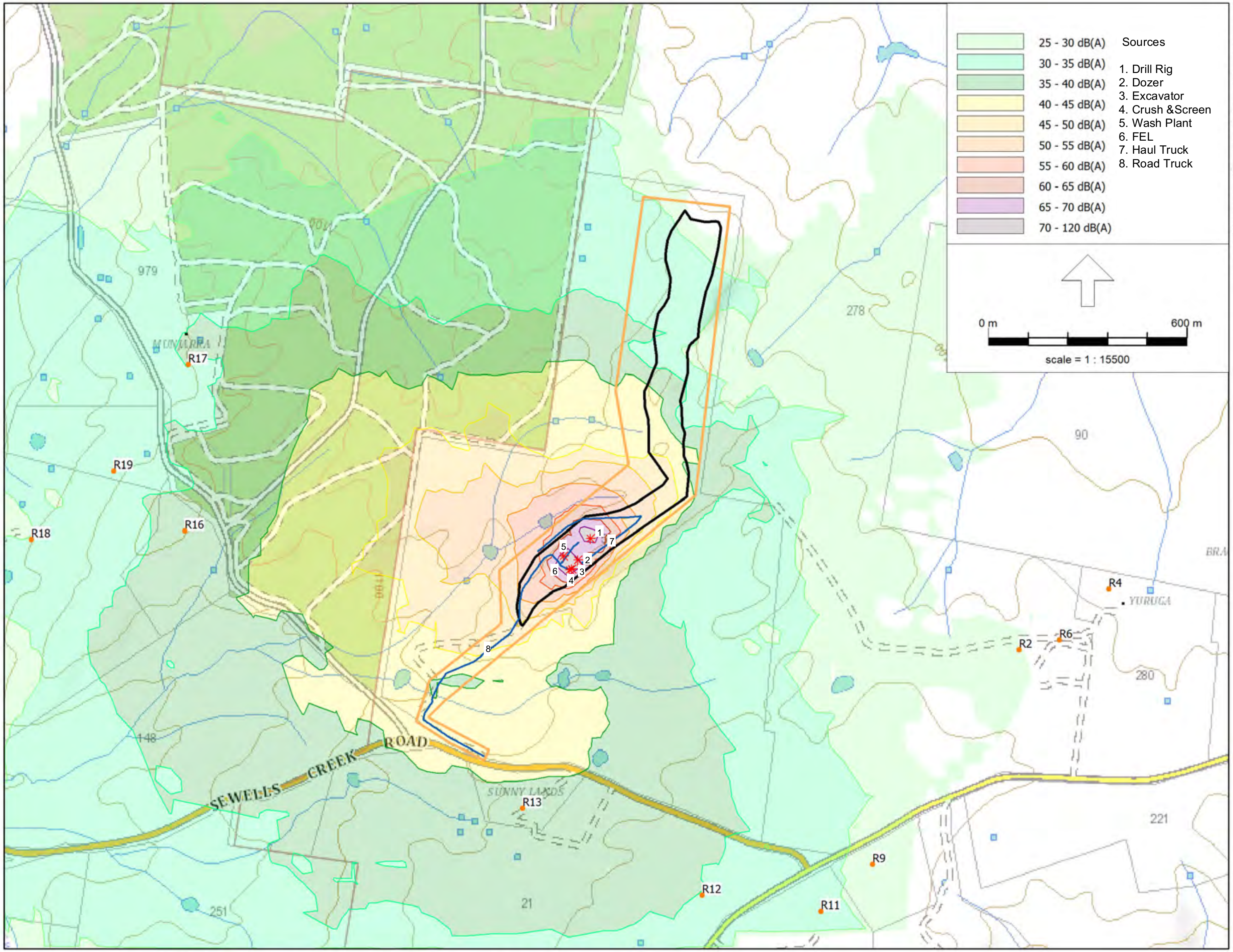
Proposed Operations Scenario 1

NE winds@3m/s, LAeq(15-min), dBA



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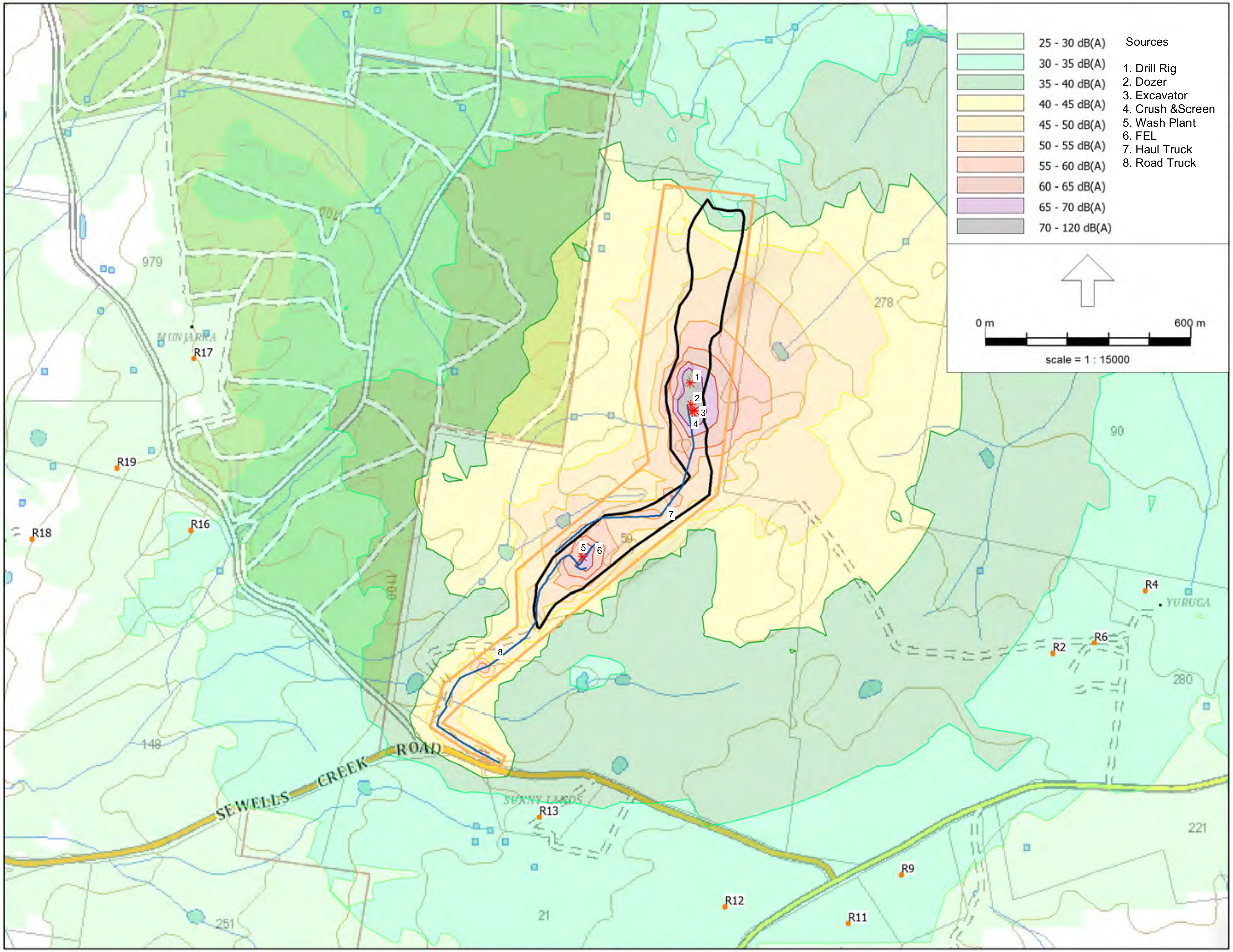
Operations Scenario 2
Calm, LAeq(15-min),dBA



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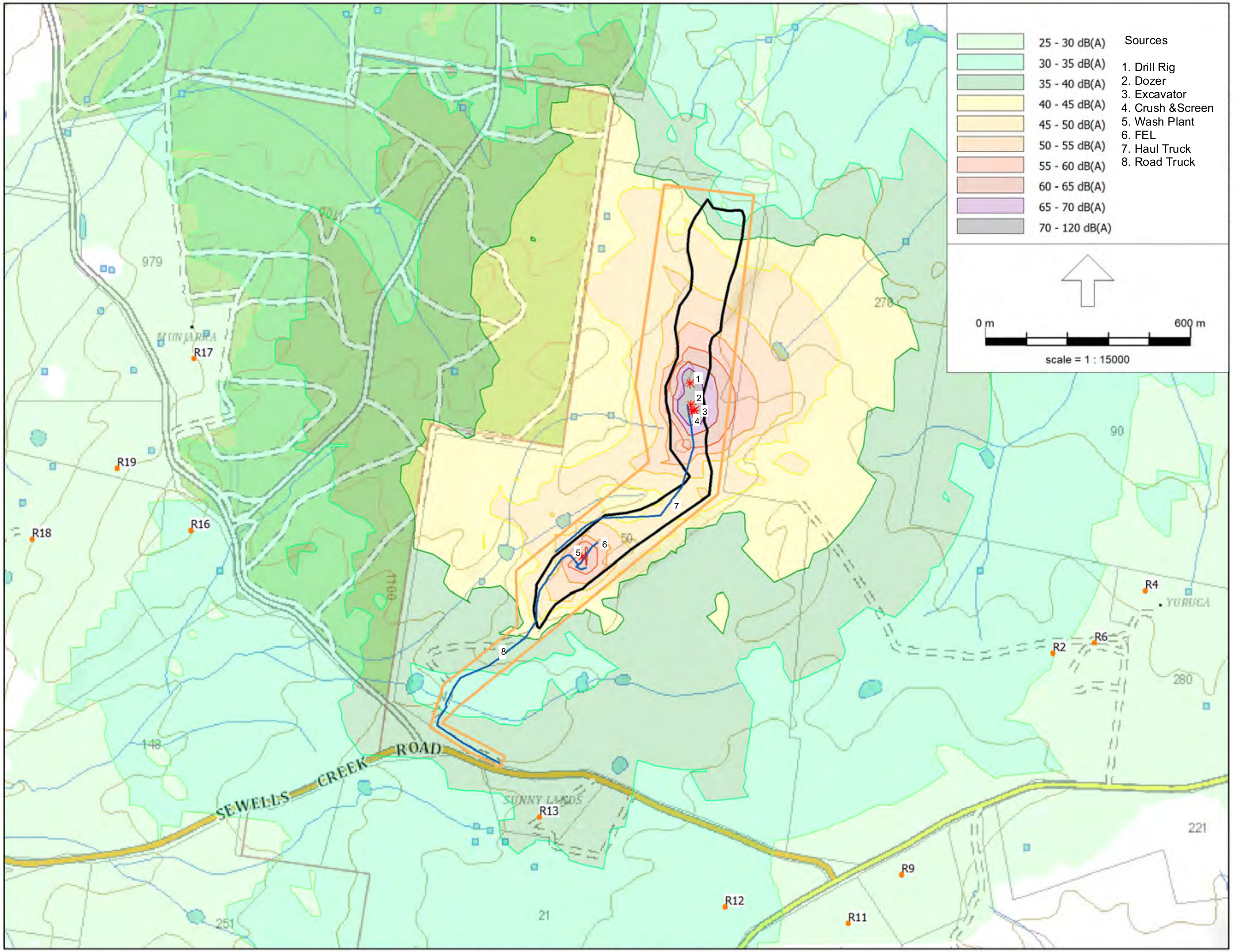
Operations Scenario 2

E winds@3m/s, LAeq(15-min),dBA



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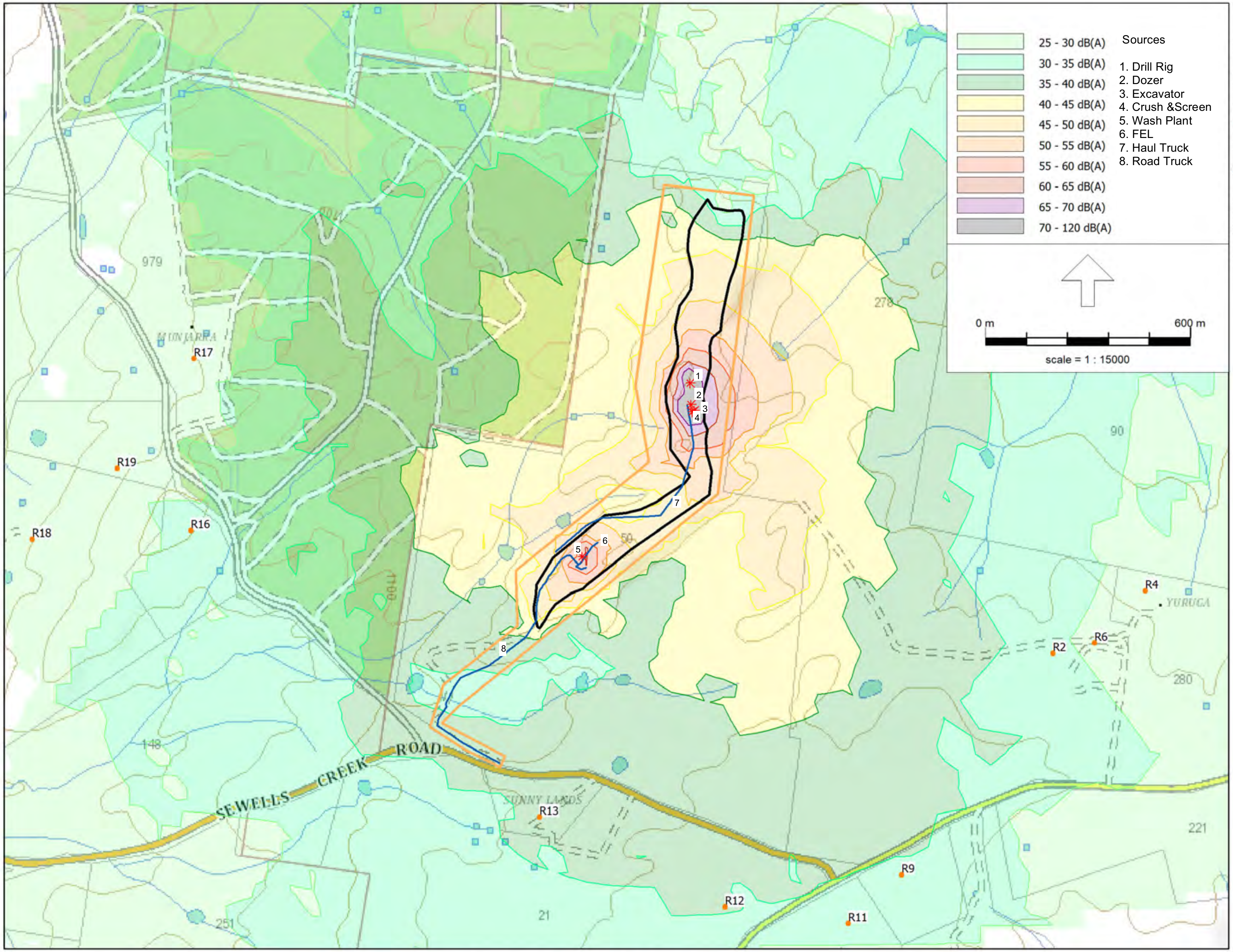

Operations Scenario 2
NE winds@3m/s, LAeq(15-min),dBA

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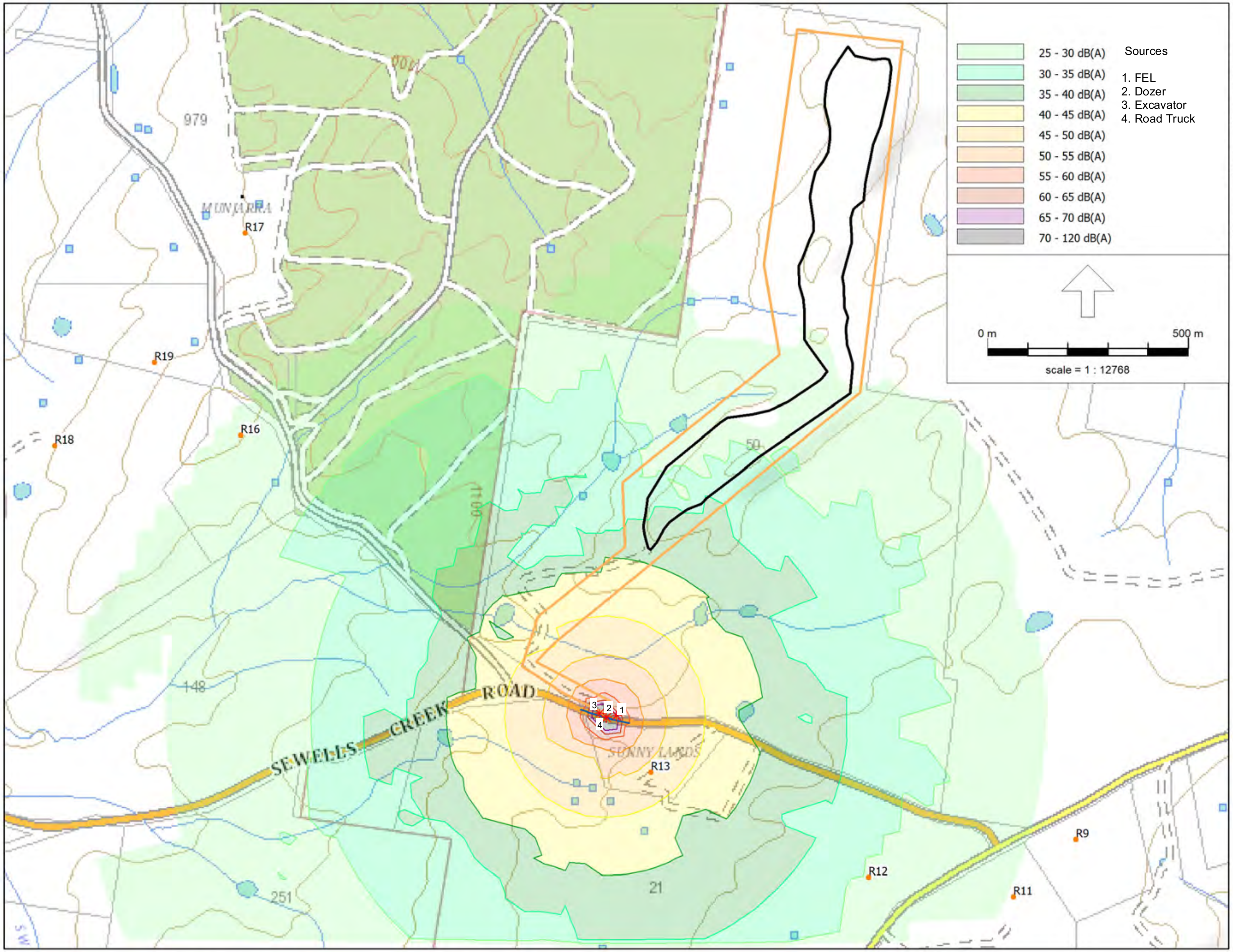
Construction - Haul Road Intersection

Noise Enhancing, LAeq(15-min), dBA



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Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting

APPENDIX 11

Traffic Impact Assessment

Traffic Impact Assessment

Middle Creek Quarry

80021011

Prepared for
Umwelt (Australia) Pty Limited

30 September 2022

Cardno

now

Stantec

Contact Information

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

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Version	Effective Date	Description of Revision	Prepared by	Reviewed by
1	30/09/2022	Draft	Sabal Sharma	Hayden Calvey

Table of Contents

Tables

Figures

1 Introduction

Cardno now Stantec (Stantec) has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving to undertake a traffic and parking impact assessment to assess the potential impacts of proposed modifications to an existing development consent for Middle Creek Quarry in Oberon.

The Quarry current holds permission for gravel extraction and storage, processing (blending) and reapplication of waste materials including raw mulch, treated drilling mud and Excavated Natural Material (ENM). Modifications seek to extend current resource recovery activities to include sand washing and waste concrete crushing. Inclusion of additional resource recovery activities, will lead to an increase of total production rate of all products from 250,000 to 315,000 tonnes per annum (tpa).

This assessment has been undertaken to assess the impacts of the quarry on traffic, transport, and local road infrastructure as well as demonstrate the compliance of the development with relevant standards and Council controls.

1.1 Scope of Works

The main objective of this report is to evaluate the traffic impacts that are generated by the proposed increase in production and its associated impact on the surrounding road network. Stantec's scope of works for this study includes:

> Reviewing existing transport network conditions
> Estimate the traffic generated by the proposed development including likely distribution
> Analysis of the development's impact on the surrounding road network and intersection network at the design year including impacts on capacity, condition, safety, and efficiency.

1.2 Agency Requirements

Transport for NSW (TfNSW) in their letter dated 16 September 2019 provided an outline of information required to be provided as part of the development application.

Table 1-1 TfNSW Requirements

Agency Requirement	Relevant Section
A Traffic Impact Assessment (TIA) prepared by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12, TfNSW Supplements to Austroads and the RTA Guide to Traffic Generating Developments.	**This document**
The TIA should be tailored to the scope of the proposed development and include, but not necessarily be limited to, consideration of the following	**Addressed individually below**
Project details, including: - Days and hours of operation - Phases and stages of the project, including construction and operation - Staffing numbers - Servicing/delivery requirements	**Section 3**
A map of the surrounding road network identifying the site access, nearby accesses, intersections and transport related facilities and the proposed transport route/s identifying all public roads proposed to obtain access from the classified (State) road/s to the development site.	**Section 2, 3 and 4**
The total impact of existing and proposed development on the road network with consideration for a 10-year horizon. This should include;	**Section 4**

▪ Identify Annual Average Daily Traffic (AADT) volumes with percentage heavy vehicles along the transport route/s and diagrammatically demonstrate AM and PM peak hour movements at key intersections. ▪ Background traffic data from published sources and/or recent survey data. The source of data and any assumptions are to be clearly explained and justified, including the growth rate applied to the future horizon. ▪ The volume and distribution of existing and proposed trips to be generated by the construction, operational and decommission phases of the development. This should identify the maximum daily and hourly demands generated by the development, particularly where they coincide with the network peak hour. ▪ The type and frequency of vehicles accessing the development site including, • The design vehicle. • Number and ratio of heavy vehicles to light vehicles. • Peak times for project-related traffic, including commuter periods. • Proposed hours for servicing vehicles. • Interactions between existing and project related traffic. • Any over size and over mass vehicles required during construction, and the materials to be transported. • Identification and assessment of potential impacts the proposal may have relating to lighting, visual amenity, noise, drainage and air quality on the function and integrity of all affected roads, road users and sensitive receivers.	
Details of the road geometry and alignment along the identified transport route/s, including existing formations, crossings, intersection treatments and any identified hazards. This should include; ▪ Available sight distances at the site access and nearby intersections and any constraint to achieving the required sight distance for the posted speed limit. ▪ An assessment of turn treatment warrants in accordance with the Austroads Guide to Traffic Management Part 6 and Austroads Guide to Road Design Part 4A for intersections along the identified transport route/s, identifying the existence of the minimum basic turn treatments and addressing the need for any warranted higher order treatments. ▪ Swept path analysis demonstrating the largest design vehicle entering and leaving the development, and moving in each direction through intersections along the proposed transport route/s. The plan is to note the parameters used to generate the swept path diagrams. ▪ The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and mitigate the impact.	**Section 4**
The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction and operation of the project.	**Section 4**
Capacity analysis using SIDRA or other relevant application, to identify an acceptable Level of Service (LOS) at intersections with the classified (State) road/s, and where relevant, analysis of any other intersections along the proposed transport route/s.	**Section 4**
A review of crash data along the identified transport route/s for the most recent 5 year reporting period and an assessment of road safety along the proposed transport route/s considering the safe systems principles adopted under Future Transport 2056.	**Section 4**
Strategic (2D) design drawings of all proposed road works and the site access demonstrating scope, estimated cost and constructability of works required to	**No plans are proposed**

mitigate the impacts of the development on road safety, traffic efficiency and the integrity of transport infrastructure. Works must be appropriately designed for the existing posted speed limit.	
Site plan demonstrating site access, internal manoeuvring, servicing and parking areas consistent with the relevant parts of AS2890 and Council requirements.	**Section 3**
Details of measures to address impacts and/or provide connections for public transport services and active transport modes, such as, public and school bus services, walking and cycling.	**Section 6**
Details of measures to ameliorate the impacts of road traffic noise, dust, and/or glare generated along the proposed transport route/s.	**Section 6**
TfNSW will require in due course the provision of a traffic management plan for all demolition/construction activities, detailing vehicle routes, number of trucks, hours of operation, access arrangements and traffic control measures. Provide details of a Traffic Management Plan (TMP) proposed to address the construction, operation and decommission phases of the proposed development. The TMP may include temporary measures such a Traffic Guidance Scheme (TGS) prepared and implemented by suitably qualified persons in accordance with the current Traffic Control at Work Sites Manual. It is recommended that any TMP adopt a Driver Code of Conduct, including but not necessarily limited to, the following; ▪ A map of the primary transport route/s highlighting critical locations. ▪ An induction process for vehicle operators and regular toolbox meetings. ▪ Procedures for travel through residential areas, school zones and/or bus route/s. ▪ A complaint resolution and disciplinary procedure. ▪ Community consultation measures proposed for peak periods. ▪ Work, health and safety requirements under the Work Health and Safety Regulation 2017.	**Section 6**
An assessment of the likely risks to public safety, in particular, transport and use of any dangerous goods, and in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and transporting reagents in accordance with the requirements of Australian Dangerous Goods Code and Australian Standard 4452 Storage and Handling of Toxic Substances. This should include relevant incident management strategies for transportation on public roads	Refer to EIS

1.3 Reference Documents

> Oberon Council Development Control Plan (2001);
> Oberon Local Environmental Plan (2013)
> Supplementary Traffic Assessment for Middle Creek Quarries (2017);
> Middle Creek Quarries Report No.930/09 Environmental Impact Statement (2017);
> Guide to Traffic Generating Developments (Roads and Maritime, 2002);
> Technical Direction (Roads and Maritime, TDT 2013/04a).

1.4 Prior Transport Assessment

The traffic and transport assessment prepared for the approved development (250,000tpa), DA10.2016, was contained in the 2017 Environmental Impact Statement (EIS) and 2017 Supplementary Traffic Assessment. The following summarises relevant extracts from these assessments.

Existing traffic volume data for the Abercrombie Road was sourced from Roads and Traffic Authority (RTA, now TfNSW) and Council, along with forecasts at the time. The results of this analysis were contained in Table 4.3 and Figure 4.11 of the EIS as shown in **Figure 1-1** below.

Figure 1-1 Existing Traffic Data

Table 4.13
Existing and Predicted AADT

	Abercrombie Road South (Station 99218)			Abercrombie Road North (Station 99908)		
Year	**Total Vehicles**	**Light Vehicles**	**Heavy Vehicles**	**Total Vehicles**	**Light Vehicles**	**Heavy Vehicles**
1992*	NA	NA	NA	1135	NA	NA
1996*	951	NA	NA	1326	NA	NA
1999*	1056	NA	NA	1343	NA	NA
2002*	752	NA	NA	1172	NA	NA
2005*	694	596	98	732	630	102
2013^	950	NA	NA	NA	NA	NA
2016#	993	853	140	862	741	121
2021#	1070	919	151	929	799	130
2026#	1153	990	163	1001	861	140
2031#	1242	1067	175	1078	927	151
2036#	1338	1149	189	1161	998	163
2041#	1441	1238	203	1251	1076	175
2046#	1553	1334	219	1348	1159	189

* RMS Data ^ Council Data # Predicted Levels

Figure 1-2 Existing Hourly Traffic

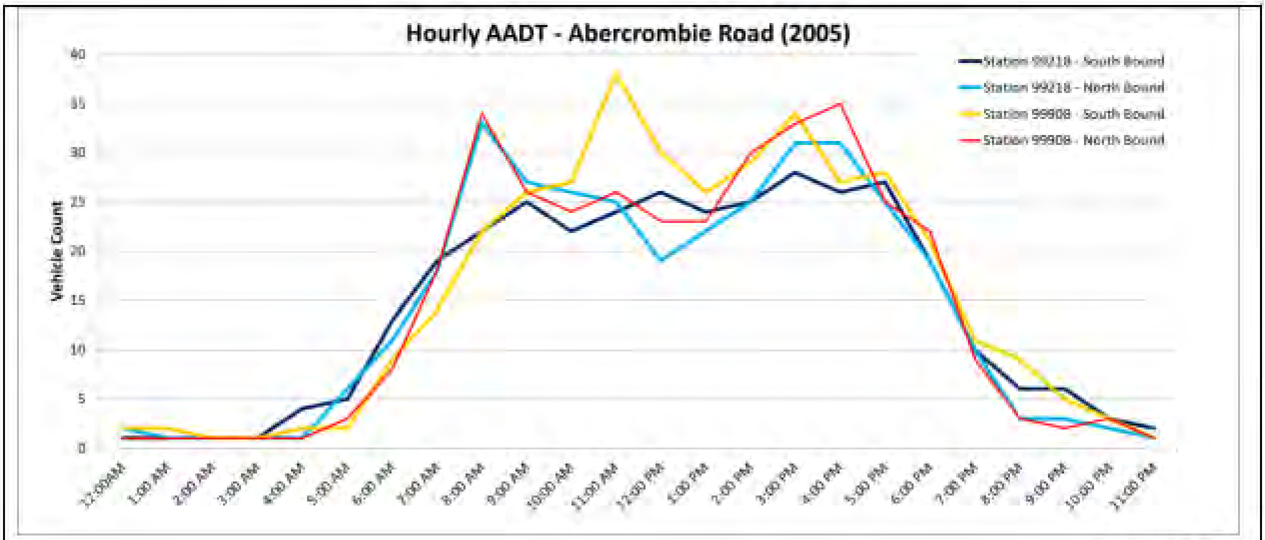


Figure 4.11
HOURLY AADT – ABERCROMBIE ROAD (2005)

Regarding Sewells Creek Road, the following was concluded: "*given that road is not a significant connecting traffic route and the very small difference in traffic numbers at the Abercrombie Road stations either side of Sewells Creek Road, average traffic levels are expected to be in the order of 100 vehicles per day or less*".

The proposal for 250,00tpa (now approved) considered a maximum product truck movements during high volume campaign would be 100 per day (or 50 loads). Consideration was also given to miscellaneous truck movements such as delivery trucks (fuels and consumables) estimated to be up to 4 truck movements per day (or 2 loads) once every 2 to 3 weeks.

1.5 Report Structure

Section 1 – Introduction

Overview of the proposal and requirements of the traffic and transport assessment

Section 2 – Existing Conditions

Examination of the site and existing traffic and transport condition

Section 3 – Site Operation

Summary of the existing site operation and proposal

Section 4 –Traffic Assessment

Examination of the operational traffic impact due to the proposal

Section 5 – Construction Traffic Impact Considerations

Outline traffic and transport impact during construction

Section 6 –Mitigation & Management Measures

Outline of recommendations based on the findings of the traffic assessment

Section 7 – Conclusion

Summarises the findings of the traffic and transport assessment

2 Existing Conditions

2.1 Subject Site

Middle Creek Quarry is located on 50 Sewells Creek Road, which is approximately 6 kilometres northwest of Oberon in the Oberon Council Local Government Area. This site is classified as a designated development under the *Environmental Planning and Assessment Regulation 2000* Schedule 3.

The location of the site is shown in **Figure 2-1**.

Figure 2-1 Subject Site

2.2 Road Network

Roads and Maritime Services (Roads and Maritime) in partnership with local government established an administrative framework of State, Regional and Local Road categories to help manage the extensive network of roads.

State roads are managed and financed by Roads and Maritime, and Regional / Local Roads are managed and financed by Councils. Notwithstanding, Regional Roads perform an intermediate function between the main arterial network of State Roads and Council controlled Local Roads and therefore received financial assistance from Roads and Maritime.

Sewells Creek Road

Sewells Creek Road is a local road under the care and maintenance of the local council. There are no speed limit marked along Sewells Creek road nearby the subject site, hence a default speed limit of 100 km/hr for rural divided roads applies. The road is sealed and configured as a two-lane carriageway with one lane provided for each direction, separated by a double centre line.

The quarry entrance is situated on Sewells Creek Road. From the quarry entrance, Sewells Creek Road provides connection to Abercrombie Road 1km to the east, and Mayfield road 150m to the west.

Mayfield Road

Mayfield Road is a local road under the care and maintenance of the local council. There are no speed limit marked along Mayfield road nearby the subject site, hence a default speed limit of 100 km/hr for rural divided applies. The road is sealed configured as a two-lane carriageway with one lane provided for each direction separated by a double centre line.

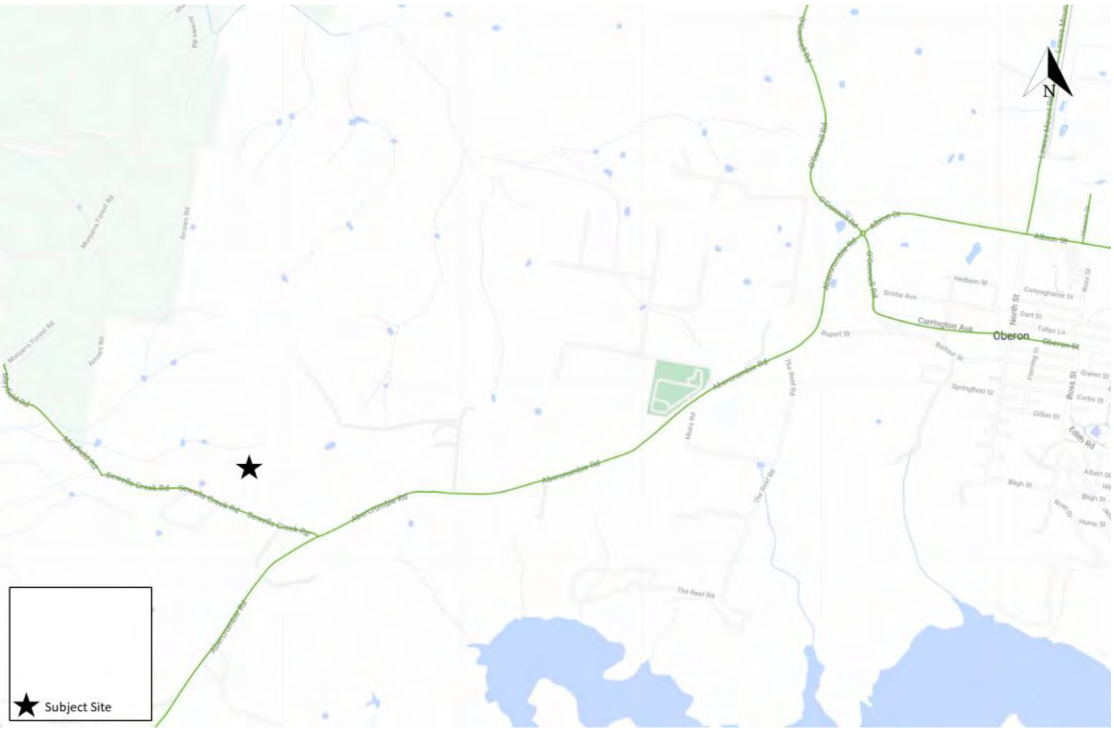
Abercrombie Road

Abercrombie Road is a local road under the care and maintenance of the local council with a speed limit of 80 km/hr. The road is configured as a sealed two-lane carriageway with one lane provided for each direction. Abercrombie Road provides connections to the regional township of Oberon to the west.

2.3 Heavy Vehicles

Figure 2-2 shows the key roads of Abercrombie Road and Sewells Creek Road are approved 26m B-Double Routes.

Figure 2-2 Heavy Vehicle Approved Routes



2.4 Public Transport

There is little to now public transport near the vicinity of the Quarry. Depending on school transport needs, there may be the potential school bus route on Sewells Creek Road. This was previously considered in the approved development. Notable, the previous measures for truck haulage that may coincide with school transport is through the use of UHF radio communication.

2.5 Active Transport

There are no footpaths in the vicinity of the site, consistent with the rural setting. Cyclists are to use the travel lanes in a shared mixed traffic environment.

2.6 Traffic Volumes

Traffic volumes for the existing road network have been sourced from historical references. The original EIS provides a comprehensive analysis of existing traffic volumes along Abercrombie Road.

The daily traffic volumes are assumed to be consistent with the original EIS, and reproduced below for the count location just south of Sewells Creek Road.

Table 2-1 Existing Traffic Volumes

Year	Total Vehicles	Light Vehicles	Heavy Vehicles
2002	752	n.a	n.a
2005	694	596	98
2013	950	n.a	n.a
2016#	993	853	140
2021#	1070	919	151
2026#	1153	990	163
2031#	1242	1067	175
2036#	1338	1149	189
2041#	1441	1238	203
2046#	1553	1334	219

Reference is also made to traffic data collected in 2015 (Borg Panel Manufacturing, Oberon – Traffic Impact Assessment Report, Smec 2016) which shows Abercrombie Road carrying 112 vehicles and 140 vehicles in the AM and PM peak respectively. Based on the 2013 recorded daily volume of 950, the AM and PM peak hour recorded in 2016 is approximately 12 to 15% of the AADT. The directional split northbound and southbound is generally 50 / 50.

The hourly profile provided in the original EIS (**Figure 1-2**) showed approximate peaks of 55 vehicles and 58 in the AM and PM peak during 2005. This compares to the 694 daily volumes recorded in 2005 such that the AM and PM peak is approximately 8 to 9% of the AADT.

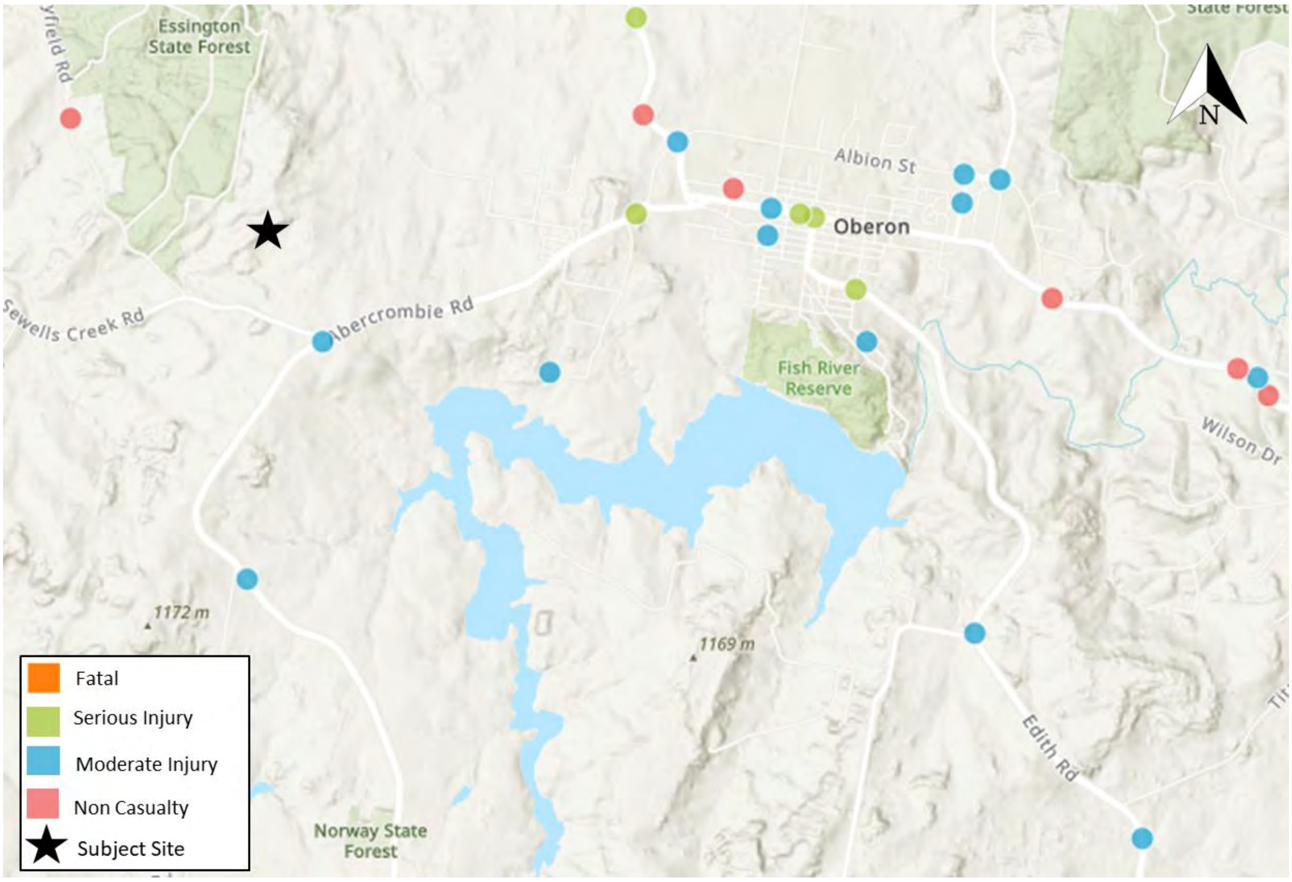
2.7 Crash History

The most recent 5-year crash history (2026-2020) is shown in **Figure 2-3**. There has been one crash at the Abercrombie Road / Sewells Creek Road intersection.

This crash occurred in 2019 resulting in a moderate injury, where a vehicle turning right into Sewells Creek Road collided with a through vehicle.

There are no other recorded crashes in the vicinity of the Quarry, nor is there any crash cluster or road safety deficiency identified.

Figure 2-3 Crash Locations



3 Site Operation

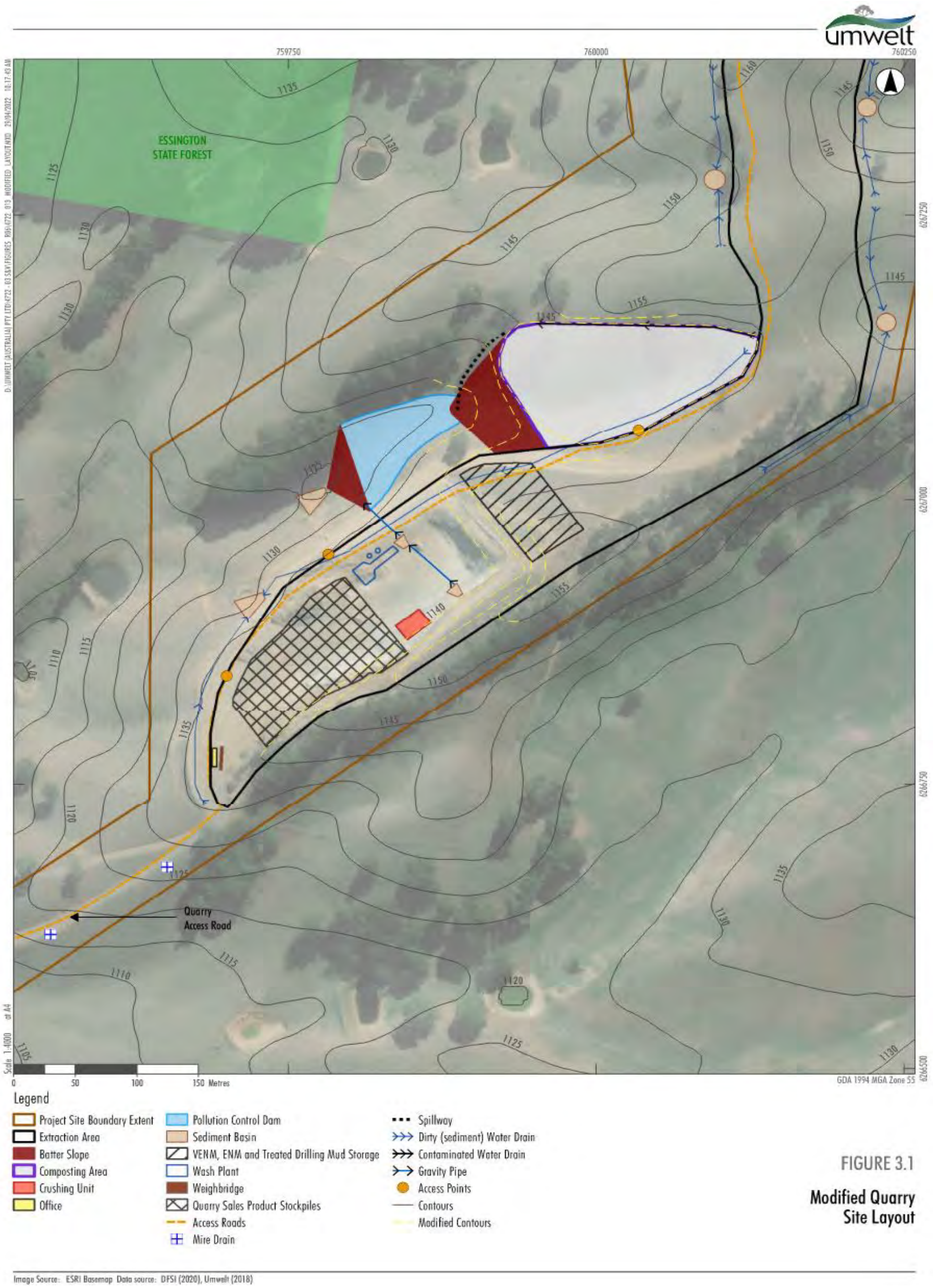
Under the existing development consent (DA 10.2016.38.1), Oberon Earthmoving has approval for the conditions highlighted in **Table 3-1**. The proposed modification is also detailed for comparison.

Table 3-1 Existing Site development consent conditions

Element	Approved	Proposed Modification
Disturbance Area	▪ Extraction Area (including all processing and stockpiling operation): 15 ha ▪ Erosion and Sediment Control features: <0.25 ha ▪ Site Access Road: <1 ha	▪ Extraction Area (including select processing and stockpiling operation): 15 ha ▪ Erosion and Sediment Control features: <0.25 ha ▪ Site Access Road: <1 ha ▪ Out of Pit Processing and Stockpile Area: 1 ha ▪ Additional Water Management Features: to be confirmed
Extraction Method	▪ Drill and blast	▪ No change
Extraction Design Features	▪ Operational Face Height: – <15 m: friable rock. – <20 m: harder rock. ▪ Operational Bench Width: 20 m to 100 m (longitudinal i.e. north-south). ▪ Terminal Bench Width: 3 m to 5 m (approximate).	▪ No change
Overburden Management	▪ Sale as select fill ▪ Void backfill (rehabilitation)	▪ Construction of an additional stockpile and processing area
Composting	▪ Aerobic windrow composting of mulch within the completed extraction area	▪ No change to process ▪ Relocation to Out of Pit Processing and Stockpile Area
Hours of Operation	▪ Monday - Friday: 7:00 am to 6:00 pm ▪ Saturday: 8:00 am to 2:00 pm	▪ No Change
Rehabilitation and Final Landform	▪ Retained void with stable final slopes	▪ No change to residual voids ▪ Out of Pit Processing and Stockpile ▪ Area to be profiled to blend with surrounding slopes
Resource Recovery	▪ Importation, storage, processing (blending) and reapplication to land or sale of: – Raw mulch; – Excavated Natural Material (ENM) including Virgin Excavated Natural Material (VENM); – Treated Drilling Muds.	▪ Importation of waste concrete for crushing and sale
Production Rate	▪ Extraction Limit: – Extraction of up to 150,000 tonnes of gravel per annum (Total extraction from the site shall not exceed 5,000,000 tonnes over the life of the quarry, from an area of approximately 15 ha of land.) ▪ Resource Recovery Limit: – Raw mulch up to 25,000 tonnes per annum	▪ Up to 315,000 tpa (increase of 26 %)

	– Treated drilling mud up to 60,000 tonnes per annum – ENM up to 50,000 tonnes per annum (VENM as a specific type of ENM, production limit up to 25,000 tonnes per annum) ▪ Total Limit: production of all products up to 250,000 tonnes per annum	
Transport Operations	▪ Up to 50 truckloads/100 movements on weekdays ▪ Up to 30 truckloads/ 60 movements on Saturday.	▪ Maximum of 180 truck movements per day (Monday to Friday) ▪ Maximum 90 truck movements per day (Saturday)

Figure 3-2 Proposed Compost Relocation Area



Source: Umwelt Briefing Note

4 Traffic Assessment

4.1 Assessment Year

It is understood the life of the quarry is to 2046 and there is no change to this horizon as part of the modification application.

4.2 Operating Hours

There is no change to the proposed hours of operation.

4.3 Largest Vehicle

There is no change in the heavy vehicle types that access the site, which is predominantly truck and dog trailer combinations, however rigid trucks and B-Doubles may also be utilised on occasions.

4.4 Haulage Route

The Middle Creek Quarry access road connects to Sewells Creek Road.

Transport operations via Mayfield Road are prohibited unless delivering to addresses on Mayfield Road.

4.5 Future Traffic Demand

The current operation has approval for 250,000tpa total production and 50 vehicle loads (100 two-way movements). The proposal for 315,000tpa total production is equivalent to a 26% increase, whilst the peak truck activity is proposed to be 90 vehicle loads (180 two-way truck movements), reflective of a 80% increase in site generated trucks across the day.

Based on assumed the transport hours of 7:00am to 6:00pm (11 hours), this would equate to 16 -17 vehicle movements per hour proposed compared to 9-10 vehicles per hour existing.

Staff levels and subsequent light vehicle traffic generation is assumed to have a minor increase associated with the extended activities. It is assumed that 16 to 26 vehicle movements are generated per day in association with staff and visitors (or 8 to 13 one-way vehicles) compared to the existing 12 to 20 vehicle movements per day (or 6 to 10 one-way vehicles).

Therefore, the peak vehicular activity generated by the proposal is forecast to be up to 29 vehicles in the morning (13 inbound light vehicles, 8 inbound heavy and 8 outbound heavy vehicles), and evening peak (13 outbound light vehicles, 8 inbound heavy and 8 outbound heavy vehicles), and up to 16 vehicles outside of these peaks (8 inbound heavy vehicles and 8 outbound heavy vehicles).

This forecast compares of 29 vehicles in the peak is compared to the existing peak of 20 vehicles.

4.6 Traffic Distribution

The origin and destination for the distribution of various products (both incoming and outgoing) will vary day-to-day. For the purpose of this analysis. It is assumed 80% of heavy vehicles travel to / from Oberon, north along Abercrombie Road with the remaining 20% being south. It is assume that 100% of light vehicles travel to / from Oberon.

4.7 Forecast Traffic Volumes

The forecast traffic volumes are shown in **Table 4-1** below for Abercrombie Road, based on the current production activity (resulting in 20 peak hour vehicles) and the proposal (resulting in 39 peak hour vehicles).

Table 4-1 Forecast Traffic Volumes with Proposal

Year	Existing baseline (with approved development)			Forecast volume (with proposed modification		
	Total	Light	Heavy	Total	Light	Heavy
2026#	1253	1010	243	1323	1016	307
2031#	1342	1087	255	1412	1093	319
2036#	1438	1169	269	1508	1175	333
2041#	1541	1258	283	1611	1264	347
2046#	1653	1354	299	1723	1360	363

By the ultimate year of 2046, the existing baseline forecast of 1,653 daily vehicles is anticipated to increase to 1,723 daily vehicles. The peak hour in 2046 is estimated to be some 206 vehicles baseline, compared to 214 vehicles with proposed modification. For simplicity, adopting the 50 / 50 northbound and southbound traffic split, this is likely to be up to 107 vehicles in each direction during the peak hour by 2046.

Sewells Creek Road is anticipated to maintain its comparative low traffic volume and is not expected to increase above 100 two-way vehicles in the peak hour.

4.8 Road Capacity Assessment

Based on the resulting traffic volumes, it is considered unnecessary to develop intersection modelling for the relatively low traffic volumes during the peak hour. Modelling, using programs such as SIDRA, are likely to show Level of Service (LoS) results A / B due to the low volumes and provision of gaps in the traffic stream. These modelling programs, at these relatively low traffic volumes, show little to no variance in LoS results which minor changes in baseline volumes.

Sewells Creek Road Quarry Access

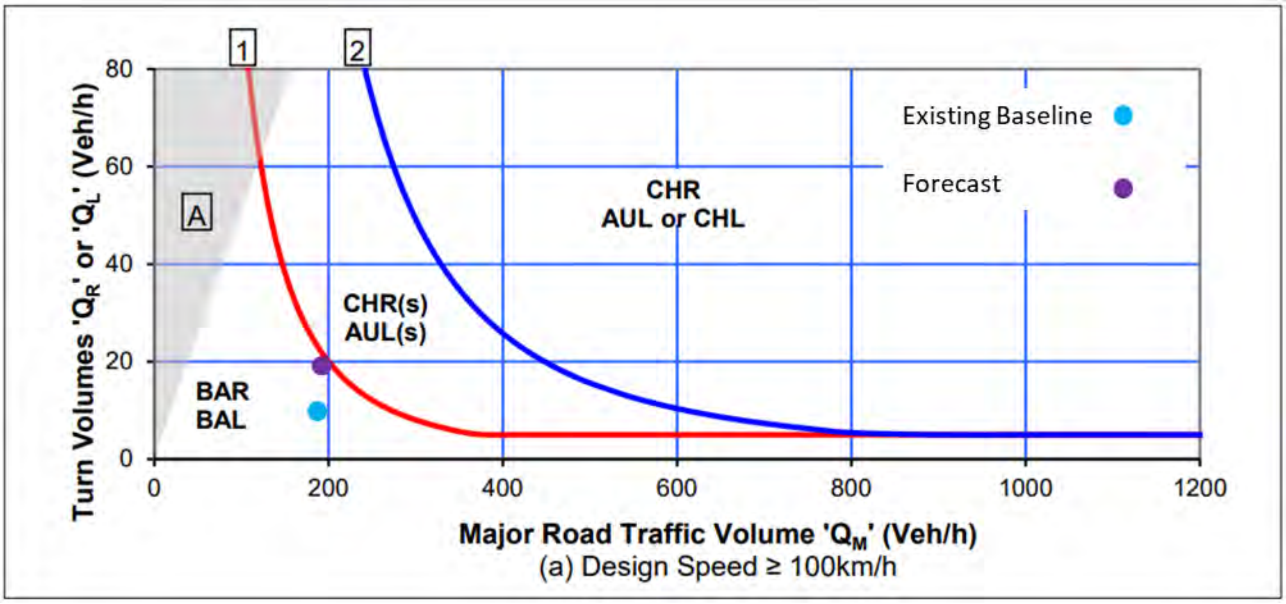
The existing Quarry access was upgraded as part of its previous consent where it is predicted that the relatively minor change in peak hour volumes will not adversely affect the upgrade, which was designed with sufficient capacity.

Abercrombie Road / Sewells Creek Road Intersection

Regarding the intersection of Abercrombie Road / Sewells Creek Road, reference is made to Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements which provides intersection turn warrants to guide treatments for various intersections.

It is noted that the application of turning warrants is based on the construction of new roads (i.e. for Greenfield sites). For existing roads, the warrants may be used as a reference however is not a strict application.

Figure 4-1 Intersection Turn Warrants



During the morning peak, where it is assumed that 100% of light vehicles and 80% of heavy vehicles travel from the north, the Quarry would generate up to 14 vehicles turning right under baseline conditions, and 19 vehicles under forecast volumes with the modification. This turning volume is likely to be against slightly less than 200 vehicles (consisting of northbound and southbound movement along Abercrombie, as well as left turn into Sewells Creek Road). This is based on the year 2046 traffic volumes.

Based on this turning volume, the warrant is likely to be within the Basic Right (BAR) turn treatment, and very close to the next treatment type, being a shortened Channelised Right (CHR) turn treatment. Given the warrants are for Greenfield sites and the relatively minor change in peak hour volumes from the Quarry, the current intersection treatment for a BAR is considered adequate and no further upgrade is required.

Midblock Traffic

The forecast peak hour traffic of just approximately 214 vehicles in the peak hour (107 in each direction) will not result in adverse impacts as this volume is within acceptable capacity for single lanes (where Level of Service A is based on 200 vehicles in a single lane). This is also true when considering heavy vehicle percentages for rural roads, where, as a guide, up to 500 vehicles in the peak hour is considered to be good level of service.

Figure 4-2 TfNSW Guide for Single Lane Capacities

Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Figure 4-3 TfNSW Guide for Rural Road Capacities

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

4.9 Road Safety

The increase in peak hour traffic volumes from 20 under approved conditions, to 29 under the proposed modification is unlikely to have a tangible impact on the existing crash history and road safety on the public road network.

5 Construction Traffic Impact Considerations

There are minor site works associated with the extended activities on-site. The likely construction traffic generation is anticipated to be lower than the forecast operational traffic and as such, the potential impacts during construction are equally low.

6 Mitigation & Management

6.1 Operation

The site operations already employ the use of driver code of conducts and is proposed to continue this, and updated to be reflective of any new development approvals.

Consistent with prior development approval, the levy on extracted material movement will be maintained and will provide for ongoing road maintenance to account for any accelerated pavement deterioration.

6.2 Construction

A Construction Traffic Management Plan is to be developed and enforced during the period of construction on-site to appropriately manage the potential impacts arising from construction activity. The CTMP should address TfNSW general requirements as listed in **Table 1-1** and below:

Provide details of a Traffic Management Plan (TMP) proposed to address the construction, operation and decommission phases of the proposed development. The TMP may include temporary measures such a Traffic Guidance Scheme (TGS) prepared and implemented by suitably qualified persons in accordance with the current Traffic Control at Work Sites Manual. It is recommended that any TMP adopt a Driver Code of Conduct, including but not necessarily limited to, the following;

> *A map of the primary transport route/s highlighting critical locations.*

> *An induction process for vehicle operators and regular toolbox meetings.*

> *Procedures for travel through residential areas, school zones and/or bus route/s.*

> *A complaint resolution and disciplinary procedure.*

> *Community consultation measures proposed for peak periods.*

> *Work, health and safety requirements under the Work Health and Safety Regulation 2017.*

7 Conclusion

Cardno now Stantec has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving to undertake a traffic and parking impact assessment to assess the potential impacts due to proposed modifications to an existing development consent for Middle Creek Quarry in Oberon.

The following has been identified within this traffic impact assessment:

> The proposal is for an increase in overall production from the approved 250,000tpa to 315,000tpa

> The proposal will result in the increase in daily truck movements, at is peak operation, from 100 vehicle movements per weekday to 180 vehicle movements. On weekends, the increase is expected to be from existing 60 movements to 90 movements on the Saturday

> During the peak hours, it is forecast that the site will generate a total of 29 vehicle movements (16 truck movements and 13 one-way light vehicle movements). This is an increase from the existing operation of 20 vehicle movements (10 truck movements and 10 one-way light vehicle movements).

> The increase in daily and peak hourly traffic by the year 2046 is not anticipated to have a detrimental impact on the Quarry site access, which was upgraded as part of the prior development approval. Similarly, the intersection of Abercrombie Road / Sewells Creek Road is forecast to operate satisfactorily based on the relatively minor change in traffic volume. There is no warrant to provide an intersection upgrade at this location.

> The traffic flow at midblock locations is expected to be satisfactorily and similarly there is no anticipated detrimental impact on road safety considerations.

> During construction activity of the extended facilities on-site, a CTMP will be prepared and implemented.

> During operation of the site, continuation of the Driver Code of Conduct and use of UHF radio communication with local bus companies will continue.

Overall, the proposal and its associated traffic impacts are shown to have a negligible impact on traffic flow efficiency and road safety.

APPENDIX 12

Biodiversity Assessment Report and Supplementary Koala Habitat Assessment

Middle Creek Quarries Proposed Modification

Biodiversity Assessment Report

Oberon Council LGA NSW

November 2020 (Finalised December 2022)

AREA Environmental & Heritage Consultants acknowledges Traditional Owners of the country on which we work

Document controls

Proponent	Oberon Earthmoving Pty Limited		
Client	Umwelt (Australia) Pty Ltd		
Document Description	**Biodiversity Assessment Report** Middle Creek Quarries Proposed Modification		
Clients Representative Managing this Document	**AREA Person(s) Managing this Document**		
	Phil Cameron (PJC)		
File Location: Clients>Umwelt>Middle Creek Quarries	**AREA Job No.** QU0232/ QU0837		
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Series V2.X = Client internal edits (Draft)	V2.0 V2.1 V.2.2	02/08/2020 16/11/2020 22/06/2022	AREA to Client AREA to Client AREA to Client
FINAL (Draft approved by client)	V3.0	1/12/2022	Final to Client
Prepared For	**Prepared By**		
Jon Novoselac Environmental Consultant **Umwelt (Australia) Pty Limited** 75 York Street Teralba, NSW 2284 Phone: (02) 4950 5322 jnovoselac@umwelt.com.au	**Genevieve Peel & Rohan Saunders** (Cadet) Environment Consultant(s) **AREA Environmental & Heritage Consultants Pty Ltd** 6 Belmore Street Dubbo NSW 2830 E gen@areaenv.com.au ABN:29 616 529 867		

Executive summary

Oberon Earthmoving Pty Limited (Oberon Earthmoving / the proponent) propose a modification to Development Consent DA 10.2016.38.1 for the existing Middle Creek Quarries (the proposal). Middle Creek Quarries is located at 50 Sewells Creek Road, approximately 3.5 kilometres west of Oberon, in the Oberon Council local government area (LGA) of New South Wales. The quarry operations are entirely contained within Lot 2 DP1112479.

Operations under the development consent (DA 10.2016.38.1) commenced in February 2019, following approval in March 2018 and confirmation of approval by orders of the Land & Environment Court in December 2018. Since then, Oberon Earthmoving has identified several constraining conditions associated with the development consent and several opportunities for the addition of ancillary development activities. As a result, Oberon Earthmoving intends on making application to modify the development consent to allow for the following:

- Extended resource recovery activities to include concrete for crushing and sale and green waste, biosolids and manure for composting and sale
- Relocation of composting activities from within the extraction area footprint to a new stockpiling and processing area to be formed at the top of a gully which adjoins the approved extraction area, and
- Increased truck movements.

Site inspection has identified clearing which has extended beyond the approved limits of DA 10.2016.38.1 which requires assessment.

AREA Environmental & Heritage Consultants (AREA) has been engaged by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving to complete a Biodiversity Assessment for this proposal. This Biodiversity Assessment will inform a Statement of Environmental Effects (SoEE) which is being prepared for the proposal.

The minimum Lot size for the development footprint is 100 hectares. The total impact to native vegetation is less than one hectare, therefore the proposal does not trigger assessment by the Biodiversity Assessment Method under the area threshold. Also, there will be no impact to land mapped on the Biodiversity Values Map or an area of outstanding biodiversity value.

This Biodiversity Assessment Report considers the following disturbance associated with the proposal:

- An extension to the west of the previously approved disturbance footprint for an additional stockpiling and processing area, and
- A small area of clearing which extends beyond the approved extraction limit on the southern side of the lower extraction area.

The purpose of this assessment was to describe the potential impact to biodiversity associated with the proposal and determine the significance of any impact to threatened species, ecological communities or their habitat listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act). Field assessment was undertaken on 28 July 2020. The weather was cool with light rain but was not a limiting factor for the assessment. No threatened fauna or flora species were recorded.

The study area incorporates Lot 2 DP1112479 and consists of an operational quarry, located within land that is zoned for primary production which has been extensively grazed and previously (to the quarry operation) cleared. There are fragmented patches of vegetation within Lot 2 DP1112479 and the Essington State Forest, a monocultural softwood pine forest plantation, lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

The development footprint incorporates the following areas:

1. Additional disturbance associated with the proposed Additional Stockpiling and Processing Area, a total of 2.54 hectares, and
2. Cleared area outside approved extraction limit, a total of 0.31 hectares.

Of the total 2.85 hectares of the development footprint, 0.42 hectares of this will impact native vegetation. The remaining 2.43 hectares were assessed as low conservation grassland occurring as grazing land dominated by invasive pasture grasses and weeds.

The native vegetation in the study area was identified as Plant Community Type 730 *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion* (PCT 730). Five trees, three of which have hollows may be impacted by the proposal. This vegetation is not consistent with the description of any Threatened Ecological Community (TEC) and impact does not trigger entry into the NSW Biodiversity Offsetting Scheme.

Database searches (NSW and Commonwealth) highlighted 12 listed flora species and 52 listed fauna species known and predicted to occur in the study area. All relevant species were considered and tests of significance for nine species listed under the BC Act and assessments of significance for two species listed under the EPBC Act were prepared for threatened species determined to be likely to occur in the development footprint, and with potential to be impacted by the proposal.

Based on the conclusions of the tests and assessments of significance in this report, it is considered the proposal would be unlikely to result in a significant impact to any threatened species, ecological communities or their habitat listed under the BC Act and EPBC Act. As the proposal is unlikely to have a significant impact on listed biodiversity values, assessment under the NSW Biodiversity Offset Scheme is not required, and Referral under the EPBC Act is not required.

The proposal does not occur in land relevant to the State Environmental Planning Policy (Koala Habitat Protection) 2021, and, based on results from the field assessment was confirmed not to be consistent with the definitions of core or potential Koala habitat under the State Environmental Planning Policy (Koala Habitat Protection) 2020. Therefore, no further plans of management would be required.

Mitigation measures have been recommended to minimise harm to the environment because of undertaking the proposal. With implementation of these standard measures, the potential impacts of the proposal would be further reduced.

Contents

Glossary of terms

Definitions

Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
Indirect impact	Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Matters of NES or MNES	A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact. (OEH 2014).
Population	All the individuals that interbreed within a given area.
Development footprint	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

Abbreviations

BAMCC	Biodiversity Assessment Method Credit Calculator
BVT	Biometric Vegetation Type
CEMP	Construction Environmental Management Plan
DPIE	Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Federal).
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
BC Act	Biodiversity Conservation Act 2016
TSPD	Threatened Species Profile Database
VIS	Vegetation information system

1 Introduction

1.1 The proposal

Oberon Earthmoving Pty Limited (the proponent) propose a modification to Development Consent DA 10.2016.38.1 for the existing Middle Creek Quarries (the proposal). Middle Creek Quarries are located at 50 Sewells Creek Road, approximately 3.5 kilometres west of Oberon, in the Oberon Council local government area (LGA) of New South Wales (Figure 1-1). The quarry operations are entirely contained within Lot 2 DP1112479.

Operations under DA 10.2016.38.1 commenced in February 2019, following approval in March 2018 and confirmation of approval by orders of the Land & Environment Court in December 2018. Since then, Oberon Earthmoving has identified several constraining conditions associated with the development consent and several opportunities for the addition of ancillary development activities.

The proposal contains the following anticipated modifications.

- An increase in truck movements (up to 150 per day).
- Importation and crushing waste concrete (up to 25,000 tonnes per annum).
- Construction of a new Stockpiling and Processing Area for the purpose of modified composting operations. The modified composting operations would extend the raw materials to be imported and composted to green waste, biosolids, manure and Food Organics Garden Organics (FOGO).
- Importation, crushing and blending of building and demolition (B&D) waste.
- Washing of crushed aggregates / sand.

Site inspection has identified clearing which has extended beyond the approved limits of DA 10.2016.38.1 which requires assessment.

AREA Environmental & Heritage Consultants (AREA) has been engaged by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving Pty Limited (the proponent / Oberon Earthmoving) to complete a Biodiversity Assessment for this proposal. This Biodiversity Assessment will inform a Statement of Environmental Effects (SoEE) which is being prepared for the proposal.

This Biodiversity Assessment considers the following components of the proposal:

- Additional disturbance associated with the proposed Additional Stockpiling and Processing Area, a total of 2.54 hectares, and
- Cleared area outside approved extraction limit, a total of 0.31 hectares.

This report will refer to:

- **The proposal**: extension of the existing Middle Creek Quarries (Figure 1-2)
- **Study area**: Lot2 DP1112479 (Figure 1-3)
- **Development footprint**: the total area of impact outside the previously approved extraction limit (Figure 1-4)
- Various sized **buffers** within and around the development footprint for considering ecological matters
- '**Approved Quarry Extraction Area**' is the approved extraction boundary previously approved under DA 10.2016.38.1. This boundary is used to indicate Middle Creek Quarries location on some maps in this document for simplicity and illustrative purposes.

The study area consists of an operational quarry, located within land zoned for primary production which has been extensively grazed and historically cleared. There are fragmented patches of native vegetation within Lot2 DP1112479 and the Essington State Forest (a softwood plantation) lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

This assessment aims to address the requirements for consideration of impacts to biodiversity from the proposal under the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Biosecurity Act 2015*.

The minimum lot size for the development footprint is 100 hectares. The total impact to native vegetation is less than one hectare, therefore the proposal does not trigger assessment by the Biodiversity Assessment Method under the area threshold (see Table 1-1 below). Also, there will be no impact to land mapped on the Biodiversity Values Map as defined by clause 7.3(3) of the Biodiversity Conservation Regulation 2017 (see Section 3) or an area of outstanding biodiversity value.

Table 1-1: Area Clearing Thresholds (Section 7.2 Biodiversity Conservation Regulation 2017)

Minimum lot size of land	Threshold for clearing
Less than 1 hectare	0.25 hectare or more
Less than 40 hectares but not less than 1 hectare	0.5 hectare or more
Less than 1,000 hectares but not less than 40 hectares	1 hectare or more
1,000 hectares or more	2 hectares or more

Figure 1-1: The proposal (Source: Umwelt)

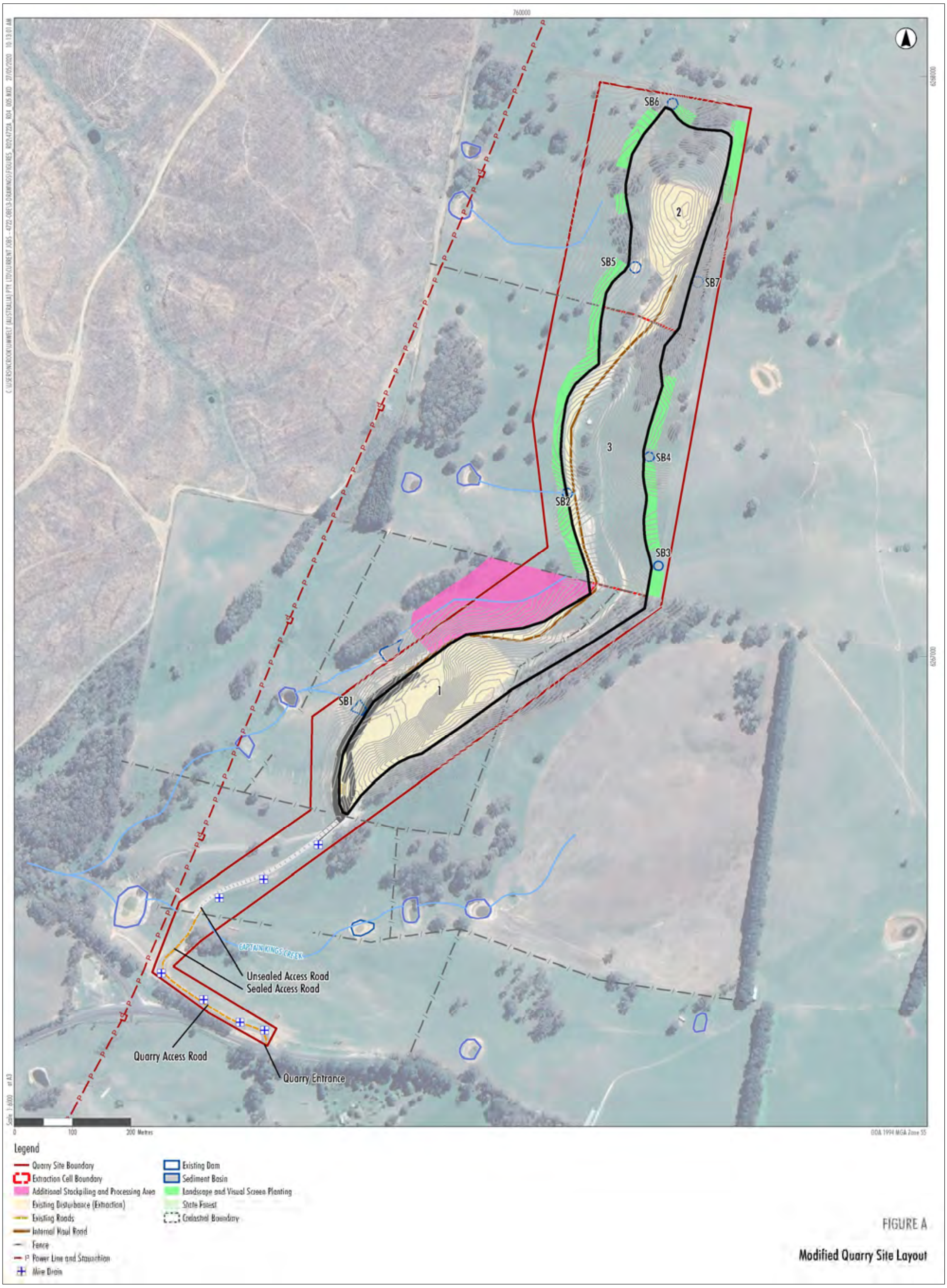

Figure 1-2: Middle Creek Quarries Location (Base image source: Google Roads)

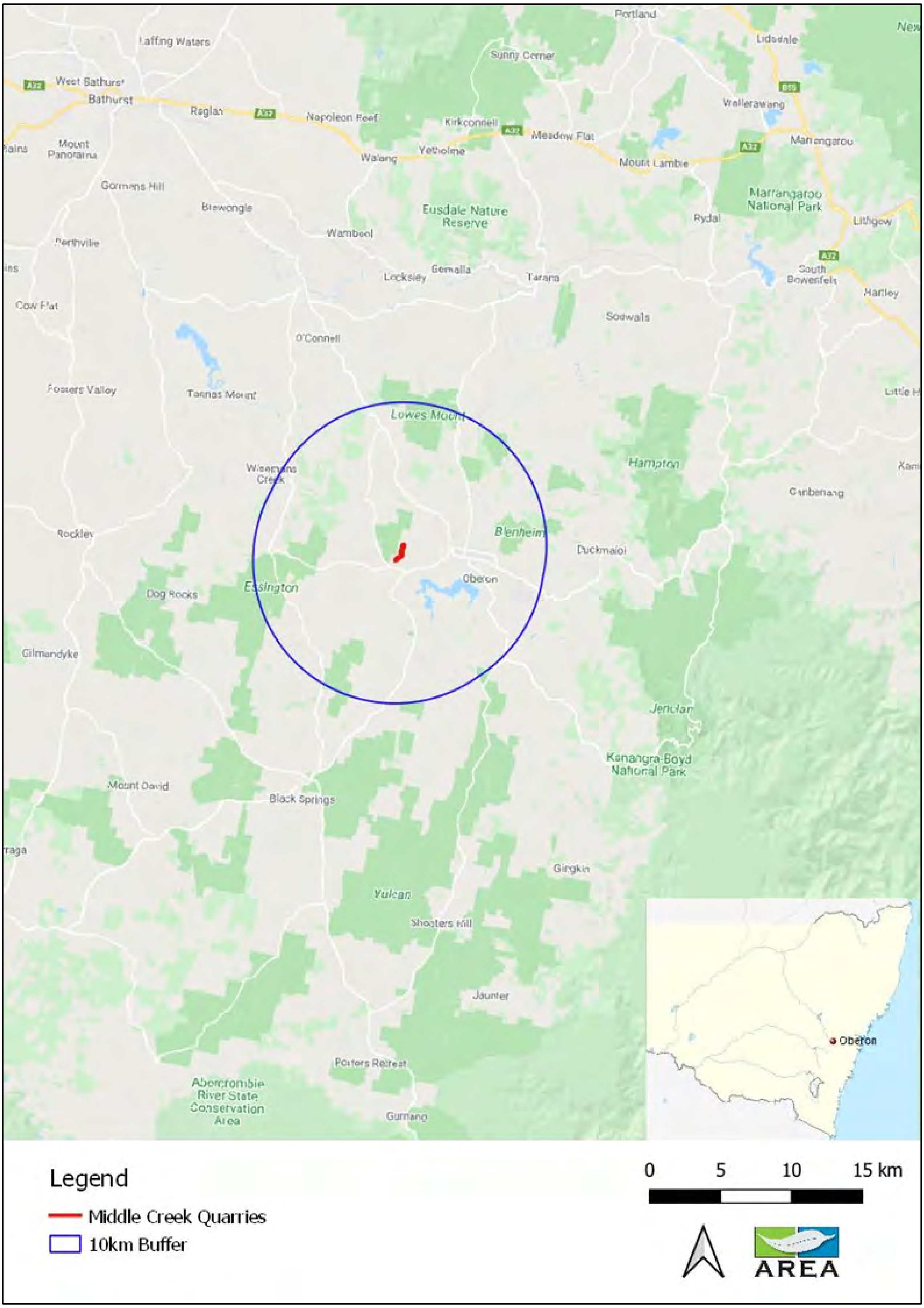

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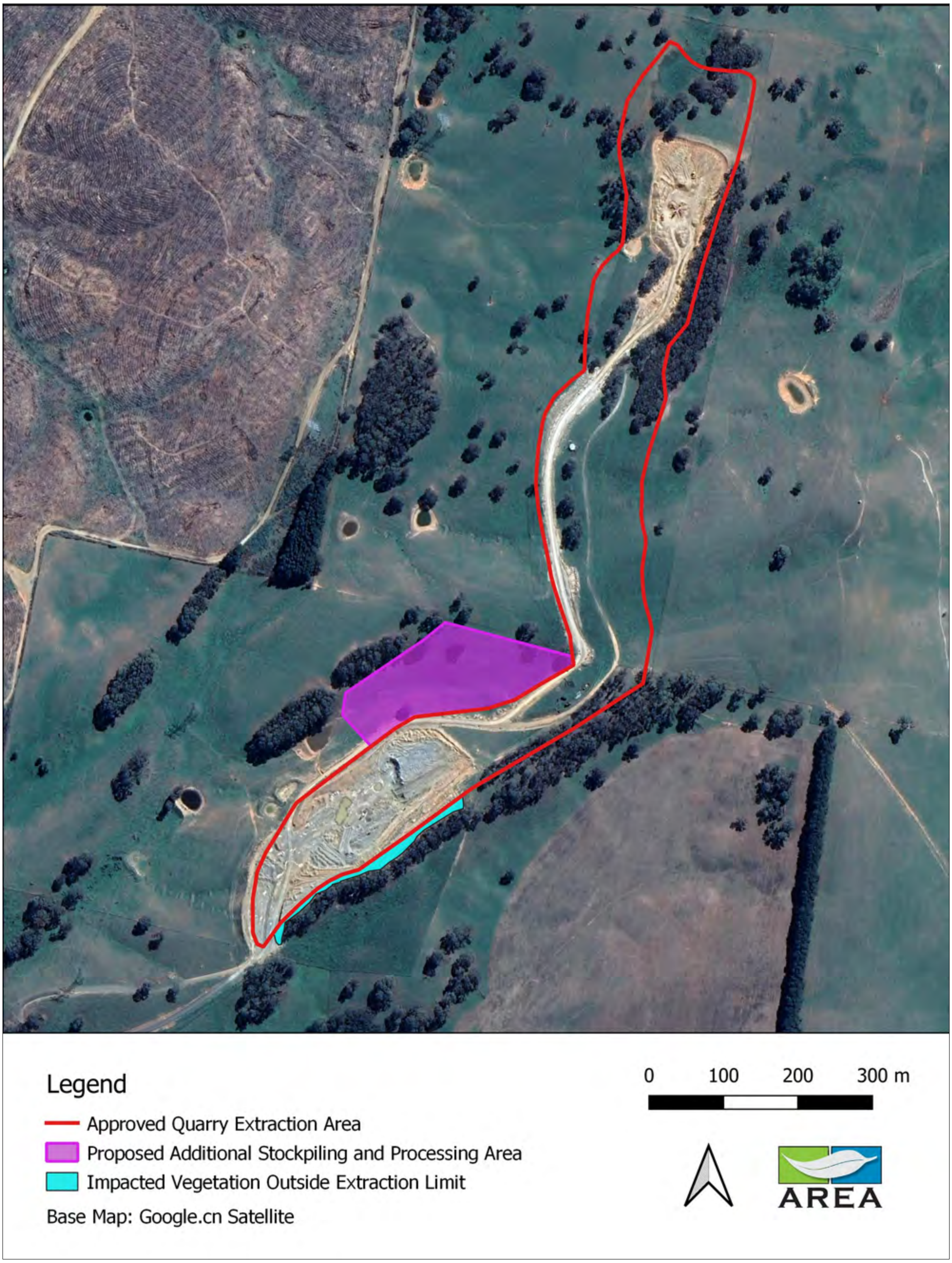
Figure 1-3: Study Area and currently Approved Quarry Extraction Area

Figure 1-4: Proposed Development Footprint



1.2 Legislative context

Middle Creek Quarries have previously been approved as a Designated Development for the purpose of the extractive industry and is also classified as Regional Development.

The proposed modification is assessed as substantially the same development and may be modified under Section 4.55(2) of the EP&A Act.

Under s.4.15(1)(b) of the EP&A Act, Oberon Earthmoving Pty Limited must consider “the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality”.

A Statement of Environmental Effects (SoEE) is prepared to meet requirements under s.4.15(1)(b) of the EP&A Act. The SoEE must assess the impact of the proposed development on biodiversity values to determine if the proposed development is “likely to significantly affect threatened species” for the purposes of Section 7.2 of the *Biodiversity Conservation Act 2016* (BC Act). This Ecology Assessment is prepared for the SoEE.

Oberon Earthmoving Pty Limited must also consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

2 Methods

2.1 Personnel

This biodiversity assessment was completed by appropriately qualified and experienced ecologists (Table 2.1).

Table 2-1: Summary of AREA project teams' qualifications

Name	Position	CV Details	Role in this ecology report and experience
Phillip Cameron	Managing Director	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland. • Certified Environmental Practitioner (EIANZ) and practicing member. • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117. • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS17082). • Cert III Captive Vertebrate Management • NSW OEH Scientific License: 101087. • NSW DPI Ethics Approval 17/459 (3). • Practicing member of the NSW Ecological Consulting Association. • WHS White Card, Blue Card and RIW. • Apply First Aid (Parasol) ID: 6007221.	**Role** Field assessment, certification, review and quality assurance. **Experience** Phil has 30 years of experience implementing biodiversity assessments and monitoring operations pre and post approval for projects including solar farms, linear developments, mining operations, quarry expansions and conservation projects. Phil has experience overseeing the environmental aspects of green field mining clearing and construction projects as well as site rehabilitation.
Addy Watson	Biodiversity Manager	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW • B. Env. Sc. University of New England. • Diploma Project Management • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS19066).	**Role** Project management, review and quality assurance. **Experience** Addy has 15 years' experience implementing biodiversity assessments and monitoring operations pre and post approval for projects including linear developments, mining operations, quarry expansions and conservation projects. Addy has a conservation, regulation and mining background.
Genevieve Peel	Environmental Consultant	• Bachelor of Science, Environmental (Hons) UNSW • Cert III Captive Animal Management • Cert IV Veterinary Nursing	**Role** Report writing **Experience** Gen has a conservation background and has experience in writing REF's, Biodiversity and Ecology Reports, Vegetation Management Plans, Monitoring Reports for mining, transport, telecommunications etc
Rohan Saunders	Rohan Saunders	• Bachelor of Science, Environmental (in progress) CSU • White Card	**Role** Report Update **Experience** Rohan has experience in conducting Koala and vegetation surveys. Writing various reports and BARs.

2.2 Desktop assessment

Desktop assessment included a review of threatened species databases and considered state and Commonwealth environmental classifications. The following sources of information were used:

- BioNet Atlas of NSW Wildlife Database http://www.bionet.nsw.gov.au
- NSW Department of Primary Industries (DPI) Council and Developer Toolkit https://www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit
- Department of Agriculture, Water and the Environment's Protected Matters Search Tool http://environment.gov.au/erin/ert/epbc/index.html
- Critical habitat registers available on the:
    - NSW Environment, Energy and Science (EES) website http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm
    - DPI NSW (Fisheries) website http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register
    - Department of Agriculture, Water and the Environment's website http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl
- EES vegetation information system (VIS) database http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx
- Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) http://www.bom.gov.au/water/groundwater/gde/map.shtml
- Department of Agriculture, Water and the Environment's directory of important wetlands: http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW
- Department of Planning, Infrastructure and Environment's SEPP (Coastal management) 2018 spatial data https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management
- DPI's database for aquatic Threatened Ecological Communities: http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what-current
- Native Vegetation Regulatory Map
- Biodiversity Values Map.

The results from the desktop assessment are presented in Section 4 under the relevant headings.

2.2.1 Literature Review

A literature review was not conducted. The assessment context was based on database search results.

2.3 Field survey

The field assessment occurred on 28 July 2020 and was conducted by Managing Director, Phillip Cameron and Environmental Research Assistant, Alex Cameron of AREA Environmental & Heritage Consultants (AREA).

Field surveys ground-truthed the results of the background research and assessed habitat values. As such, any threatened species, populations or communities that are considered likely to occur within the development footprint were targeted during the field survey to determine presence or likely occurrence.

Survey included identification and mapping of plant community types, threatened species searches, habitat identification and weed / pest identification. The day was spent completing vegetation plots, mapping vegetation, walking search transects and inspecting all habitat trees in the development footprint.

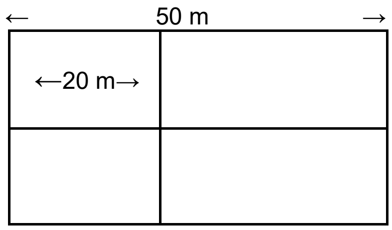
Results of the assessment are provided in Section 4 of this report.

2.3.1 Vegetation surveys

The survey included assessment on foot of existing vegetation in the development footprint. This assessment involved:

- identification, measurement and habitat assessment with focus on trees and habitat most likely to be removed by the proposal
- targeted searches for threatened species to meet biodiversity and impact assessment requirements of Part 7 of the NSW *Biodiversity Conservation Act 2016*
- recording presence of exotic species; High Threat Weeds or Weeds of National Significance were identified.

Vegetation surveys were completed in line with the Biodiversity Assessment Methodology 2017 (BAM) to capture the value of the vegetation within the study area and to help to inform what native species to recommend for landscape and visual planting. Two plot-based full floristic surveys were completed, based on a nested 20m × 50m quadrat.



Floristic and structural data were collected from each of the plots in accordance with the Biodiversity Assessment Method 2017 (BAM 2017). BAM plot data is provided in Appendix F.

The conservation value of grassland and other groundcover vegetation areas were assessed using transect-intercept survey methods according to the NSW DPIE's *Interim Grasslands and other Groundcover Assessment Method.* This is the appropriate guidance material for a project seeking approval under Part 4 of the NSW EP&A Act.

Native vegetation was classified according to the Plant Community Types (PCTs) in the DPIE BioNet Vegetation Information System (VIS) Classification Database. Vegetation described in this report will refer to PCTs described in the NSW DPIE VIS Map 4778 as well as those confirmed to be present in the study area after field survey. The VIS was used to indicate where a PCT may be associated with a TEC.

Targeted searches for listed flora were completed using transects in accordance with requirements of NSW *Guide to Surveying Threatened Plants.*

2.3.2 Targeted fauna surveys

Assessment considered the likelihood of threatened species to occur in the development footprint based on desktop assessment and evidence of suitable habitat recorded during the field survey. Where threatened species were considered likely to occur or use suitable habitat in the development footprint, the potential impact of the proposal on these species was considered.

Fauna surveys during the field assessment were restricted to opportunistic sightings, flushing of ground birds during field survey, checking trees for signs of koala and applying the Spot Assessment Technique (SAT, Phillips and Callaghan 2011) technique where required and other species and assessment and mapping of the habitat values present in the development footprint. Each tree was inspected for hollows and the development footprint was searched for threatened fauna habitat.

Listed microbats with potential to occur in hollows were presumed to potentially occur as ultrasonic bat call detection was not used (see Section 2.5).

Some risk exists for threatened species to be encountered during the implementation of this work. Appendix C provides a Fauna Handling and Rescue Procedure to follow if there are any fauna encountered during construction.

2.3.3 Aquatic Surveys

No aquatic surveys were conducted as part of the assessment as no aquatic environs occur in the study area.

2.4 Tests and assessments of significance

Tests of significance were undertaken for all relevant threatened species, populations and communities listed under the *Biodiversity Conservation Act 2016* (BC Act) considered likely to occur in the development footprint, and which have the potential to be impacted by the proposal.

Where these species were listed under the EPBC Act, an assessment of significance using the EPBC Act Significant Impact Guidelines was conducted (DoE 2013).

Likelihood of occurrence in the development footprint was considered for listed species, populations, communities and migratory species identified from database searches. Potential for each species to be affected by the proposal was also considered. The following three terms of likelihood were used in this process:

- "Unlikely" = a very low to low probability a species uses the development footprint. An assessment of significance under the EPBC or BC Acts is not required for this species.
- "Potential" = a medium to high probability a species uses the development footprint. An assessment of significance under the EPBC or BC Acts is required for this species
- "Yes" = the species was or has been observed on the development footprint. An assessment of significance under the EPBC or BC Acts is required for this species.

Where species were scored 'Potential' or 'Yes' for likelihood of occurrence and 'Yes' for potential to be impacted by the proposal, a test or assessment of significance has been completed (Appendix B).

The decision processes for tests of significance are described as described under the following Acts:

BC Act

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

> (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
>
> (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(c) in relation to the habitat of a threatened species or ecological community:

> (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
>
> (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
>
> (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),
(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

EPBC Act

1. A ‘population of a species’ as determined by the *Environment Protection and Biodiversity Conservation Act 1999* is an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
   a. a geographically distinct regional population, or collection of local populations, or
   a population, or collection of local populations, that occurs within a particular bioregion.
2. Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:
   a. is likely to be key source populations either for breeding or dispersal
   b. is likely to be necessary for maintaining genetic diversity
   c. is at or near the limit of the species range.
3. An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will: a) lead to a long-term decrease in the size of an important population of a species b) reduce the area of occupancy of an important population c) fragment an existing important population into two or more populations d) adversely affect habitat critical to the survival of a species e) disrupt the breeding cycle of an important population f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat h) introduce disease that may cause the species to decline, or i) interfere substantially with the recovery of the species.
4. An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will: a) reduce the extent of an ecological community b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines c) adversely affect habitat critical to the survival of an ecological community d) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community’s survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns e) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting f) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or g) causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological

2.5 Limitations

Not all animals and plants can be fully accounted for within any given study area. The presence of threatened species is not static and changes over time, often in response to longer term natural forces which can at any time be dramatically influenced by anthropogenic disturbance or weather. A ‘precautionary approach’ for species occurrence has been adopted where required.

Other, specific limitations associated with the survey included the following:

- Trapping was not a component of the assessment. This was not considered critical. Where suitable habitat was available in the development footprint, predicted threatened fauna was considered likely to occur.
- Microbat ultrasonic call capture was not a component of the assessment. Some species of microbat will use vegetation or quarry workings as roosting sites. Microbat species predicted to occur in database searches were assessed based on the species likelihood to use the habitat in the development footprint.
- Nocturnal assessments were not a component of the assessment. This was not considered critical. Where suitable habitat was available in the development footprint, predicted threatened fauna was considered likely to occur.

The above-mentioned constraints are not considered to compromise the findings or results of the field assessment given the previous disturbance of the site, and small size of the development footprint.

3 Project Context

3.1 Regional context

An overview of the regional context is provided in Table 3-1. Regional context is further illustrated in Figure 3-1.

Table 3-1: Regional context of the study area

Criteria	Value
Lot and DP	Lot 2 DP1112479
Interim Biogeographic Regionalisation for Australia (IBRA Region)	South Eastern Highlands (IBRA 7), Oberon Subregion
State	New South Wales
Local Government Area	Oberon Council LGA
Nearest town / locality	Oberon
Accessed from nearest town by	Sewells Creek Road
Land use / disturbance	Primary Production (Grazing) and Quarry Operations
Nearest waterway (Name, Strahler Order)	One unnamed first Strahler Order drainage lines occur in the development footprint which runs into an existing farm dam 20 metres from the development footprint. Captain Kings Creek lies approximately 200 metres south of the development footprint. In this location it is a first Strahler Order waterway
Spot point Australian Height Datum (AHD)	1130m to 1160m AHD
Surrounding land use	Existing quarry operation, pine plantation/ state forest, grazing and other primary production and rural residential.

Other regional, national and international environmental matters relative to the development footprint are considered in Table 3-2 and illustrated in Figure 3-2 and Figure 3-3.

Table 3-2: Proximity of environmentally sensitive areas to the development footprint

Environmental Considerations	In the development footprint?
Commonwealth land?	No
An area reserved or a dedicated National Park?	No
Is the proposal located within land reserved or dedicated for preservation of other environmental protection purposes?	No
A World Heritage Property or Area?	No
National or Commonwealth Heritage Place?	No
Environmental Protection Zones in environmental planning instruments?	No
Land identified in an Act as wilderness?	No
Wetland areas dedicated under the Ramsar Wetlands Convention?	No
Great Barrier Reef or Marine Park?	No
Commonwealth Marine Area?	No
Critical habitat state or nationally?	No
An area mapped as Key Fish Habitat?	No

Environmental Considerations	In the development footprint?
An area mapped on the Biodiversity Values (BV) map?	No - Captain Kings Creek which runs through the study area, approximately 200 metres south of the development footprint is mapped on the BV Map. This area will not be impacted (Figure 3-2).
An area mapped on the Native Vegetation Regulation (NVR) map?	No - Captain Kings Creek which runs through the study area, approximately 200 metres south of the development footprint is mapped as Category 2 – Vulnerable Regulated Land. This area will not be impacted (Figure 3-3).

Figure 3-1: IBRA subregions and LGA boundaries

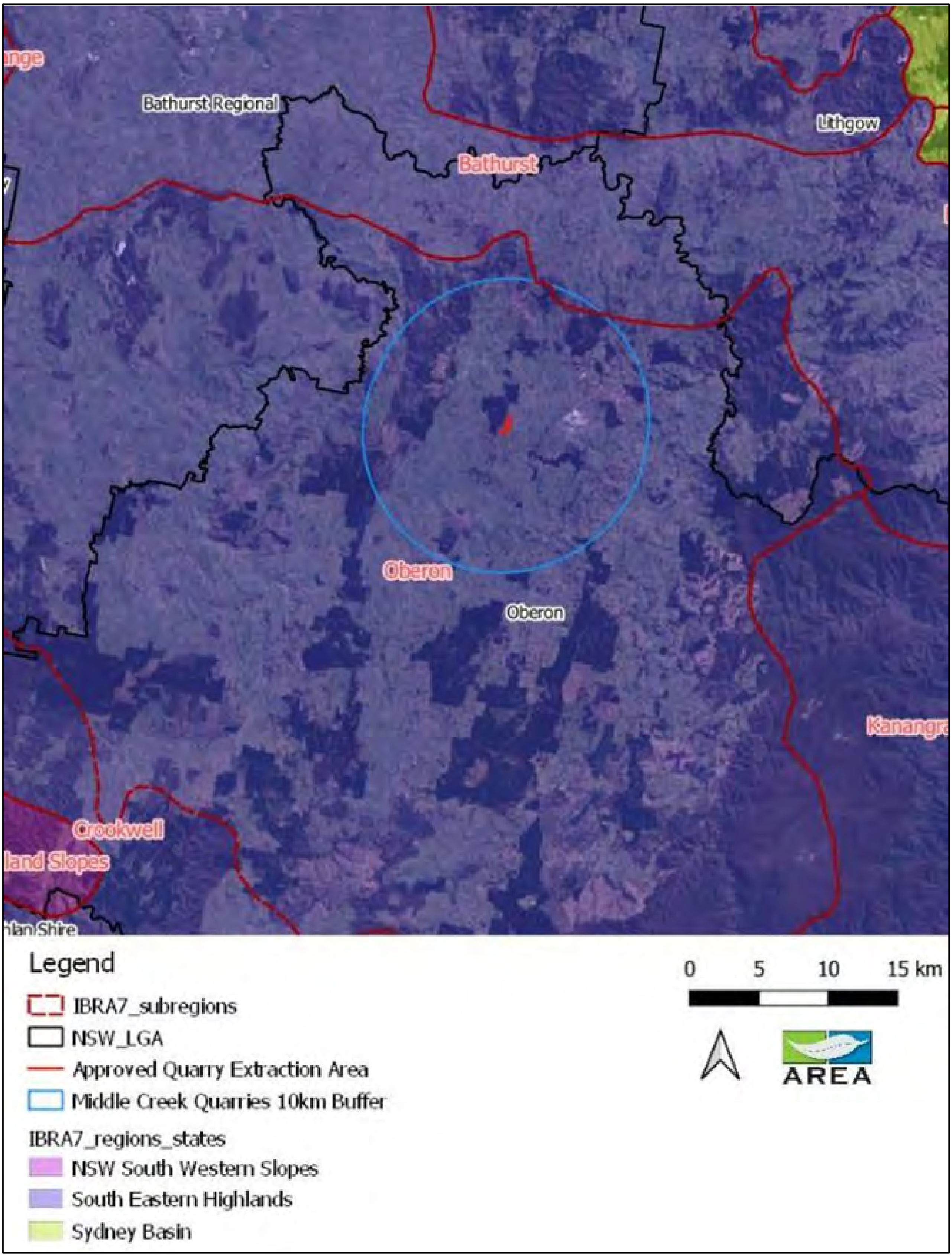


Figure 3-2: Biodiversity Values Map (development footprint circled in red)

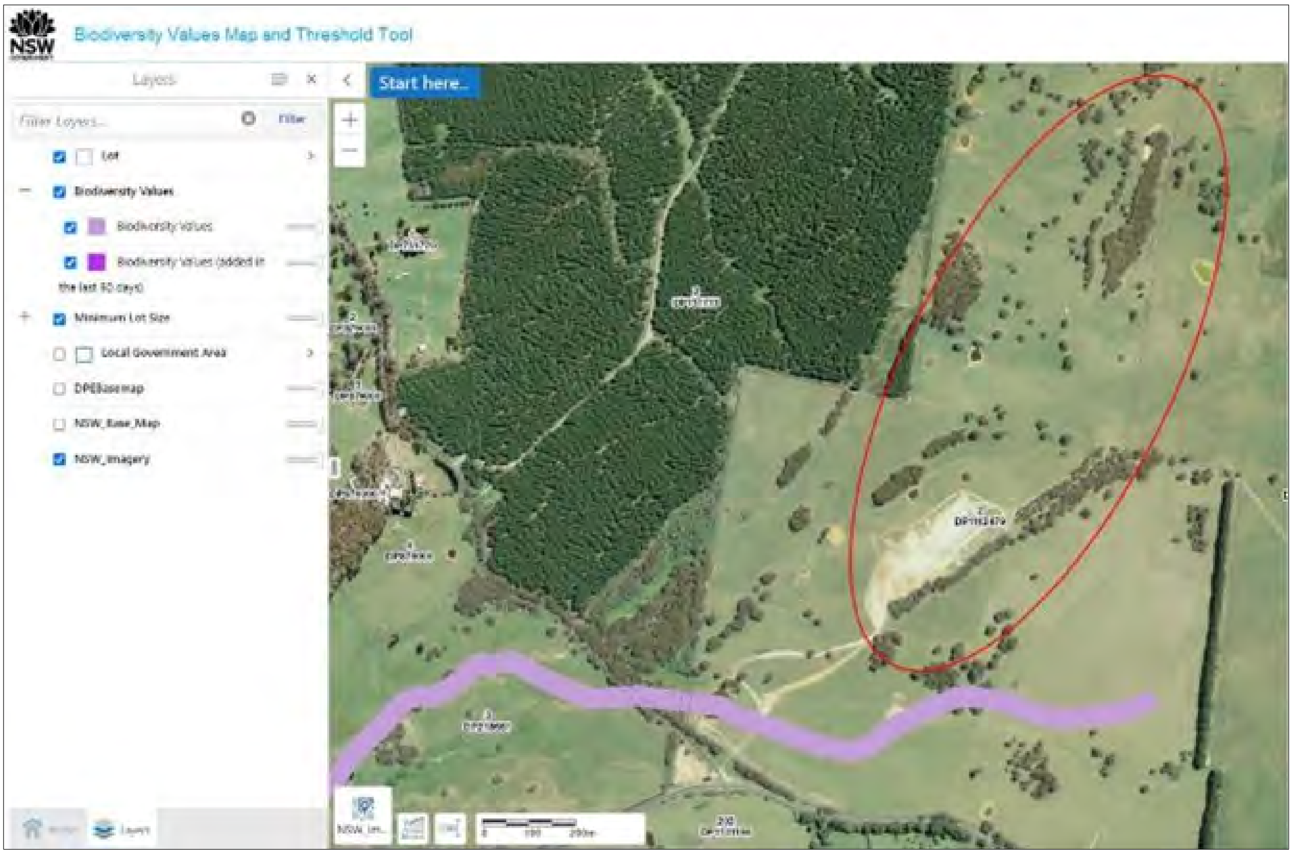
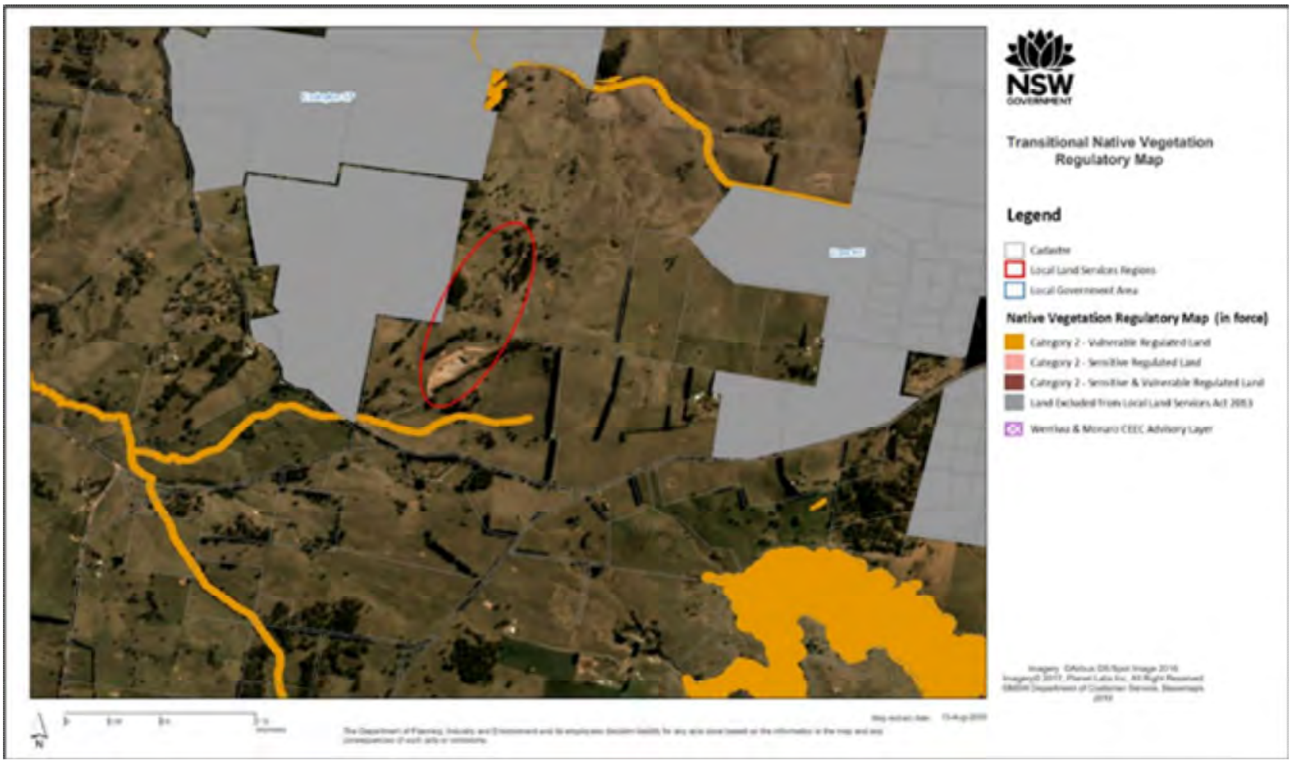


Figure 3-3: Native vegetation Regulatory Map (development footprint circled in red)



3.1.1 IBRA bioregion and subregion

The South Eastern Highlands Bioregion lies just inland from the coastal bioregions of the South East Corner and the Sydney Basin, bounded by the Australian Alps and South Western Slopes bioregions to the south and west. The bioregion includes most of the ACT and extends south into Victoria.

With a total area of about 8,749,155 hectares, 55.9 per cent or 4,888,633 hectares of the South Eastern Highlands Bioregion lies in NSW. The bioregion occupies approximately 6.11 per cent of the state.

The bioregion includes the towns of Orange, Oberon and Lithgow in the north, Goulburn, Queanbeyan and Yass in the centre and Cooma, Jindabyne and Bombala in the south. https://www.environment.nsw.gov.au/bioregions/SouthEasternHighlandsBioregion.htm

The Oberon Subregion consists of fine grained Silurian and Devonian slates, shales and sandstones with Ordovician acid volcanics. Basalt caps and flows are on the highest crests. There are rounded and stepped hills of plateau, dendritic drainage pattern parallels basalts on crests and ridges. Typical soils consist of red and yellow texture contrast soils on slopes, well-structured deep red loams on basalt. They are moderately fertile soils but cold environment.

Vegetation is typically narrow-leaved peppermint, mountain gum and some snow gum on high areas. Apple box, yellow box, ribbon gum and Blakely's red gum in the west. https://www.environment.nsw.gov.au/bioregions/SouthEasternHighlands-Subregions.htm.

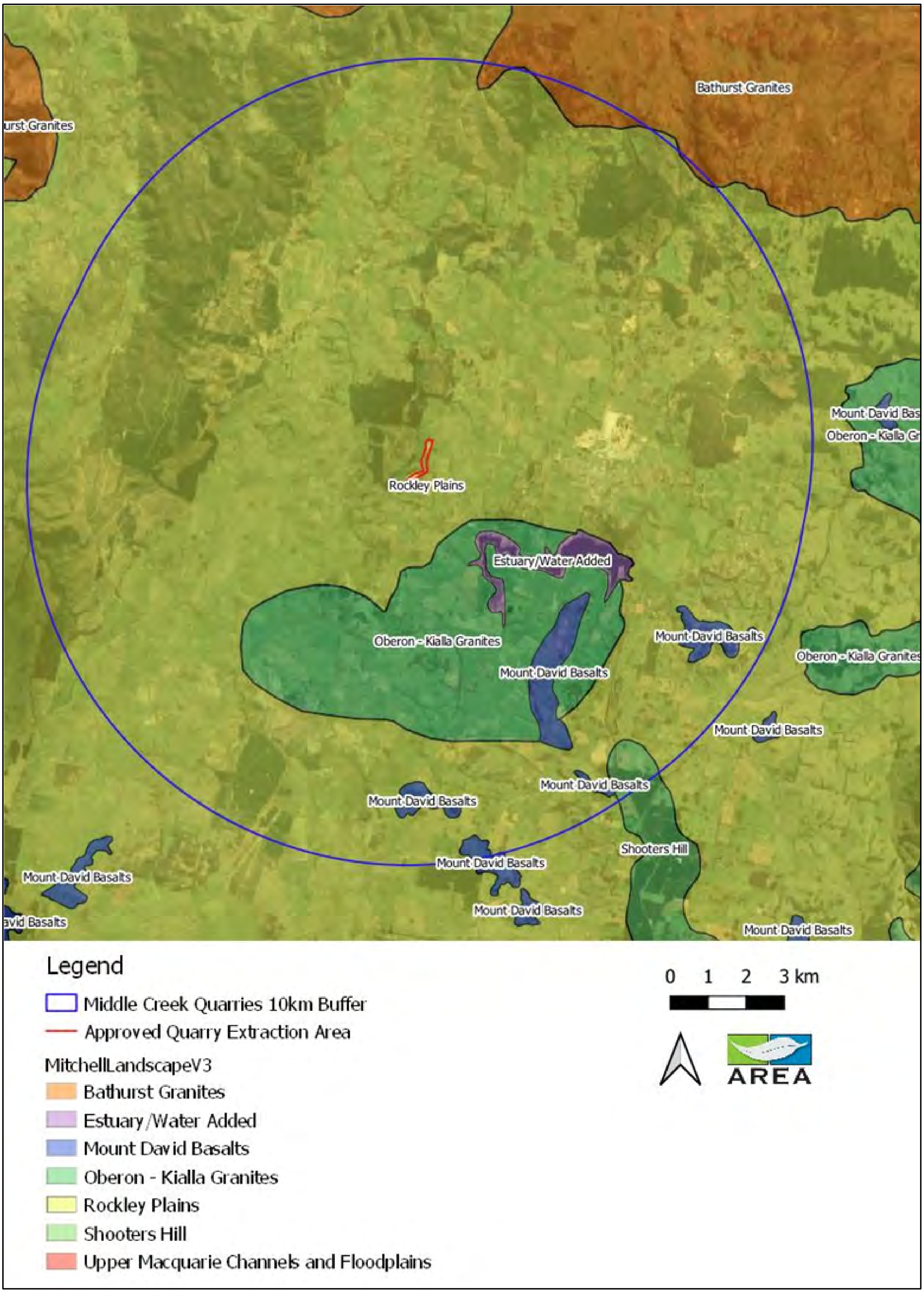
3.1.2 NSW landscapes

The development footprint occurs entirely within the Rockley Plains NSW Landscape (Mitchell 2002; Figure 3-4).

Table 3-3: NSW Mitchell landscapes over the development footprint (source Mitchell 2002, OEH 2013)

Landscape	Landscape characteristics (geomorphic, pedologic and vegetation)	Per cent of landscape cleared
Rockley Plains	Low rolling hills on plateau surface with Silurian and Ordovician slate, phyllites, felspathic sandstones and interbedded volcanics. General elevation over 1000m, relief to 150m. Red and yellow texture-contrast soils with often with prominent bleached A2 horizons. Mixed eucalyptus forest and woodlands including peppermints (Eucalyptus sp.), stringybark (Eucalyptus sp.), candlebark (Eucalyptus rubida), brittle gum (Eucalyptus mannifera) and snow gum (Eucalyptus pauciflora). Cold air drainage hollows with grasslands and swamps.	62

Figure 3-4: NSW Landscapes



4 Assessment

Matters of National Environmental Significance (MNES) are identified by the Protected Matters Report generated by the Protected Matters Search (Appendix A). The report included the area covered by the development footprint with a one-kilometre buffer. Matters raised by this report are included under the relevant chapters in this document in conjunction with NSW matters.

4.1 Native vegetation

4.1.1 Vegetation database searches

The NSW government State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778 was accessed via the NSW Government SEED website (https://datasets.seed.nsw.gov.au/).

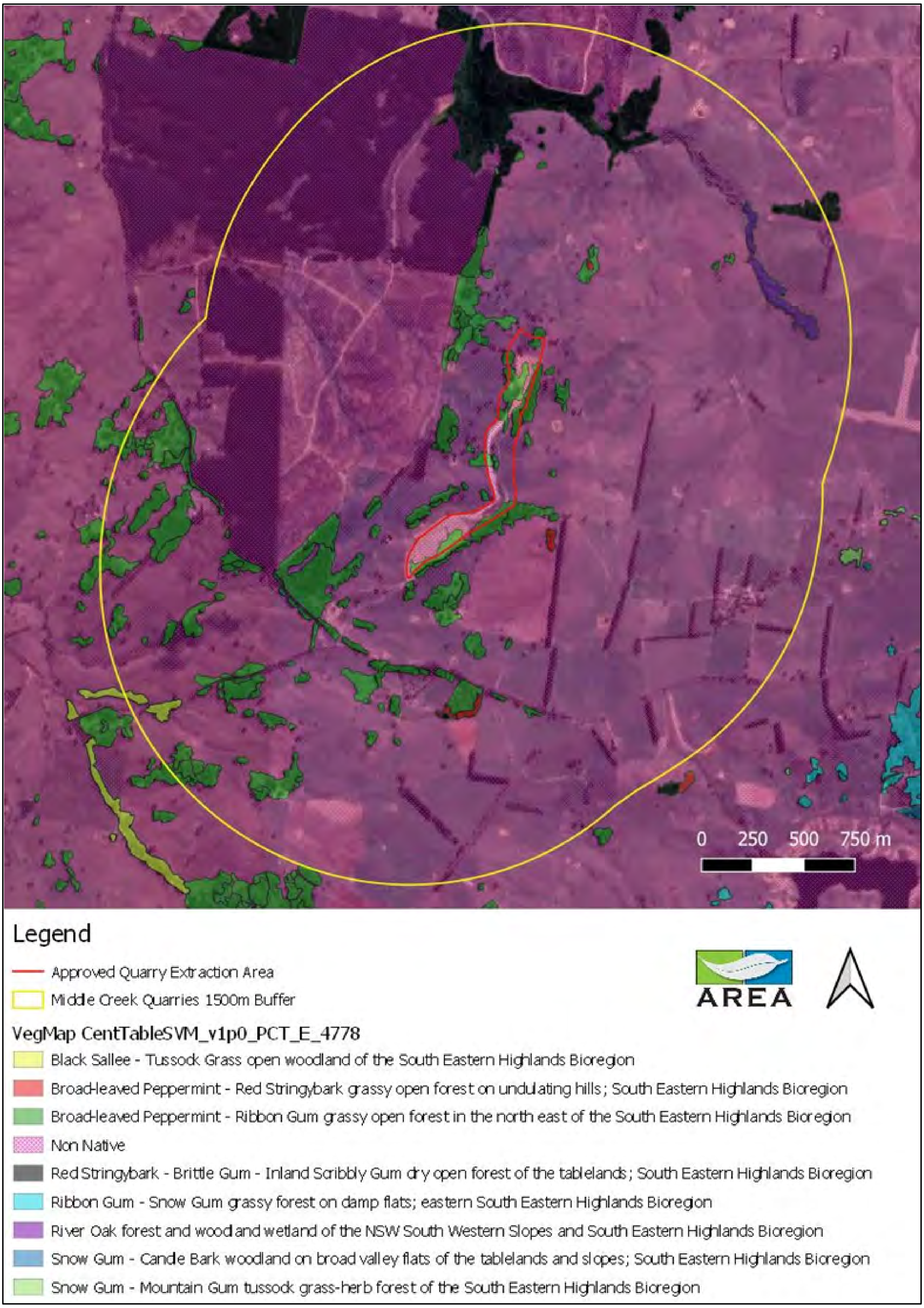
The development footprint is partially mapped as non-native vegetation because of previous disturbance. Seven Plant Community Types are mapped within 1500 metres of the development footprint (Figure 4-1). Vegetation in the development footprint was ground-truthed and more accurately mapped (see Section 4.1.3).

Native Vegetation Regulatory Map and Biodiversity Values Map

The development footprint is not in areas mapped on the Native Vegetation Regulatory Map nor the Biodiversity Values Map. Assessment under the Biodiversity Offset Scheme is not triggered through the Biodiversity Values Map.

Captain Kings Creek which runs through the study area, approximately 200 metres south of the development footprint is mapped on the BV Map and as Category 2 – Vulnerable Regulated Land. This area will not be impacted (Figures 3-2 and Figure 3-3).

Figure 4-1: Plant Community Types mapped within 1500 m of the development footprint on the SVTM



4.1.2 Vegetation field assessment of the study area

The study area incorporates Lot 2 DP1112479 and consists of an operational quarry, located within land that is zoned for primary production and has been extensively grazed and cleared. There are fragmented patches of native vegetation within Lot 2 DP1112479 and the Essington State Forest, a monocultural softwood pine forest plantation, lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

Field survey found the native vegetation in the study area is a dry sclerophyll forest with a mostly absent shrub layer and dense grassy, highly weedy groundcover, which has been historically cleared for primary production and quarry operations. Due to recent rain the area was boggy and waterlogged.

The NSW State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778 shows the following PCT's in and around the study area (see Section 4.1.3):

- PCT731 *Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion*
- PCT732 Broad-leaved Peppermint - *Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion*.

Field assessment determined the vegetation in the study area had a dominance of Broad-leaved Peppermint *Eucalyptus dives* and Mountain Gum *Eucalyptus dalrympleana* subsp. *Dalrympleana.* Blakely's Red Gum *Eucalyptus blakelyi* was recorded sparsely in the study area. The presence of native ground stratus species, rough spear grass *Austrostipa scabra,* was detected, but an estimate of approximately 90 per cent of groundcover species were not native.

After consideration of the upper, mid and ground stratum species recorded in the study area and the regional context, the native vegetation in the study area has been groundtruthed and mapped as PCT730 *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion.* PCT730 (described below) is the best fit for the vegetation in the study area due the dominance of the two previously mentioned Eucalypt species.

PCT730: Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion

Vegetation formation: Southern Tableland Dry Sclerophyll Forests;

Conservation status: Listed TSC Act,E: Mt Canobolas Xanthoparmelia Lichen Community (Part) ; Listed TSC Act,E: Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions (Part) ;

Estimate of percent cleared: 90

Description: Occurs on deep volcanic or granitic soils.
Landscape Position: On broad higher parts of the Crookwell and Taralga plateaux.
Upper stratum species: *Eucalyptus dives; Eucalyptus dalrympleana subsp. dalrympleana; Eucalyptus macrorhyncha.*
Mid stratum species: *Acacia dealbata; Daviesia latifolia;*
Ground stratum species: *Hibbertia obtusifolia; Hydrocotyle laxiflora; Joycea pallida; Poa sieberiana var. sieberiana; Themeda australis; Danthonia racemosa var. racemose.*

4.1.3 Vegetation field assessment of the development footprint

The development footprint incorporates the following two areas:

1. An extension to the west of the previously approved extraction limit for an additional stockpiling and processing area. This area is mapped as the *Proposed Additional Stockpiling and Processing Area* and covers a total of 2.54 hectares.

2. Impacts of clearing already undertaken outside the previously approved extraction limit on the southern side of Extraction Cell 1. This area is mapped as *Impacted Vegetation Outside Extraction Limit* and covers a total of 0.31 hectares.

Native vegetation within the development footprint reflects historic severe ground surface disturbance and is highly altered and weed dominated with large areas of exotic grasses and weed species (Section 4.6). PCT730 was determined to occur where there are trees only and the remaining grassland areas were highly altered and consisted of greater than 90% exotic weed and grass species and this vegetation was assessed as low conservation value grassland (as per the *Interim Grasslands and other Groundcover Assessment Method).*

Vegetation field assessment of the two areas concluded the following:

1. The Additional Stockpiling and Processing Area (2.54 hectares) is mostly low conservation value grassland which is dominated by exotic species including Phalaris *Phalaris aquatica,* Soft Brome grass *Bromus hordeaceus* and perennial ryegrass *Lolium perenne.* There are five trees in the development footprint, four Broadleafed Peppermint *Eucalyptus dives* (two of which have hollows) and one Blakely's Red Gum *Eucalyptus blakelyi* which has a hollow. These trees will be impacted/removed and result in the impact to 0.11 hectares of PCT730.
2. The impacted vegetation outside the previously approved extraction limit has impacted a total of 0.31 hectares of PCT730.

Of a total 2.85 hectares of development footprint, 0.42 hectares of this would impact to native vegetation. The remaining 2.43 hectares were assessed as low conservation grassland, which has been heavily impacted by intensive grazing and invasive pasture grasses and weeds. Figure 4-2 shows PCT's previously mapped on the NSW BioNet Vegetation Information System (VIS) in and around the development footprint and Figure 4-3 illustrates the groundtruthed vegetation. Table 4-1 illustrates the vegetation in the different areas of the development footprint.

Figure 4-2: Plant Community Types – SVTM 4778

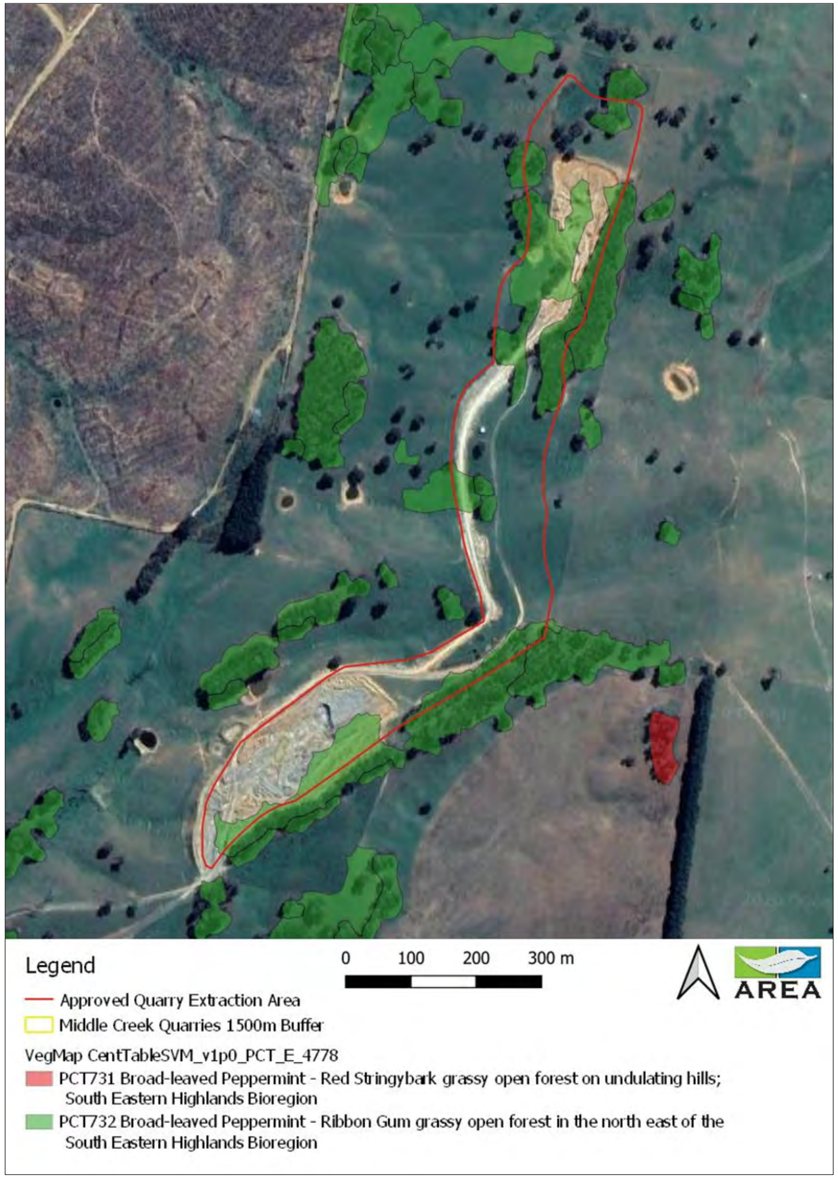


Figure 4-3: Groundtruthed Plant Community Types in development footprint

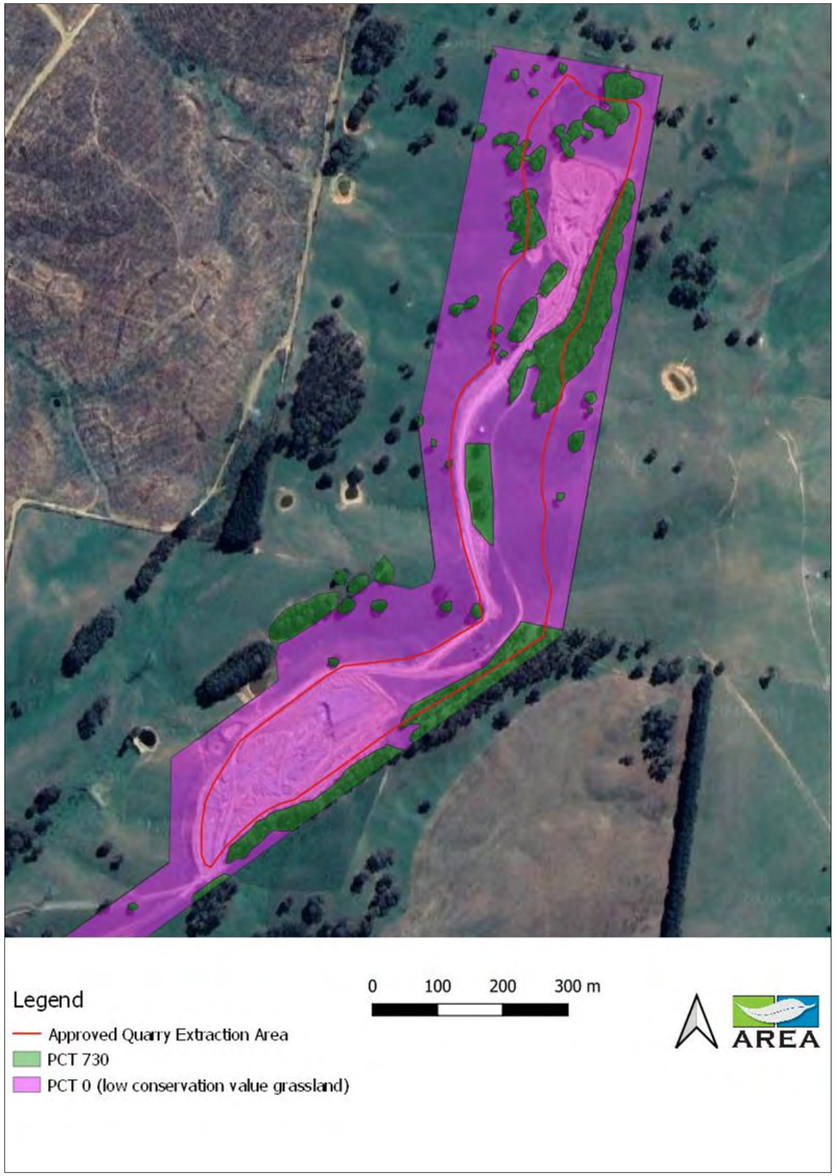


Table 4-1: Example vegetation in and adjacent to the development footprint

Location	Vegetation description	Photo
Additional Stockpiling and Processing Area, facing east	Low conservation grassland	
Additional Stockpiling and Processing Area, facing north	PCT730 occurs where there are trees, vegetation to the right and tree in centre of picture will not be impacted, tree to the left of the centre tree would be impacted.	
Additional Stockpiling and Processing Area, facing south	PCT730 occurs where there are trees, foremost tree and tree in the far left of this picture would be impacted.	

Location	Vegetation description	Photo
Clearing already undertaken outside the previously approved extraction limit on the southern side of the lower extraction area.	PCT730 adjoining disturbed area	
Clearing already undertaken outside the previously approved extraction limit on the southern side of the lower extraction area.	PCT730 adjoining disturbed area	
Vegetation surrounding mid section of the Quarry. This area will not be impacted by the proposal.	PCT730	
Vegetation surrounding northern extraction area. This area will not be impacted by the proposal.	PCT730	

4.1.4 Assessment of impact to vegetation

A summary of vegetation within the two different areas of the development footprint is provided in Table 4-2.

Table 4-2: Hectares of vegetation impacted by the proposal

PCT ID	PCT Name	Hectares in the development footprint
PCT730	Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion in the proposed Additional Stockpiling and Processing Area.	0.11
PCT730	Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion in the *already impacted* vegetation outside extraction limit.	0.31
PCT0	Low conservation value grassland	2.43
	Total	**2.85**

Figure 4-3 shows the location of impacted native vegetation in the development footprint. Impacted vegetation outside extraction limit has already been cleared and equates to 0.31 hectares. Figure 4-4 shows the location of the five trees within the development footprint.

Remaining vegetation in the development footprint has no shrubs and has been completely cleared of trees. It is highly disturbed and degraded from clearing, grazing and quarry operations. Greater than 90 per cent of groundcover was found to be exotic weed and grass species and the vegetation was assessed as low conservation value grassland.

The impact to native vegetation, including groundcover, within the development footprint would be minimised where reasonably practicable by detailed design.

Figure 4-4: Impacted native vegetation

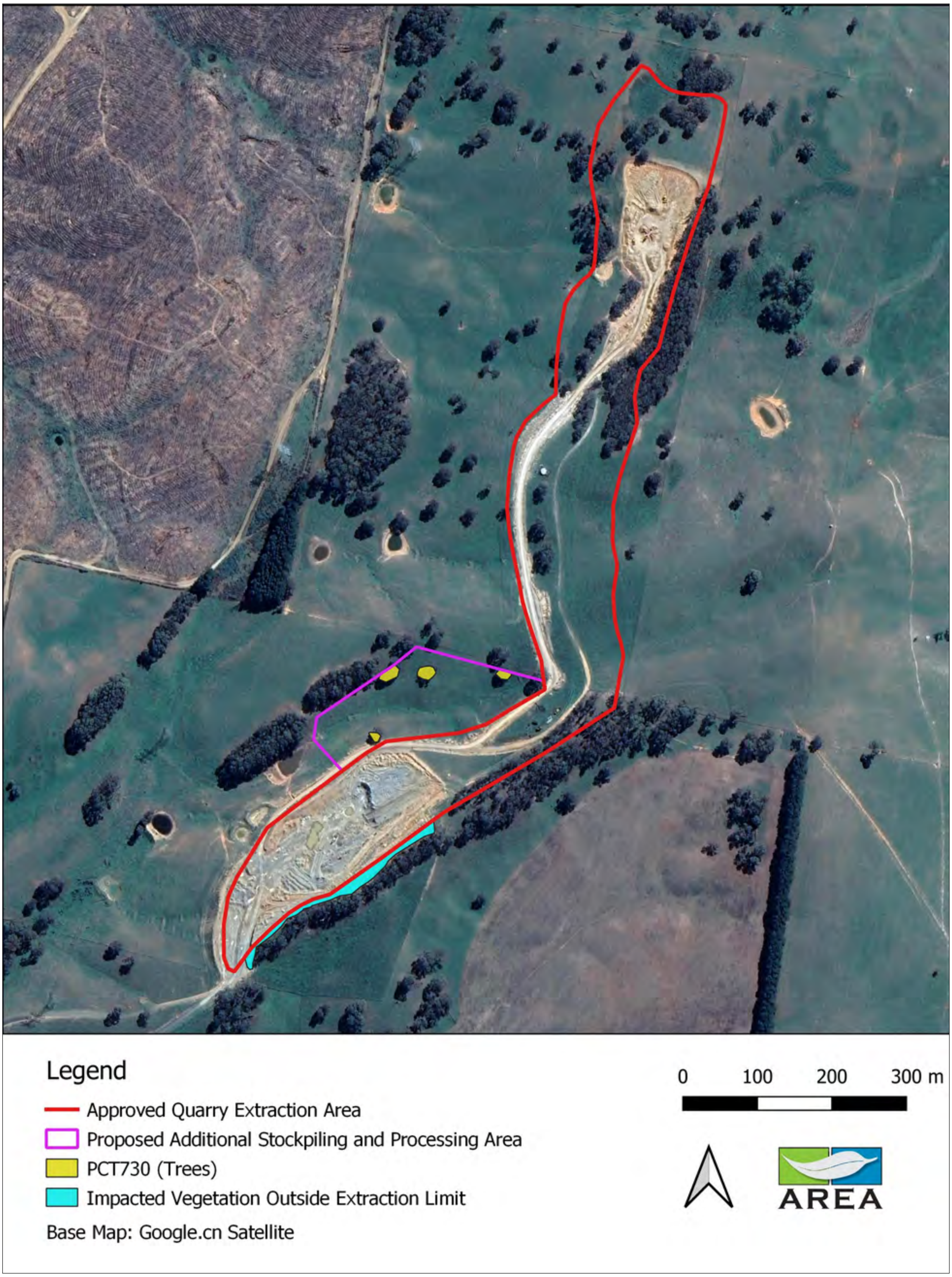
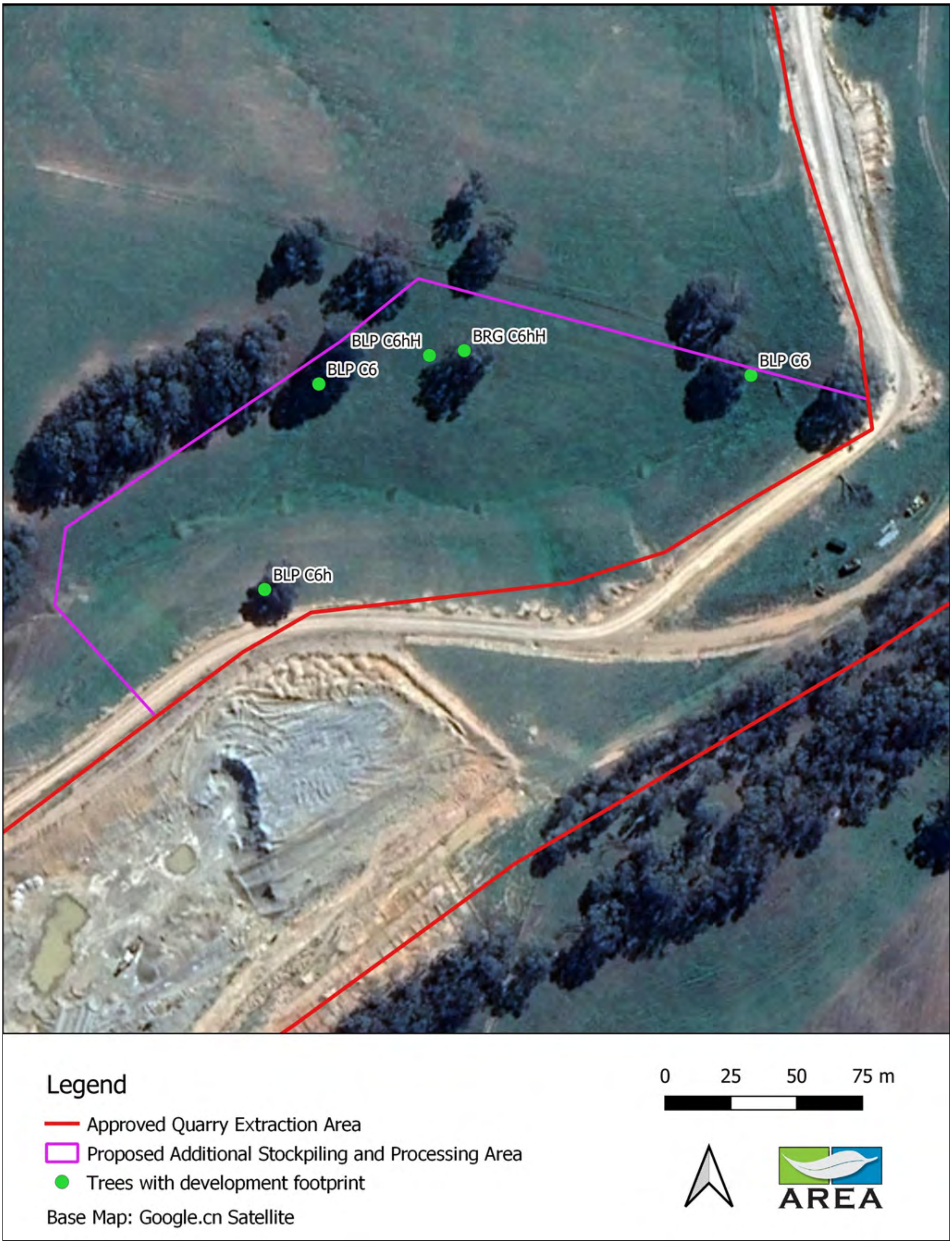


Figure 4-5: Trees within development footprint



Key: BLP (Broadleaved Peppermint), BRG (Blakely's Red Gum), C (Class size of tree following BAM Plot sheet), H (Tree hollow with a diameter of opening > 20cm), h (Tree hollow with a diameter of opening < 20cm but > 10cm).

4.2 Flora

4.2.1 Threatened flora species database searches

All threatened flora species database search results are incorporated into Table 4-3. Detailed results are attached in Appendix A.

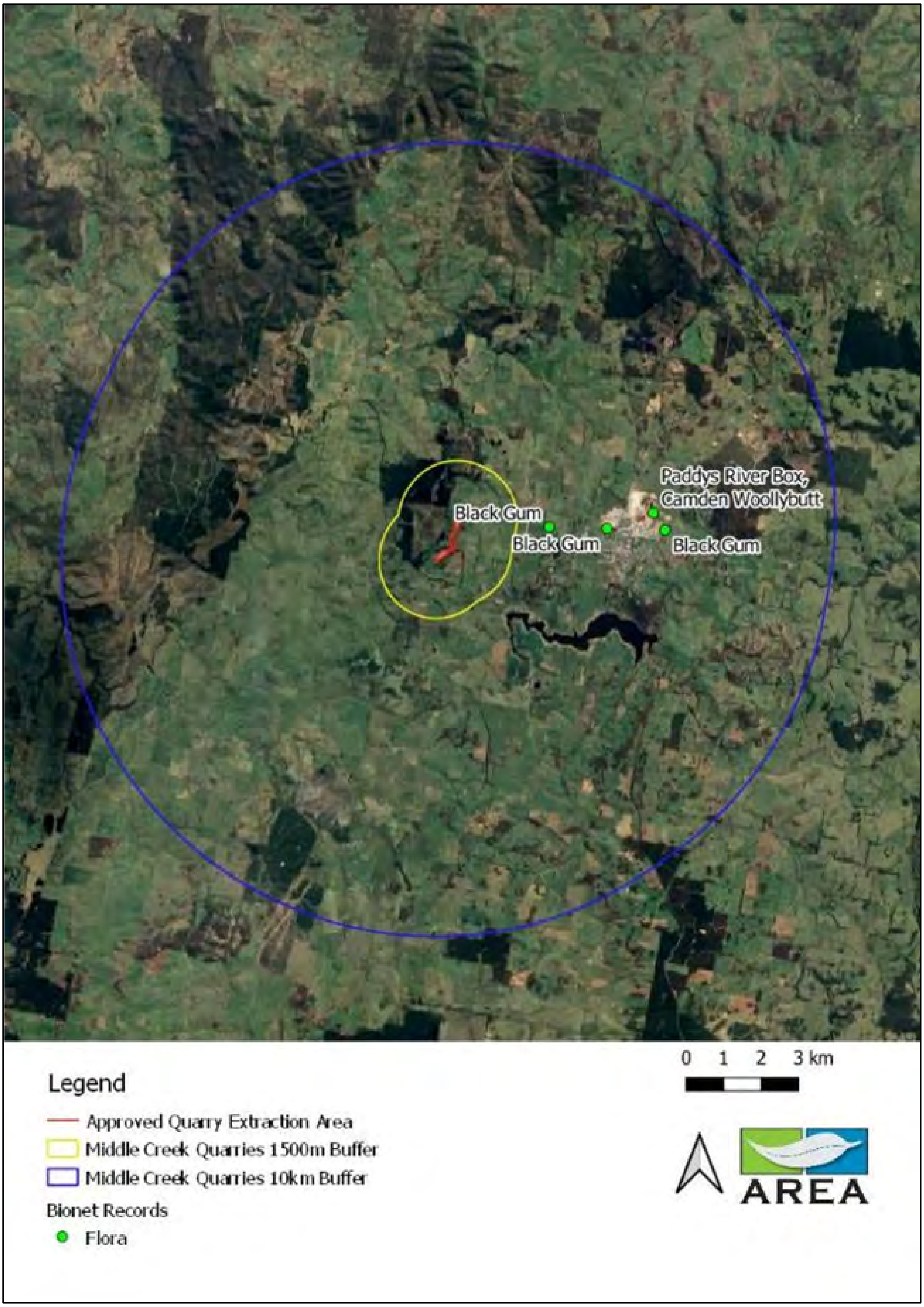
Table 4-3: Threatened flora database search results.

Database searched	Date searched	Result
BioNet- the website for the Atlas of NSW Wildlife Database: http://www.bionet.nsw.gov.au and OEH BAMCC Threatened Species outputs.	06/08/2020	**Atlas of Wildlife**, (Appendix A) 1.5 km radius • Nil 10 km radius • Black Gum *Eucalyptus aggregata* • Paddys River Box, Camden Woollybutt *Eucalyptus macarthurii* **OEH Threatened Species Profile Database** (Appendix A) A search using South Eastern Highlands Bioregion, Oberon subregion, filtered by Southern Tableland Dry Sclerophyll Forests showed nine species of flora having potential to use habitat in the proposal.
The federal Department of Environment's Protected Matters Search Tool: http://environment.gov.au/erin/ert/epbc/index.html	06/08/2020	**MNES predicted threatened flora species:** • Black Gum *Eucalyptus aggregata* • Silver-leaved Mountain Gum *Eucalyptus pulverulenta* • *Euphrasia arguta* • Hoary Sunray *Leucochrysum albicans subsp. tricolor* • Austral Toadflax *Thesium australe* • Swamp Everlasting *Xerochrysum palustre*

NSW predicted threatened plant species were identified using a predicted species search in the IBRA South Eastern Highlands Bioregion, Oberon subregion, which was filtered by Southern Tableland Dry Sclerophyll Forests (in line with the ground-truthed PCT). A Matters of National Environmental Significance (MNES) report was generated which highlighted the threatened species listed under the EPBC Act to within one kilometre of the study area (Appendix A). BioNet Atlas of Wildlife species sightings within 10 kilometres were considered relevant and included in assessment. BioNet sightings are illustrated Figure 4-6.

Potential impact to native vegetation and threatened flora identified by database searches and field survey is considered in Section 4.2.3.

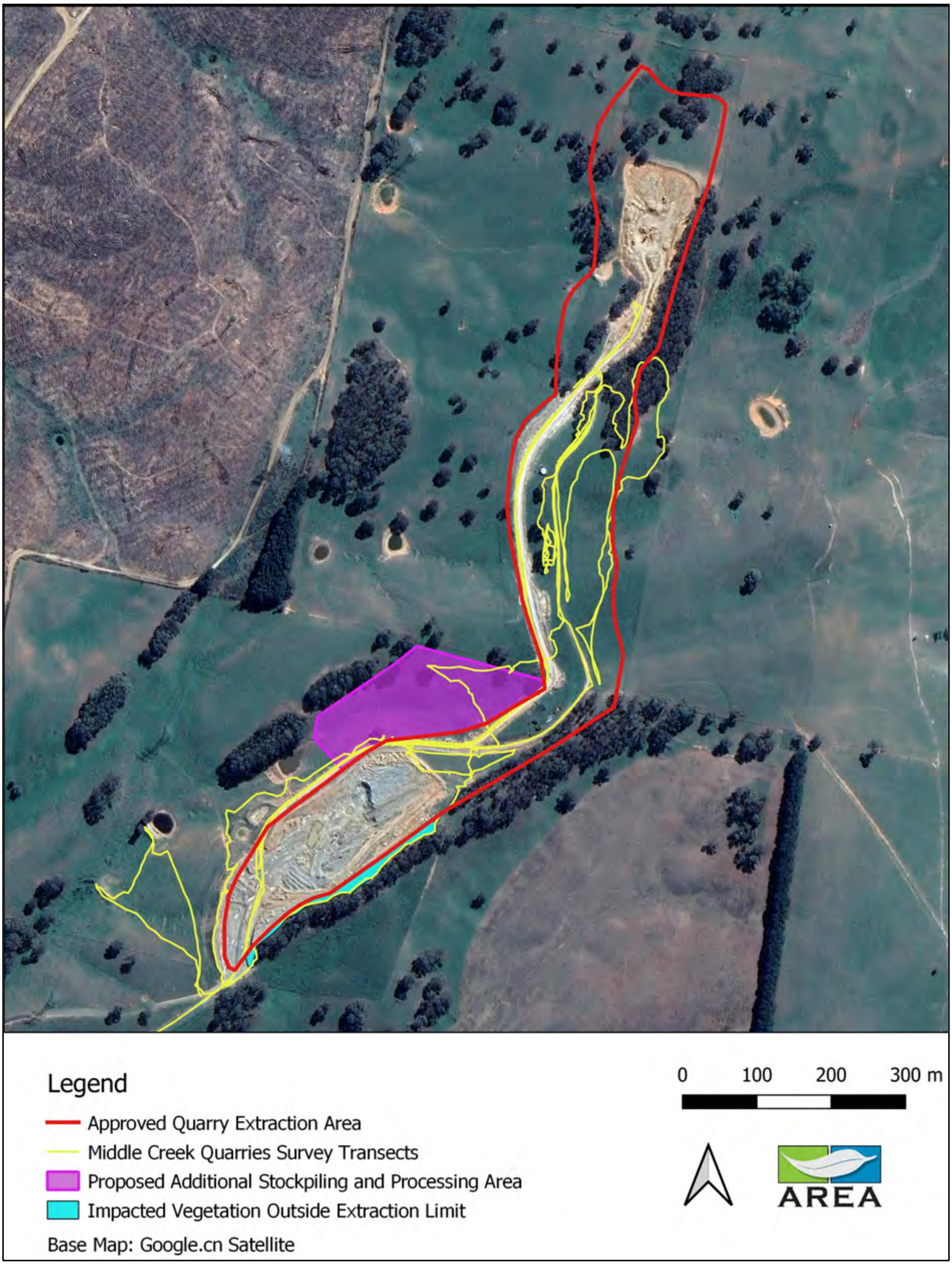
Figure 4-6: BioNet flora records



4.2.2 Targeted threatened flora surveys

The field survey included targeted surveys for the flora species predicted in the database searches. The development footprint was accessed on foot. Figure 4-7 illustrates a portion of the search effort (only half the effort was tracked). No threatened flora was detected in the development footprint.

Figure 4-7: Threatened flora survey effort (one person)



4.2.3 Assessment of impact to threatened flora species

Threatened flora species listed under state and Commonwealth legislation are predicted and/or known to occur in the development footprint. No threatened species were detected during survey.

Likelihood of occurrence in the development footprint was considered for 12 listed flora species identified by database searches. No species were considered likely to occur in the development footprint and are likely to be impacted. No flora species required a test (BC Act) or assessment (EPBC Act) of significance (Table 4-4). No referral or additional assessment is required for any threatened flora species.

Table 4-4: Threatened flora Assessment

Scientific name	Common name	NSW status	Comm status	Likely to occur in the development footprint?	Likely to be impacted?
Baloskion longipes	Dense Cord-rush	V	V	Unlikely Occurs in swamps and depressions in sandy alluvium sometimes growing with sphagnum moss. Also occurs in swales within tall forest, and in Black Gum (*Eucalyptus aggregata*) Woodland. The species is susceptible to disturbance related to forestry activities such as trail maintenance, harvesting and weed control and may be impacted by inappropriate land management activity and changed to hydrology. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable microhabitat, this species was not detected during field survey.	No
Diuris aequalis	Buttercup Doubletail	E	V	Unlikely Is only known to occur in a few small populations in limited locations. Has not previously recorded in the development footprint, is threatened by grazing and invasive grasses. The development footprint is highly disturbed from grazing and quarry activities and contains mostly invasive exotic grasses. unlikely to occur.	No
Eucalyptus pulverulenta	Silver-leafed Gum	V	V	Unlikely Tree species in the development footprint all identified. Species not present	No
Eucalyptus robertsonii subsp. hemisphaerica	Robertson's Peppermint	V	V	Unlikely Tree species in the development footprint all identified. Species not present	No
Euphrasia arguta	Euphrasia arguta	CE	CE	Unlikely Rarely recorded. Historic records of the species (over 100 years ago) noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Is threatened by grazing and frequent disturbance regimes. The development footprint is highly disturbed from grazing and quarry activities and contains mostly invasive exotic grasses. Unlikely to occur.	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the development footprint?	Likely to be impacted?
Leucochrysum albicans var. tricolor	Hoary Sunray		E	Unlikely In NSW it currently occurs on the Southern Tablelands adjacent areas in an area roughly bounded by Albury, Bega and Goulburn. Is threatened by weeds and grazing by livestock. The development footprint is highly disturbed from grazing and quarry activities and contains mostly invasive exotic grasses. Unlikely to occur.	No
Thesium australe	Austral Toadflax		V	Unlikely Often found in association with Kangaroo Grass (*Themeda australis*). Is threatened by loss and degradation of habitat and/or populations by intensification of grazing regimes and invasion of weeds. The development footprint is highly disturbed from grazing and quarry activities and contains mostly invasive exotic grasses. No kangaroo grass present. Unlikely to occur.	No
Veronica blakelyi	Veronica blakelyi	V		Unlikely Restricted to the western Blue Mountains, near Clarence, near Mt Horrible, on Nullo Mountain and in the Coricudgy Range. Over this range, occurrences are patchy and generally small in in size. Is threatened by changes in hydrology due to mining activities and loss of habitat by clearing. All shrubs in development footprint identified, species not present.	No
Eucalyptus aggregata	Black Gum	V	V	Possible Has been recorded within 10 kilometres of the development footprint.	No Tree species in the development footprint all identified. Species not present
Eucalyptus macarthurii	Paddys River Box, Camden Woollybutt	E	E	Possible Has been recorded within 10 kilometres of the development footprint.	No Tree species in the development footprint all identified. Species not present
Swainsona sericea	Silky Swainson-pea	V		Unlikely Found in Natural Temperate Grassland and Snow Gum *Eucalyptus pauciflora* Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines Callitris spp. Associated PCT and canopy species not present. is threatened by invasion of weeds and intensification of grazing regimes. The development footprint is highly disturbed from grazing and quarry activities and contains mostly invasive exotic grasses. unlikely to occur.	No
Xerochrysum palustre	Swamp Paper Daisy		V	Unlikely Found in Kosciuszko National Park and the eastern escarpment south of Badja. Also found in eastern Victoria. Grows in swamps and bogs which are often dominated by heaths. Swamp heath habitat is not present in the development footprint.	No

4.2.4 Edge effects on adjacent native vegetation and habitat

The removal of native vegetation in the development footprint may increase the edge effects on adjacent native vegetation. However, the area is already highly disturbed and impacted by edge effects from the existing quarry operations and historic grazing and clearing. Mitigation measures such as pest and weed management and dust suppression is recommended which will reduce the impact of edge effects.

Landscape and visual screen planting will aid in reducing edge effects as it will result in increased vegetated areas, with species planted recommended to complement existing native vegetation (see below).

4.2.5 Recommendations for landscape and visual screen planting

Recommended species for landscape and visual screen planting include the species nominated in Table 4-5. These are suitable screening species which grow in the region and would complement the existing native vegetation PCT730.

Table 4-5: Recommended species for planting

Tree Species	Shrub Species
Broad Leaved Peppermint *Eucalyptus dives*	Silver Wattle *Acacia dealbata*
Mountain Gum *Eucalyptus dalrympleana subsp. dalrympleana*	Weeping Bottlebrush *Melaleuca viminalis*,
Red Springybark *Eucalyptus macrorhyncha*	Crimson Bottlebrush *Melaleuca citrinus*

It is recommended planting is undertaken by ripping three lines, each one vehicle width apart to allow room to grow and maintain plantation. The middle row should be planted with trees only at a distance of 10 metres apart. The front and rear rows (outside rows) should be planted with a combination of 60 percent trees and 40 percent shrubs. Weed control is recommended to encourage the recovery of native ground stratum species.

Central West Local Land Services have created a revegetation guide which may be beneficial: https://www.lls.nsw.gov.au/__data/assets/pdf_file/0003/1189605/PlantingYourPatch_accessible.pdf

4.3 Habitat

4.3.1 Critical habitat

No areas defined as Critical Habitat (Area of Outstanding Biodiversity Value) by the NSW or Commonwealth government are mapped within, or next to, the development footprint (Table 4-6).

Table 4-6: Critical habitat database searches

Database searched	Date searched	Result
Critical habitat registers available on the: **DPIE website** at https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/areas-of-outstanding-biodiversity-value/area-of-outstanding-biodiversity-value-register **DPI NSW (Fisheries) website** at http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register **Federal Department of the Environment website** at http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl	16/06/2026	**DPIE website** No critical habitat in the development footprint. **DPI NSW (Fisheries) website** No critical habitat in the development footprint **Federal Department of the Environment website** No critical habitat in the development footprint

4.3.2 Terrestrial fauna habitat

The study area includes an operational quarry, located within land that is zoned for primary production and has been extensively grazed and cleared. There are fragmented patches of native vegetation within the study area and the Essington State Forest lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area. Captain Kings Creek flows through the study area and several open dams are located on drainage lines within the wider property.

Native vegetation (where there are trees) in the development footprint was determined to be PCT730 (Plant Community Type), *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion.* Remaining vegetation in the development footprint was assessed as low conservation grassland, which has been heavily impacted by clearing, intensive grazing and invasive pasture grasses and weeds.

PCT730 can provide habitat for a wide range of terrestrial fauna, including birds, microbats, reptiles, rodents and small marsupials. However, the vegetation is highly disturbed and there are few fallen logs are present in the development footprint, except where the vegetation has been cleared outside the previously approved extraction and pushed up (see mitigation measures in Section 6).

Five trees, three of which have hollows will potentially be impacted by the proposal. These tree hollows can provide habitat value for microbats, birds and arboreal mammals and will be retained and/or mitigated where possible. Habitat values such as shade, shelter and food provided by the vegetation to be removed represents some decline in habitat features. Wombats and their burrows are known to be present in the study area.

Aquatic habitat close to the development footprint (farm dams) is highly artificial and lacks complex structural features such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation and tree stumps. Captain Kings Creek is an intermittent waterway. It lies south of the development footprint and would not be impacted.

4.3.3 Koala habitat assessment

Koala are predicted to occur in the study area by NSW and Commonwealth database searches. Two Koala records exist within 10 kilometres of the development footprint but both records are more than 20 years old. No evidence of Koala presence in the development footprint was recorded during this assessment.

State Environmental Planning Policy (SEPP) – Koala Habitat Protection 2020 and 2021

The SEPP (Koala Habitat Protection) 2021 does not apply land being zoned RU1 Primary Production and located outside the Sydney Metropolitan Area, Blue Mountains and Central Coast areas. Where a proposal occurs in RU1 land located outside the areas listed above, SEPP (Koala Habitat Protection) 2020 applies, which is the case for this proposal.

Further, the SEPP (Koala Habitat Protection) 2020 applies to the proposal because:
- the Lot is larger than one hectare
- the Oberon LGA is listed in Schedule 1 of the (SEPP) (Koala Habitat Protection) 2020.

The SEPP (Koala Habitat Protection) 2020 is made under the *Environmental Planning and Assessment Act 1979* (EP&A Act), replacing the SEPP (Koala Habitat Protection) 2019 and largely reinstates SEPP 44. The SEPP (Koala Habitat Protection) 2020 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

The policy requires a suitable qualified person(s) experienced and qualified in tree identification, biological science, fauna survey and management to determine if the development footprint is consistent with the definitions of core koala habitat and potential koala habitat outlined in the SEPP 2020. Details of person(s) (Phil Cameron) who conducted the field assessment are in Table 2-1.

The definitions of core koala habitat and potential koala habitat are provided below:

- **Core koala habitat** means an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population.

- **Potential koala habitat** means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15 percent of the total number of trees in the upper or lower strata of the tree component.

Field assessment determined potential and core koala habitat do not occur in the development footprint. No tree species present in the development footprint were listed in Schedule 2 of the SEPP (Koala Habitat Protection) 2020. No Koalas or evidence of Koalas was noted during field assessment. Desktop assessment determined no historical records within five kilometres of the development footprint. Details of the field assessment are outlined in Appendix E.

Therefore, no further management plans would be required, and consent would not be prevented under the SEPP (Koala Habitat Protection) 2020.

The development footprint was further assessed for Koala under the BC Act and EPBC Act in this report. Under the requirements of the BC Act and EPBC Act, tests of significance were undertaken for Koala (Appendix C). There will be no significant impact to Koala.

4.3.4 Wildlife connectivity and habitat fragmentation

All native vegetation mapped in the development footprint has some role in habitat connectivity. However, connectivity will not be reduced by the proposal as the vegetation is already highly fragmented and will be no less connected by the proposal.

Landscape and visual screen planting, required by DA 10.2016.38.1 will improve connectivity by creating more vegetated areas and connecting currently fragmented patches of native vegetation in the northern extraction area. Overall, connectivity would not be reduced, nor fragmentation increased by the proposal.

4.4 Fauna

4.4.1 Threatened fauna database searches

All threatened fauna database search results are incorporated into Table 4-8. NSW known and predicted threatened fauna species were identified using a BioNet search and an IBRA search in the South Eastern Highlands Bioregion, Oberon subregion, filtered by Southern Tableland Dry Sclerophyll Forests Vegetation Class. There are eight BioNet threatened fauna species recorded within 10 kilometres of the development footprint (Figure 4-9).

A Matters of National Environmental Significance (MNES) report was generated which predicted threatened fauna species listed under the EPBC Act with the potential to occur within one kilometre of the study area (Appendix A). Potential impact to threatened fauna identified by database searches and field survey is considered in Section 4.4.2.

Table 4-7: Threatened species database search results

Database searched	Date searched	Result
BioNet- the website for the Atlas of NSW Wildlife Database: http://www.bionet.nsw.gov.au and OEH BAMCC Threatened Species outputs.	16/06/2022	**Atlas of Wildlife** (Figure 4-8, Appendix A) 1.5km radius • Nil 10km radius • Green and Golden Bell Frog *Litoria aurea* • Booroolong Frog *Litoria booroolongensis* • Blue-billed Duck *Oxyura australis* • Little Eagle *Hieraaetus morphnoides* • Latham's Snipe *Gallinago hardwickii* • Koala *Phascolarctos cinereus* • Greater Glider *Petauroides volans* • Large Bent-winged Bat *Miniopterus orianae oceanensis* • Large Bent-winged Bat *(Miniopterus orianae oceanensis)* • Latham's Snipe *(Gallinago hardwickii)* • Little Eagle *(Hieraaetus morphnoides)* **OEH Threatened Species Profile Database** (Appendix A). A search using South Eastern Highlands Bioregion, Oberon subregion, filtered by Southern Tableland Dry Sclerophyll Forests; showed 42 species of fauna having potential to use habitat in the development footprint.
The federal Department of Environment's Protected Matters Search Tool: http://environment.gov.au/erin/ert/epbc/index.html	06/08/2020	**MNES predicted threatened fauna species:** • Seven birds • Two fish • Two frogs • Five mammals.

4.4.2 Assessment of impact to threatened fauna species

No threatened fauna was observed in the development footprint during the field assessment, however threatened species listed under State and Commonwealth legislation have the potential to impacted by the proposal. Based on the results of tests and assessments of significance, the proposal is not likely to have a significant impact on threatened fauna species because habitat loss is minimal and the development footprint is already highly disturbed and degraded from existing clearing, farming and quarry operations. No referral or additional assessment is required.

All relevant species were taken into consideration when assessing the impact of the proposal. Threatened fauna species searches involved searching for signs of resident microbat populations, looking for tell-tale marks of koala on trees and observing any birds and reptiles. The development footprint was also searched for fauna habitat values.

A total of 52 known and predicted threatened fauna species were individually considered and assessed, see Appendix B: Predicted Fauna Assessment. Most predicted threatened fauna species were determined not to require a test or assessment of significance as assessment concluded the species was:

- Not present or
- Unlikely to be present or
- Unlikely to use the suitable habitat in the development footprint.

Considering the above factors, it was deduced the following nine fauna species (Table 4-9) require a test or assessment of significance because they:

- Are known, or are likely, to occur in the development footprint
- Have feeding resources and/or habitat in the development footprint which will potentially be impacted
- Cannot be reasonably excluded.

Tests and assessments of significance for threatened fauna species listed under the relevant BC Act and the EPBC Act are provided in Appendix C and an overview of results is provided in Table 4-9.

Figure 4-8: BioNet fauna records

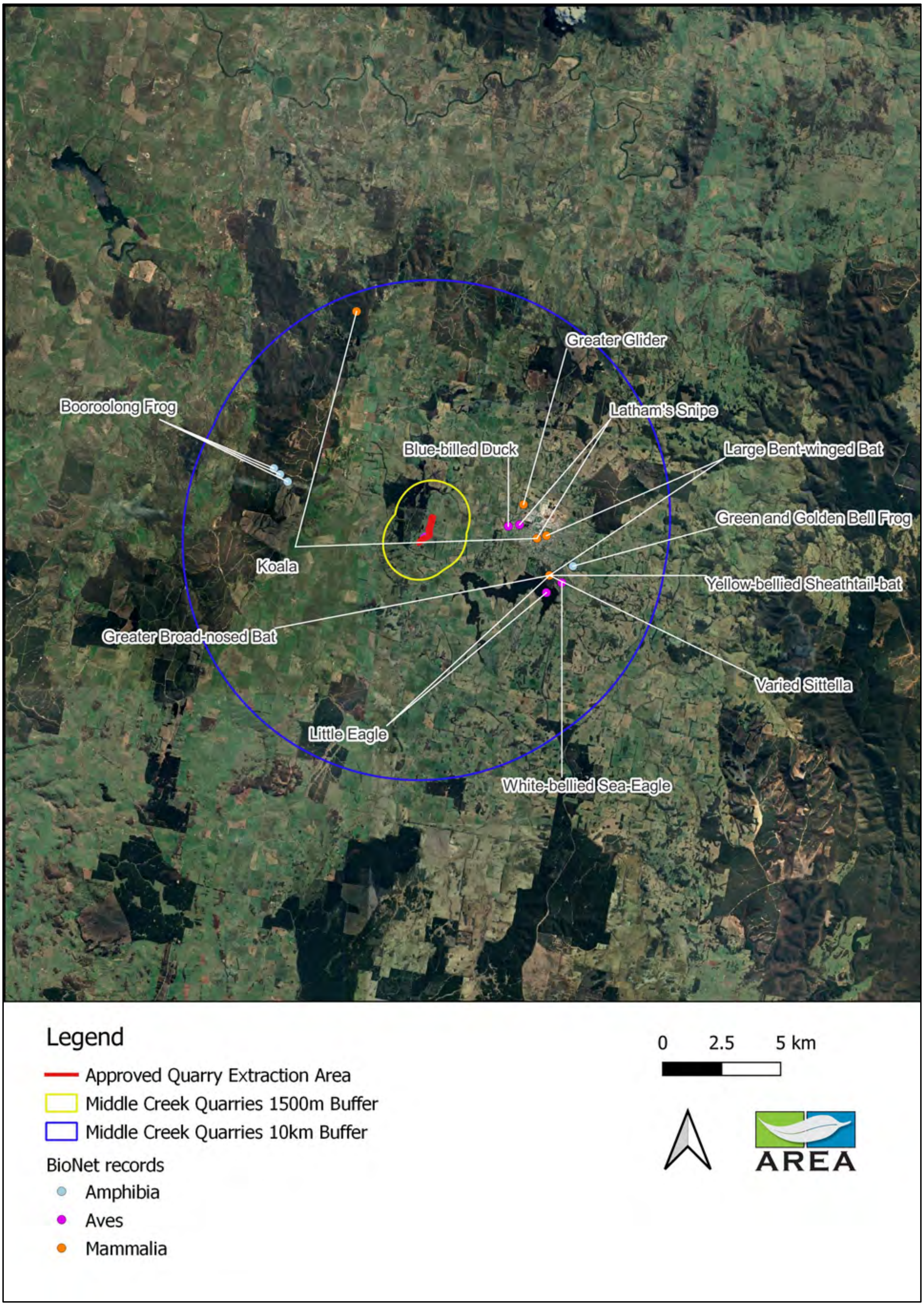


Table 4-8: Threatened species with potential to be impacted

Scientific name	Common name	NSW status	Comm status	Likely to occur in the development footprint?	Potential to be Impacted?	Significant Impact?
Bird						
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Potential Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Hollows will be impacted. Recorded in previous survey (2015).	Yes	No
Hieraaetus morphnoides	Little Eagle	V	-	Potential Recorded within 10km. Occupies open eucalypt forest, woodland or open woodland. No stick nests were present in the development footprint, but foraging habitat may be impacted.	Yes	No
Ninox connivens	Barking Owl	V	-	Potential Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Nests in tree hollows. Tree hollows will be impacted.	Yes	No
Petroica boodang	Scarlet Robin	V	-	Potential Recorded in previous survey (2015). In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Potential foraging habitat will be impacted.	Yes	No
Polytelis swainsonii	Superb Parrot	V	V	Potential Nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Potential foraging and nesting habitat will be impacted.	Yes	No
Mammal						
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Potential Generally roosts in eucalypt hollows, but has also been found under loose bark on trees. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hollows will be impacted.	Yes	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the development footprint?	Potential to be Impacted?	Significant Impact?
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Potential Can roosts in tree hollows and forages in most habitats across its very wide range, with and without trees. Hollows and potential foraging habitat will be impacted.	Yes	No
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Potential Usually roosts in tree hollows and forages over open woodland habitat. Hollows and potential foraging habitat will be impacted.	Yes	No
Phascolarctos cinereus	Koala	V	V	Potential Individuals have been sighted within 10km of the development footprint. Potential food trees exist within the development footprint.	Yes	No

4.4.3 Assessment of impact to migratory species

An assessment of significance for migratory birds is provided in Table 4-10. There will not be a significant impact on migratory birds.

Table 4-9: Assessment of Significance, Migratory birds

Criteria	Migratory birds
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	There is no 'real chance' direct or indirect impacts to migratory birds.
substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	There is little evidence to suggest that the development footprint supports 'important habitat' for migratory species, however it would most likely provide seasonal breeding and feeding grounds. Given their migratory habits, the arid nature of food and habitat resources and the extent of habitat across their range, it is likely that the existing resources within the development footprint would be utilised infrequently and on a transitory basis only. Migratory birds are extremely mobile in nature and have a large feeding area that would not be solely reliant on the habitat provided in the development footprint. Large areas of woodland are mapped within 1.5km of the development footprint in the event they are disturbed during the construction process.
result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	The local area has a history of habitat modification, which has benefited feral and invasive flora and fauna species. The proponent should aim to ensure the spread of weeds and feral fauna is not enhanced by the proposal, with proposed landscape and visual screen planting contributing towards the overall enhancement of habitat for migratory species.
seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	As noted above, the development footprint is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. It is unlikely that an ecological significant proportion of migratory birds would rely on habitat in the development footprint.

4.4.4 Injury and mortality

Injury and mortality of fauna could occur during construction and quarry activities. Specific impacts to be addressed include:

- risk to nesting birds in trees to be felled lopped or driven past during removal and disturbance of vegetation and habitat clearing
- risk to hollow dependent species if present in trees when felled
- construction and operational traffic
- machinery and plant movements.

A Fauna Handling and Rescue Procedure has been included as Appendix D to be followed in the event of an and unexpected find or fauna injury or mortality.

4.5 Threatened Ecological Communities

4.5.1 Desktop searches

Threatened Ecological Communities (TEC) which may occur in the development footprint were highlighted by IBRA search, MNES report and PCT associations, see Table 4-11.

Table 4-10: Threatened Ecological Communities predicted in development footprint

Community	BC Status	Comm Status	Source	Excluded?
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Endangered Ecological Community	N/A	IBRA, PCT Description	Requires further consideration Associated PCT is present
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered Ecological Community	Critically Endangered Ecological Community	IBRA, MNES	Excluded Associated PCT's not present in development footprint.
Natural Temperate Grassland of the South Eastern Highlands	N/A	Critically Endangered Ecological Community	MNES	Excluded Associated PCT's not present in development footprint.
Listed TSC Act,E: Mt Canobolas Xanthoparmelia Lichen Community	Endangered Ecological Community	N/A	PCT Description	Excluded Development footprint is not in Mount Canobolas. TEC not present.

4.5.2 Threatened plant communities

Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions required further consideration as an associated PCT is present in the development footprint and it is known to occur in the Oberon region. Assessment concluded the vegetation in the development footprint is not consistent with Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions.

Justification is provided with reference to the key characteristics to help identify areas of Tableland Basalt Forest (https://www.environment.nsw.gov.au/resources/pnf/10520TablelandBasaltForestGuidelines.pdf).

- *Is the site 600–900m above sea level in the Sydney Basin and South Eastern Highlands bioregions? No – it is entirely above 1100 metres*
- *Is the site on relatively fertile loam or clay soils derived mainly from basalt but also from other substrates? No – the site is on Red Podzolic Soils - less fertile (granites and metasediment) (based on GIS mapping layers from NSW Government SEED Website)*

- *Is the vegetation a grassy open forest or woodland, or a native grassland (where trees and shrubs have been removed?* Yes, open woodland but no native grassland (90% exotic ground layer)
- *Does the tree layer, if present, contain any of the following: ribbon gum, narrow-leaved peppermint, mountain gum or white sally (snow gum)?* Only mountain gum present.

Moderate to heavy grazing of Tableland Basalt Forest by livestock and rabbits results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil. This makes it difficult for a diverse native understorey to re-establish at times when total grazing pressure is reduced. Weed invasion also poses a significant threat to Tableland Basalt Forest.

The development footprint is already highly disturbed and degraded from existing clearing, farming and quarry operations. This TEC is not present in the development footprint, no further assessment is required.

4.5.3 Key Fish Habitat – Endangered Ecological Community

None of the drainage lines in the development footprint for this proposal are mapped as Key Fish Habitat under the *Fisheries Management Act 1994*.

The proposal will not impact any Key Fish Habitat (Figure 4-9). No further assessment is required regarding KFH.

4.6 Aquatic environment

Aquatic habitats differ from terrestrial habitats and are more susceptible to degradation and loss. Disturbances on land can translate to disturbances to aquatic habitats. Sediments and pollutants carried by overland flow can enter aquatic environments, smothering habitats and reducing water quality. The aquatic environment relevant to the proposal is addressed in the following sections.

4.6.1 Wetlands, rivers and streams

Waterways within the development footprint are shown in Figure 4-11. No wetlands of international or national importance are located within relevant distance to the development footprint.

4.6.1 Aquatic environment and fauna habitat

One Strahler 1^{st} order drainage line commences in the proposed Additional Stockpiling and Processing Area of the development footprint (Plate 4-1). This drainage line has no structure or form. This flows into a farm dam which contains no aquatic fauna or habitat (Plate 4-2). Overflow from this is a tributary to Captain Kings Creek and is a part of the Macquarie River catchment.

4.6.2 Aquatic impacts

The proposal will directly impact the above-mentioned drainage line. The proposed activities associated with the quarry modification would generate contaminated runoff which creates a risk of pollution to downstream water (either as surface flow or leachate) if not appropriately managed.

Implementation of the proposal will need to ensure excessive sediment, nutrients or other elements are not allowed to contaminate down stream flows. Movement of water through the site during the implementation of this proposal should be controlled using sediment traps and drainage structures. This will be further addressed in the SoEE.

Figure 4-9: Key Fish Habitat (Base image source: Google Hybrid)

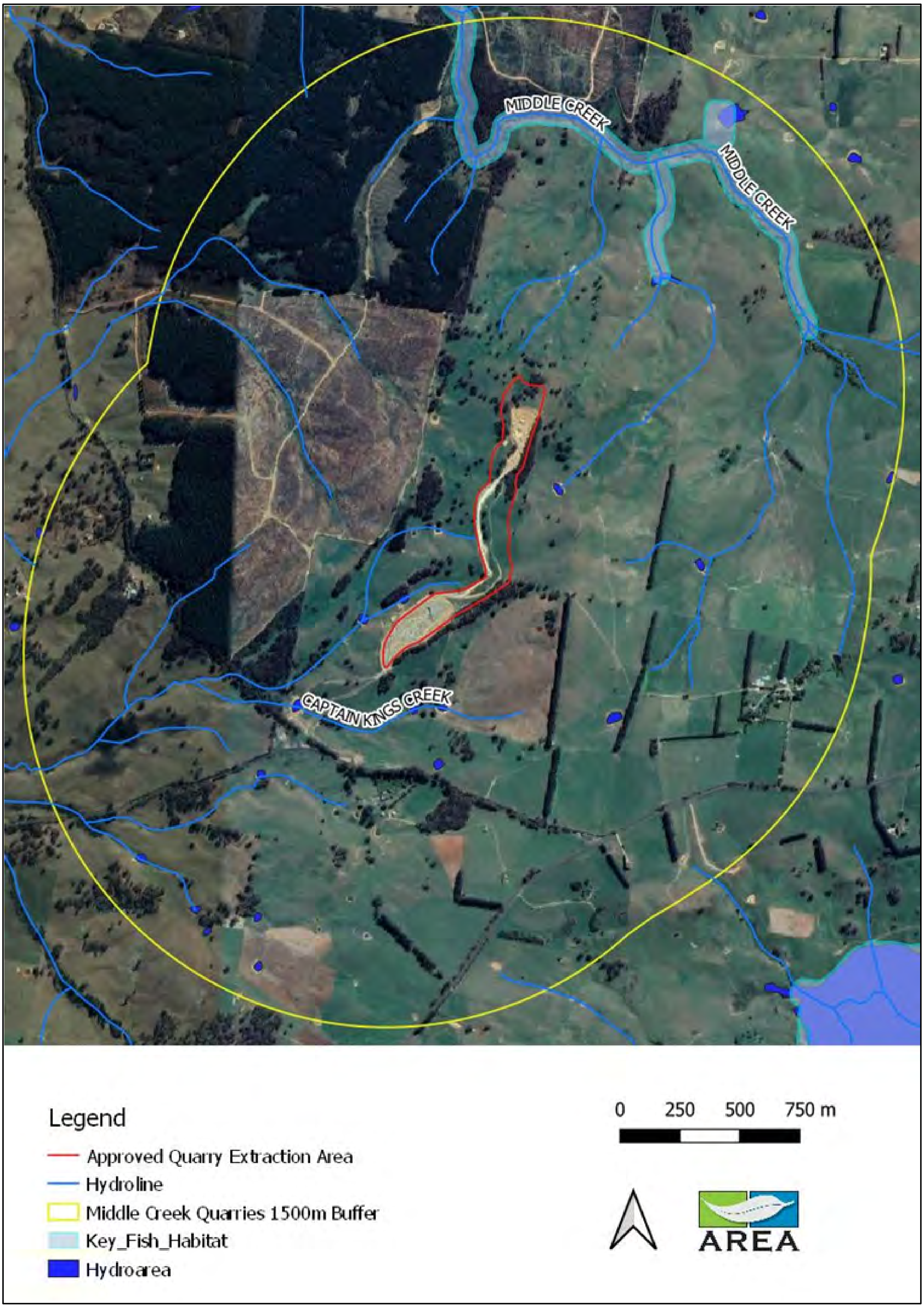


Figure 4-10: Waterways / drainage lines within 1500 metres of the proposal

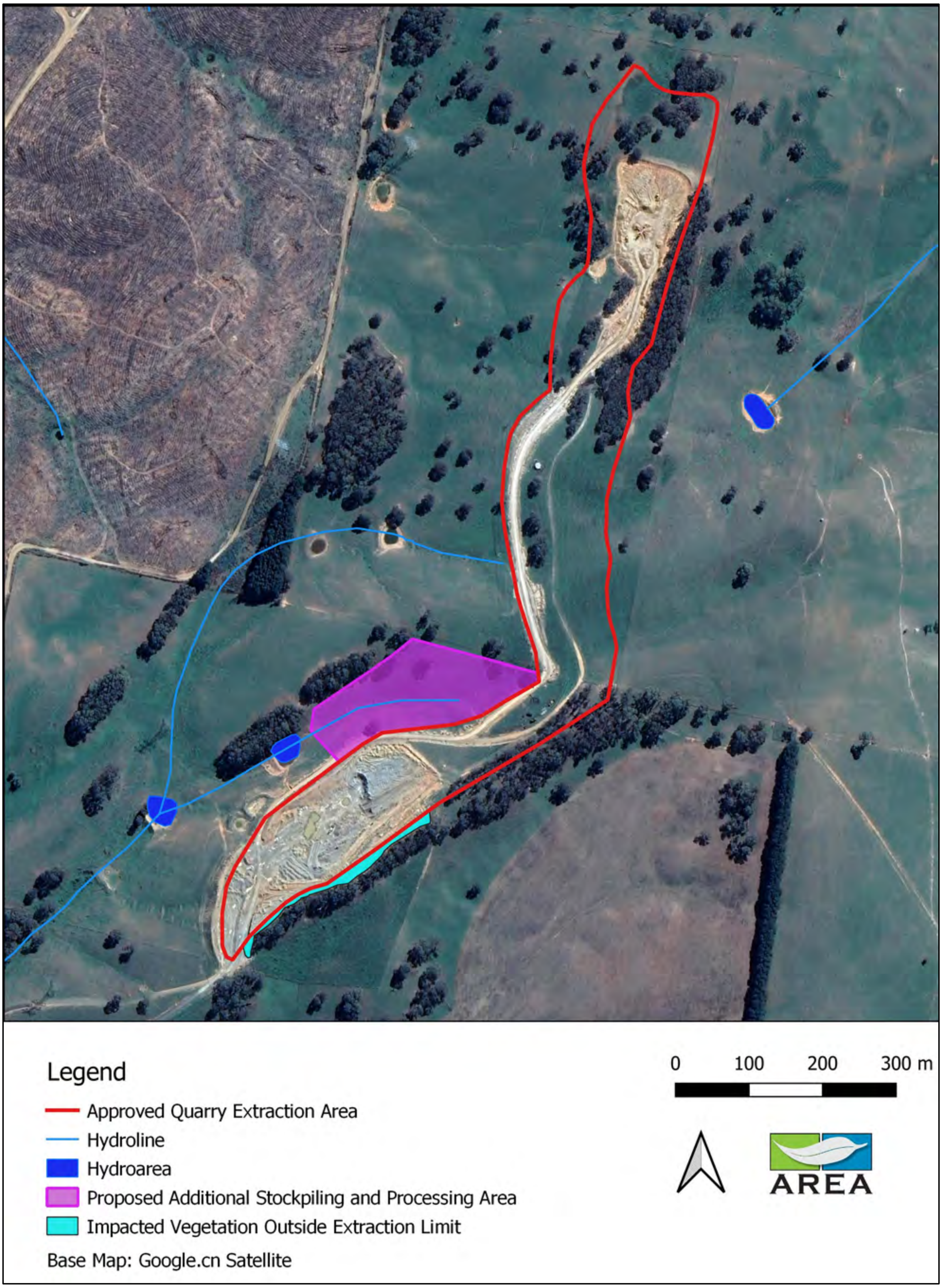


Plate 4-1: The development footprint, facing southwest along the 1st order drainage line

Plate 4-2: The catchment dam below the 1st order drainage line

4.6.3 Groundwater dependent ecosystems

The level of water dependence of vegetation communities in the development footprint has been identified using the *Atlas of Groundwater Dependent Ecosystems* Bureau of Meteorology (BOM 2017) and mapping by Kuginis *et al.* (2012). Maps are provided in Appendix A, results are as follows:

- No Aquatic GDE is mapped in the development footprint
- Low potential terrestrial GDE – regional study is mapped in the development footprint. The terrestrial GDE layer expresses the potential for groundwater and mapped vegetation communities across Australia to interact. It shows the vegetation communities that interact with groundwater from the water table or in the capillary zone. It does not imply an entire mapped

ecosystem is using groundwater, but rather groundwater interaction may be occurring somewhere within the mapped ecosystem.

- No ecosystems have been analysed for Subterranean GDE.

The *Risk assessment guidelines for groundwater dependent ecosystems* (Serov *et al.* 2012) available online at http://www.water.nsw.gov.au/__data/assets/pdf_file/0005/547682/gde_risk_assessment_guidelines_volume_1_final_accessible.pdf.

These guidelines were reviewed which determined changes to these waterways during the implementation of this proposal are unlikely to significantly impact Groundwater Dependent Ecosystems. Extraction activities are not anticipated to impact on groundwater flows and depth and therefore impacts on groundwater dependent ecosystems is possible but unlikely.

4.7 Weeds and pests

Presence and control of weeds and pests have been considered in this assessment (see below).

4.7.1 Significant weeds

One Weed of National Significance was recorded in the study area - Asparagus fern *Asparagus virgatus.*

4.7.2 Invasion and spread of weeds

Invasive exotic grasses represent a threat to native vegetation. Exotic pasture and invasive grasses, especially Phalaris *Phalaris aquatica,* Soft Brome grass *Bromus hordeaceus* and perennial ryegrass *Lolium perenne* already dominate the ground stratum.

Other exotic species observed in the study area include:

- Capeweed *Arctotheca calendula*
- Red-flowered Mallow *Modiola caroliniana*
- Clover *Medicago sp.*

The MNES report were also suggested the following weeds may occur:

- Broom *Genista sp. X Genista monspessulana*
- Chilean Needle grass *Nassella neesiana*
- Serrated Tussock *Nassella trichotoma*
- Radiata Pine *Pinus radiata*
- Blackberry *Rubus fruticosus aggregate*
- Willows except Weeping Willow Salix spp. except *S.babylonica, S.x calodendron & S.x reichardtii*
- Gorse *Ulex europaeus*

An increase in the movement of people, vehicles, machinery, vegetation waste and soil as a result of the proposal is unlikely to alter the current exotic grass burden at the development footprint and is unlikely to increase the prevalence of these weeds elsewhere, due to the existing levels of disturbance and weed infestation.

However, disturbed areas, such as those in which earthwork are to be carried out, will be susceptible to weed establishment. Management measures will be required to minimise the risk of introduction and spread of weeds. Site rehabilitation plans should consider engagement of a weed contractor to eradicate and control Asparagus fern *Asparagus virgatus* and other locally known weeds in the development footprint which may be exacerbated by further disturbance.

4.7.3 Invasion and spread of pests

The proposal is unlikely to result in the spread of new pests. Precautionary measures are not necessary during implementation of the proposal.

4.7.4 Invasion and spread of pathogens and disease

In NSW, there are infectious pathogens with potential to impact on biodiversity. Any activities involving the movement of soil and equipment over large areas are a potential risk for spread and infection. Three pathogens are considered a negligible risk to the development footprint due to the low rainfall of the area. These are listed as key threatening processes under the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (EPBC Act and BC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act).
- Infection by Psittacine Circoviral (beak and feather) (EPBC Act and BC Act).

Mitigation measures for these diseases have been provided in Section 6.2.

<u>Phytophthora (*Phytophthora cinnamomi*)</u>
Phytophthora is soil-borne fungus causing tree death (dieback). It attacks the roots of a wide range of native plant species. Spores can be dispersed over relatively large distances by surface and sub-surface water flows. Infected soil/root material may be dispersed by vehicles (e.g. earth moving equipment).

<u>Infection by Psittacine Circoviral (beak and feather)</u>
Psittacine Circoviral (beak and feather) Disease (PCD) affects parrots and their allies (psittacines) and is often fatal. No other faunal species or groups are known to be susceptible to PCD (Murdoch University 1997). It is caused by a relatively simple virus that infects and kills the cells of the feather and beak, as well as cells of the immune system, leaving birds vulnerable to bacterial and other infections (Murdoch University 1997). The distribution of the disease and the factors involved in its spread are not well understood. The virus multiplies in the liver and can be transmitted orally or in faeces or feathers.

<u>Chytrid fungus (*Batrachocytrium dendrobatidis*)</u>
Chytrid fungus is a fatal infectious disease affecting amphibians worldwide. It is a water-borne fungus that may be spread because of handling frogs or through cross contamination of water bodies by vehicles and workers.

5 Construction impacts

Construction activities include:

- use of excavators and earth moving equipment
- truck movements to and from the site to deliver and remove materials
- additional stockpiling of materials.

Construction activity is expected to be completed in three months from the start of the work.

5.1.1 Noise, dust and vibration

Implementation of this proposal will result in increased localised noise, dust and vibration impacts. This will be further addressed in the SoEE.

5.1.2 Changes to surface hydrology

One Strahler 1st order drainage line commences in the Additional Stockpiling and Processing Area of the development footprint. This flows into a farm dam which contains no aquatic fauna or habitat. Overflow from this is a tributary to Captain Kings Creek and is a part of the Macquarie River catchment.

The proposed activities associated with the quarry modification would generate contaminated runoff which creates a risk of pollution to downstream water (either as surface flow or leachate) if not appropriately managed. Implementation of the proposal will need to ensure excessive sediment, nutrients or other elements are not allowed to contaminate down stream flows. Movement of water through the site during the implementation of this proposal should be controlled using sediment traps and drainage structures. This will be further addressed in the SoEE.

5.1.3 Cumulative impacts

Cumulative impact will be low as the proposal will largely be occurring on historically disturbed land, which is an already operating quarry. There will be a negligible negative increase to impact from clearing native vegetation, noise and air quality. However, the operations will also positively contribute to reuse and recycling of former waste materials.

The area surrounding Middle Creek Quarries is occupied by residential and hobby farm areas, as well as pine plantations. There are no known other concurrent or future major projects or large-scale developments planned for the surrounding area, and it is considered there are no other impacts cumulatively affecting the study area.

6 Avoid, minimise and mitigate impacts

6.1 Avoidance and minimisation

Removal of vegetation will be avoided where reasonably practicable and is limited to isolated paddock trees. Larger areas of intact vegetation will not be impacted. Landscape and visual screen planting will assist in offsetting the loss of vegetation.

6.2 Mitigation measures

Where impact to the environment cannot be avoided, safeguards will be implemented to mitigate these impacts during construction and operation. Mitigation measures proposed to be implemented are described in Table 6-1.

Table 6-1: Mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Attribute	**Environmental safeguard(s)**	**Detailed design, during construction and post construction**	**Proven, effective, unknown**	**Comment**
Removal of: • native vegetation • threatened species habitat and habitat features • hollow bearing trees.	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	No residual impact is expected
	Native vegetation will be re-established in areas disturbed by the proposal and not occupied by operational needs once the proposal has been completed.	Detailed design, throughout proposal	Effective	
	Removal of native vegetation (including hollow bearing trees) should be guided by TfNSW Biodiversity Guidelines (RTA 2011).	During construction	Effective	
	A preclearing inspection should be undertaken by a qualified ecologist prior to the removal of vegetation. An ecologist should be present for the removal of hollow-bearing trees, logs or stags which could contain native fauna.	During construction	Effective	
	Clearing should be undertaken in winter outside of many fauna species breeding season that are likely to use hollows.	During construction	Effective	
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Detailed design	Effective	No residual impact is expected
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Detailed design, throughout proposal	Effective	There is a chance of residual impact if not managed appropriately. Refer to SoEE for more information.
Aquatic impacts	Aquatic impacts will be minimised through detailed project design. Follow NSW DPI Publication - Controlled Activities on Waterfront Land: • Guidelines for instream works on waterfront land • Guidelines for vegetation management plans on waterfront land • Guidelines for water crossings on waterfront land Identification of potential risks to water quality (e.g. sediment runoff) will occur though the SoEE.	Detailed design, throughout proposal	Effective	There is a chance of residual impact if not managed appropriately. Refer to SoEE for more information.

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Fragmentation of habitat corridors	Connectivity impacts will be minimised through detail design. Landscape and visual screen planting will assist with joining previously fragmented patches of vegetation.	Design and throughout proposal	Effective	No residual impact is expected
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing.	Throughout proposal	Effective	No residual impact is expected
Injury and mortality of fauna	Fauna will be managed in accordance with attached guidelines and procedures. The fauna handling and rescue procedure is to be referred to if required.	Throughout proposal	Effective	No residual impact is expected with implementation of the attached guidelines and procedures.
Invasion and spread of weeds	Weed species in the development footprint will be managed, and disposed of accordingly, with attention to the significant weeds (Weeds of National Significance and High Threat Exotic species).	Throughout proposal	Effective	No residual impact is expected
Invasion and spread of pests	Pest species are unlikely to be encountered during the proposal. If pest invasion occurs during the proposal, the animal/s should be removed if possible.	Throughout proposal	Effective	No residual impact is expected
Invasion and spread of pathogens and disease	Pathogens such as *Phytophthora cinnamomi* will be managed by implementing precaution such as washing down equipment prior to commencing the proposal. Handling of frogs encountered during proposal will be done only if necessary, and always in accordance with safe frog handling procedures to prevent the spread of Chytridiomycosis (Amphibian Chytrid Fungus Disease). See fact sheets such as available at https://www.environment.gov.au/system/files/resources/279bf387-09e0-433f-8973-3e18158febb6/files/c-disease_1.pdf	Throughout proposal	Effective	No residual impact is expected
Noise, dust and vibration	Noise, dust and vibration impacts will be minimised through detailed design and with consideration for residents surrounding the development footprint.	Detailed design and throughout proposal	Effective	There is a chance of residual impact if not managed appropriately. Refer to SoEE for more information.

7 Offset strategy

Assessment under the NSW Biodiversity Offset Scheme is not triggered by this proposal.

The minimum lot size for the development footprint is 100 hectares. The total impact to native vegetation is less than one hectare, therefore the proposal does not trigger assessment by the Biodiversity Assessment Method under the area threshold. Also, there will be no impact to land mapped on the Biodiversity Values Map or an area of outstanding biodiversity value. This assessment demonstrates there will also be no significant impact to listed species populations or communities.

8 Conclusion

The proponent's proposal to modify the existing Middle Creek Quarries will not have a significant impact on species, populations or communities. No threatened flora or fauna species were identified in the development footprint, and none are at risk of significant impact from the proposal.

This Biodiversity Assessment has been prepared to support and inform a SoEE being prepared for the proposal and is based on a field survey and desktop conducted in July 2020.

The Plant Community Type present in the development footprint is PCT730 Plant Community Type, *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion.*

A total area of 2.85 hectares has been considered in this biodiversity assessment, of which 0.42 hectares of disturbed and degraded native vegetation may be impacted, including five isolated paddock trees (three of which contain hollows). Impact outside the development footprint assessed should be considered by an ecologist prior to impact.

The minimum lot size for the development footprint is 100 hectares. The total impact to native vegetation is less than one hectare, therefore the proposal does not trigger assessment by the Biodiversity Assessment Method under the area. Also, there will be no impact to land mapped on the Biodiversity Values Map as defined by clause 7.3(3) of the Biodiversity Conservation Regulation 2017 or an area of outstanding biodiversity value.

The proposal may directly and/or indirectly impact threatened entities known or likely to occur in the development footprint, largely due to the removal of habitat from the footprint potentially utilised by threatened species. Accordingly, tests and assessments of significance were prepared for the threatened species listed under the BC Act, FM Act and EPBC Act which would potentially be impacted. These assessments concluded threatened species and ecological communities would not be significantly impacted by the proposal.

The development footprint is not located in an area consistent with the definitions of core and potential Koala habitat under the 2020 (Koala Habitat Protection) SEPP. The SEPP would not prevent consent from being given and no further assessment or management plans would be required.

Mitigation measures have been recommended to minimise harm to the environment which may result from undertaking the proposal. Implementation of these measures will reduce the potential impacts of the proposal.

As the proposal is unlikely to have a significant impact on biodiversity values, assessment under the NSW Biodiversity Offset Scheme is not required, and Referral under the EPBC Act is not required.

9 References

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Appendix A – Database search results

IBRA

Threatened species predicted to occur – NSW Department of Planning, Industry and Environment threatened species search by South Eastern Highlands Bioregion, Oberon subregion, filtered by Southern Tableland Dry Sclerophyll Forests

Scientific name	Common name	NSW status	Comm status	Occurrence
Amphibian				
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable	Known
Litoria booroolongensis	Booroolong Frog	Endangered	Endangered	Known
Litoria raniformis	Southern Bell Frog	Endangered	Vulnerable	Predicted
Mixophyes balbus	Stuttering Frog	Endangered	Vulnerable	Known
Bird				
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered	Known
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable		Known
Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable		Known
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable		Predicted
Chthonicola sagittata	Speckled Warbler	Vulnerable		Known
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable		Known
Daphoenositta chrysoptera	Varied Sittella	Vulnerable		Known
Grantiella picta	Painted Honeyeater	Vulnerable	Vulnerable	Known
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable		Known
Hieraaetus morphnoides	Little Eagle	Vulnerable		Known
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	Predicted
Lophoictinia isura	Square-tailed Kite	Vulnerable		Predicted
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable		Known
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable		Predicted
Ninox connivens	Barking Owl	Vulnerable		Known
Ninox strenua	Powerful Owl	Vulnerable		Known
Petroica boodang	Scarlet Robin	Vulnerable		Known
Petroica phoenicea	Flame Robin	Vulnerable		Known
Polytelis swainsonii	Superb Parrot	Vulnerable	Vulnerable	Known
Stagonopleura guttata	Diamond Firetail	Vulnerable		Known
Tyto novaehollandiae	Masked Owl	Vulnerable		Predicted
Insect				
Paralucia spinifera	Purple Copper Butterfly, Bathurst Copper Butterfly	Endangered	Vulnerable	Known
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	Known
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable		Known

Scientific name	Common name	NSW status	Comm status	Occurrence
Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable		Known
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable	Known
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable		Predicted
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable		Known
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable		Known
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered	Known
Petaurus australis	Yellow-bellied Glider	Vulnerable		Known
Petaurus norfolcensis	Squirrel Glider	Vulnerable		Known
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	Vulnerable	Predicted
Phascogale tapoatafa	Brush-tailed Phascogale	Vulnerable		Predicted
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable	Known
Reptile				
Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Vulnerable	Predicted
Varanus rosenbergi	Rosenberg's Goanna	Vulnerable		Predicted
Delma impar	Striped Legless Lizard	Vulnerable	Vulnerable	Predicted
Plant				
Baloskion longipes	Dense Cord-rush	Vulnerable	Vulnerable	Known
Diuris aequalis	Buttercup Doubletail	Endangered	Vulnerable	Known
Eucalyptus pulverulenta	Silver-leafed Gum	Vulnerable	Vulnerable	Known
Eucalyptus robertsonii subsp. hemisphaerica	Robertson's Peppermint	Vulnerable	Vulnerable	Predicted
Leucochrysum albicans var. tricolor	Hoary Sunray	Not listed	Endangered	Predicted
Veronica blakelyi	Veronica blakelyi	Vulnerable		Known
Eucalyptus aggregata	Black Gum	Vulnerable	Vulnerable	Known
Eucalyptus macarthurii	Paddys River Box, Camden Woollybutt	Endangered	Endangered	Known
Swainsona sericea	Silky Swainson-pea	Vulnerable		Predicted
Community				
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Endangered Ecological Community		Known
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	Critically Endangered Ecological Community	Critically Endangered	Known

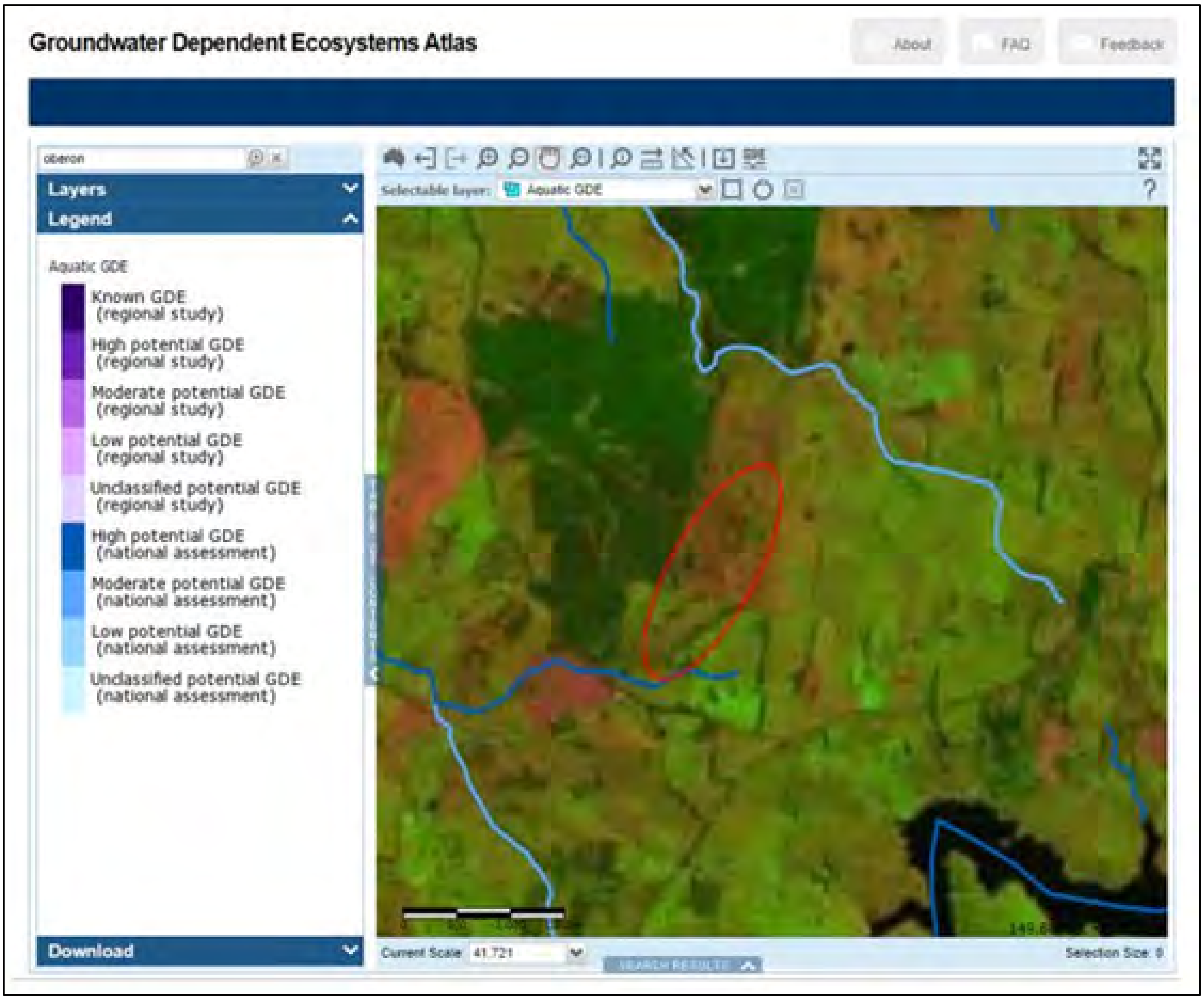
Bionet

Species Recorded on BioNet within 10 kilometres of the development footprint

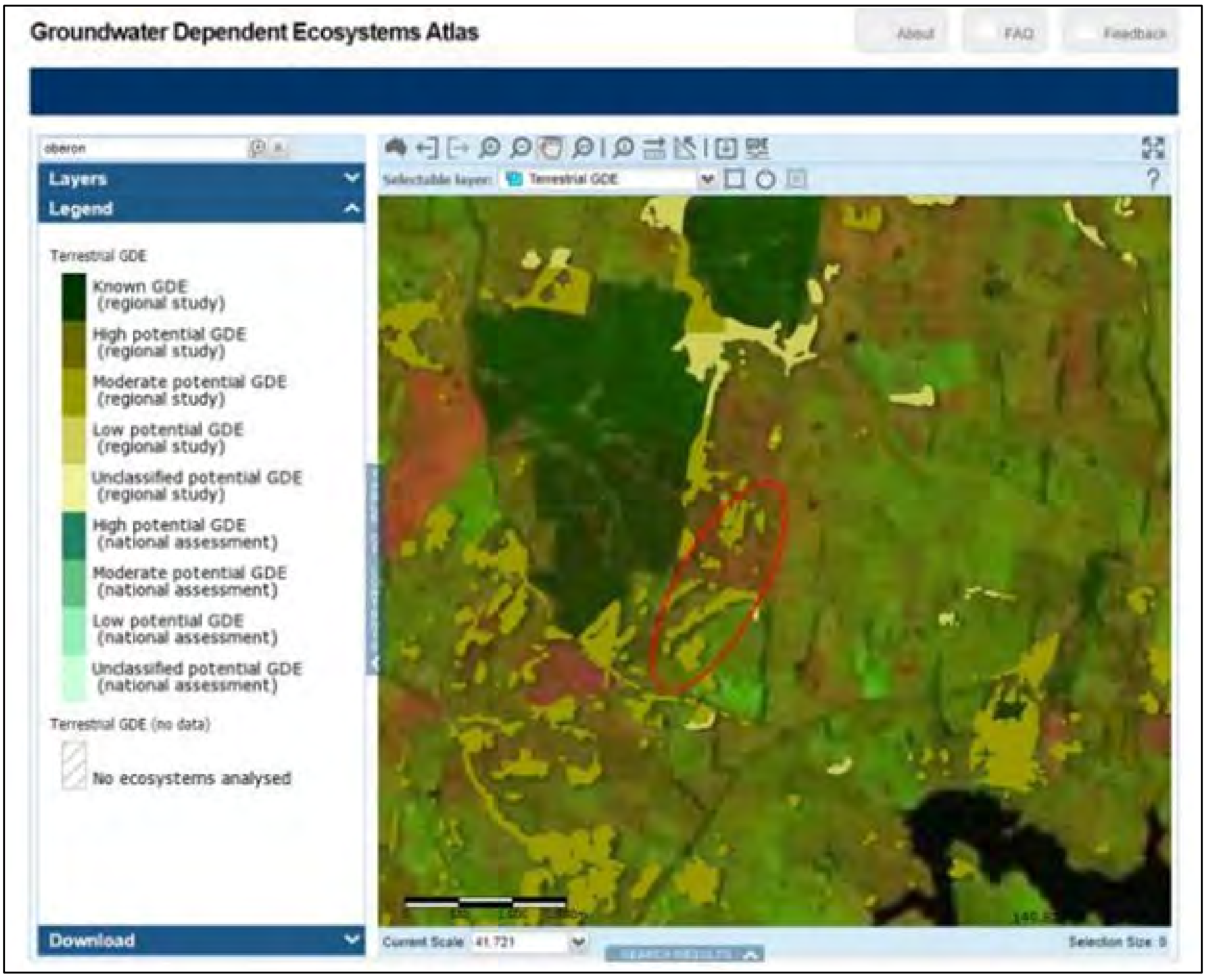
Scientific	Common Name	NSW Status	Comm Status
Litoria aurea	Green and Golden Bell Frog	E	V
Litoria booroolongensis	Booroolong Frog	E	E
Oxyura australis	Blue-billed Duck	V	
Hieraaetus morphnoides	Little Eagle	V	
Gallinago hardwickii	Latham's Snipe		J,K
Phascolarctos cinereus	Koala	V	V
Petauroides volans	Greater Glider		V
Eucalyptus aggregata	Black Gum	V	V
Eucalyptus macarthurii	Paddys River Box, Camden Woollybutt	E	E
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	

Groundwater dependant ecosystems

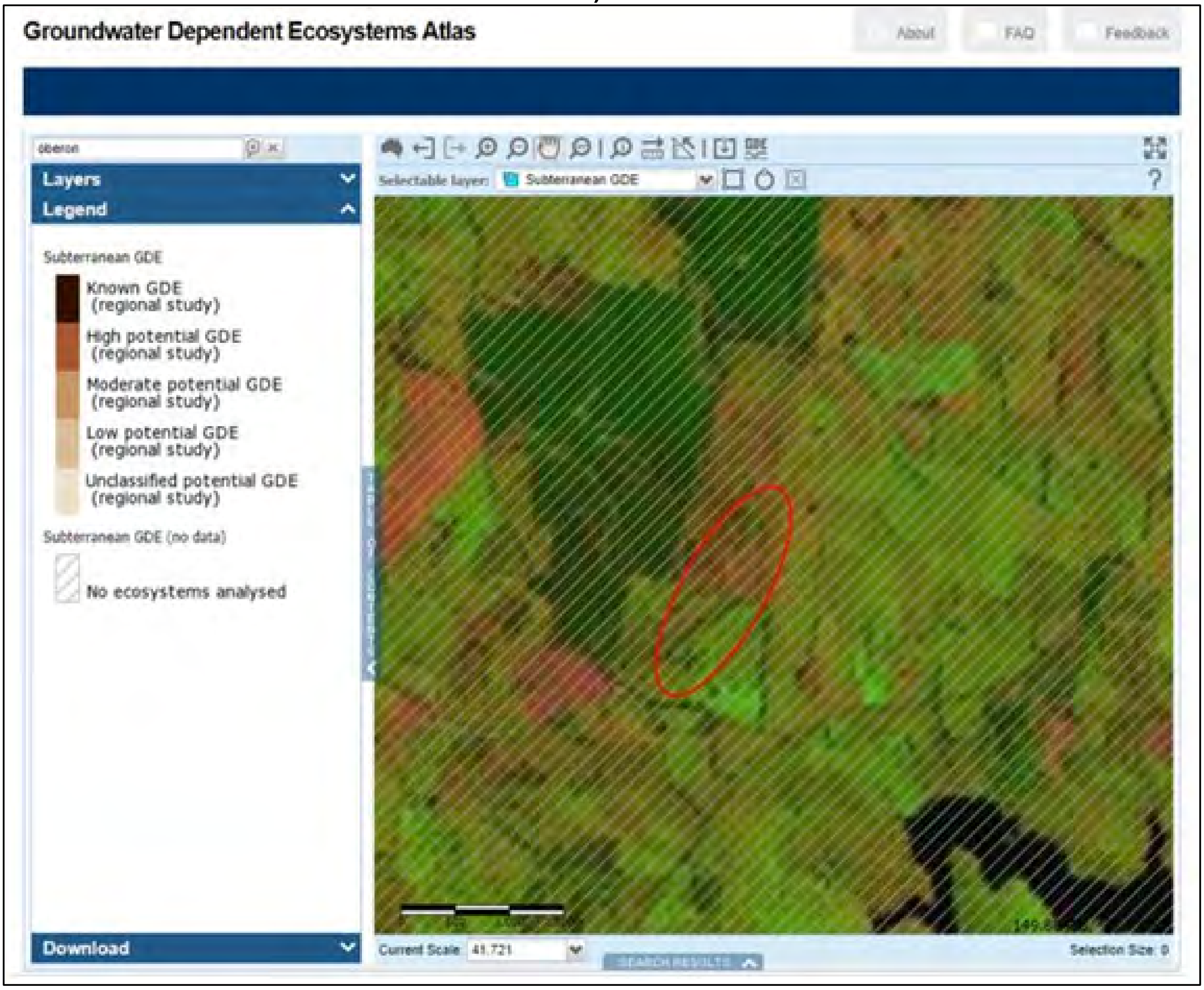
Aquatic Groundwater Dependant Ecosystems (development footprint indicated in red)



Terrestrial Groundwater Dependant Ecosystems (development footprint indicated in red)



Subterranean Groundwater Dependant Ecosystems (development footprint indicated in red)



EPBC Act Protected Matters Report

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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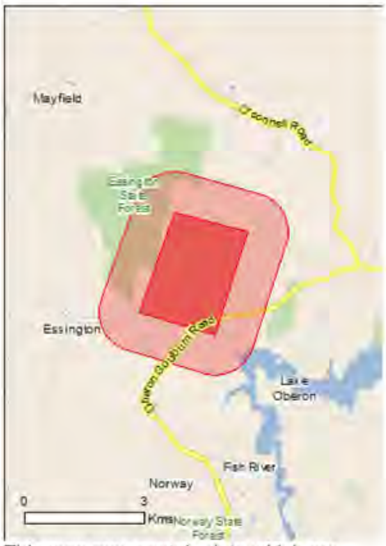

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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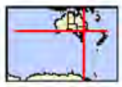

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	22
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	800 - 900km upstream
Riverland	800 - 900km upstream
The coorong, and lakes alexandrina and albert wetland	900 - 1000km upstream
The macquarie marshes	300 - 400km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus pulverulenta Silver-leaved Mountain Gum, Silver-leaved Gum [21537]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.69252 149.807311,-33.696233 149.823619,-33.715512 149.816066,-33.711228 149.799071,-33.692377 149.807139,-33.69252 149.807311

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix B – Predicted Fauna Assessment

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Amphibian					
Litoria aurea	Green and Golden Bell Frog	E	V	Unlikely Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Has been recorded within 10 kilometres of the study area, however dams present in the study area do not have any aquatic vegetation. Is threatened by alteration of drainage patterns and stormwater runoff. No suitable habitat in the development footprint.	No
Litoria booroolongensis	Booroolong Frog	E	E	Unlikely Species lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Dams present in the study area do not have any aquatic vegetation, no streams present. no suitable habitat in the development footprint.	No
Litoria raniformis	Southern Bell Frog	E	V	Unlikely Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. Dams present in the study area do not have any aquatic vegetation, no streams present. no suitable habitat in the development footprint.	No
Mixophyes balbus	Stuttering Frog	E	V	Unlikely Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Breed in streams during summer after heavy rain. no streams, wet forest or suitable understory present in the development footprint.	No
Bird					
Anthochaera phrygia	Regent Honeyeater	CE	CE	Unlikely The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat, this species is not known to occur and is unlikely to occur.	No
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V		Unlikely Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat, this species is not known to occur and is unlikely to occur.	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Potential Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Hollows are present in the development footprint and this species has been recorded in previous survey (2015).	Yes

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Calidris ferruginea	Curlew Sandpiper		CE	Unlikely Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. No suitable waterbodies present in the development footprint.	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Unlikely Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. No sheoaks present in the development footprint.	No
Chthonicola sagittata	Speckled Warbler	V		Unlikely Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat, this species is not known to occur and is unlikely to occur.	No
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		Unlikely Fallen timber is an important habitat component for foraging; is threatened by fragmentation, loss of ground litter and loos of understorey habitat. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat, this species is not known to occur and is unlikely to occur.	No
Daphoenositta chrysoptera	Varied Sittella	V		Unlikely The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement. It is threatened by weed infestation and overgrazing by stock impacting on leaf litter and shrub layer. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat, this species is not known to occur within 1500m and is unlikely to occur.	No
Falco hypoleucos	Grey Falcon	E	V	Unlikely Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions. Also occurs near wetlands where surface water attracts prey. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; No suitable watercourses nearby, no suitable nest detected, unlikely to occur.	No
Gallinago hardwickii	Latham's Snipe		J,K	Unlikely Recorded within 10km however Latham's Snipe occurs in permanent and ephemeral wetlands and usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). No suitable wetland habitat is present in the development footprint.	No
Grantiella picta	Painted Honeyeater	V	V	Unlikely Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Is threatened by heavy grazing, degradation of open forest and clearing. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable habitat or abundant mistletoe, this species is not known to occur and is unlikely to occur.	No
Haliaeetus leucogaster	White-bellied Sea-Eagle	V		Unlikely Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. No suitable waterbodies are present in the development footprint.	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Hieraaetus morphnoides	Little Eagle	V		Potential Recorded within 10km. Occupies open eucalypt forest, woodland or open woodland. No sticknests were present in the development footprint but foraging habitat may be impacted.	Yes
Hirundapus caudacutus	White-throated Needletail		V	Unlikely The White-throated Needletail is almost exclusively aerial, unlikely to be impacted.	No
Lathamus discolor	Swift Parrot	E	CE	Unlikely Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta,* Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon,* and White Box *E. albens.* This species is not known to occur and is unlikely to occur as there are no suitable feed trees.	No
Lophoictinia isura	Square-tailed Kite	V		Unlikely Shows a particular preference for timbered watercourses. Is threatened by clearing, logging, burning, and grazing of habitats resulting in a reduction in nesting and feeding resources. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable timbered watercourse in the study area, this species is not known to occur and is unlikely to occur.	No
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V		Unlikely Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. is threatened by modification and destruction of ground habitat through heavy grazing and compaction by stock, removal of litter and fallen timber and introduction of exotic pasture grasses. Habitat complexity does not exist in the development footprint which is grazed and disturbed.	No
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		Unlikely Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. Is threatened by clearing of remnant open forest and woodland habitat and poor regeneration of open forest and woodland habitats because of intense grazing. Unlikely to occur in the development footprint which is mostly cleared and highly disturbed from grazing and quarry activities.	No
Oxyura australis	Blue-billed Duck	V		Unlikely Has been recorded within 10km however the Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed but prefers to dive if approached. No suitable waterways are present in the development footprint.	No
Ninox connivens	Barking Owl	V		Potential Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Nests in tree hollows, hollows will be impacted.	Yes
Ninox strenua	Powerful Owl	V		Unlikely	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
				The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. However, the main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Is threatened by clearing and degradation of habitat, mostly through cultivation, intense grazing and the establishment of exotic pastures. No suitable prey species in the development footprint. The development footprint is highly disturbed from grazing and quarry activities, this species is not known to occur and is unlikely to occur.	
Numenius madagascariensis	Eastern Curlew		CE	Unlikely The eastern curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. The eastern curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. It is extremely shy and will take flight at the first sign of danger. No suitable habitat and too much disturbance present in the development footprint.	No
Petroica boodang	Scarlet Robin	V		Potential Recorded in previous survey (2015). In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer.	Yes
Petroica phoenicea	Flame Robin	V		Unlikely Birds forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Is threatened by isolation of patches of habitat, particularly where these patches are smaller than 10 ha, and in landscapes where clearing has been heavy or where remnants are surrounded by cropping or stock grazing. Development footprint is disturbed and cleared, lacks required habitat complexity.	No
Polytelis swainsonii	Superb Parrot	V	V	Potential Nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants.	Yes
Rostratula australis	Australian Painted Snipe		E	Unlikely Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. No suitable habitat in the development footprint.	No
Stagonopleura guttata	Diamond Firetail	V		Unlikely Birds roost in dense shrubs or in smaller nests built especially for roosting. this species is threaten ed by the invasion of weeds, resulting in the loss of important food plants, modification and destruction of ground- and shrub layers within habitat through: removal of native plants, litter and fallen timber; introduction of exotic pasture grasses and heavy grazing and compaction by stock. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable timbered watercourse in the study area, this species is not known to occur and is unlikely to occur.	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Tyto novaehollandiae	Masked Owl	V		Unlikely The masked owl is a forest owl which roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. It is threatened by grazing through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable moist eucalypt forested gullies in the study area, this species is not known to occur and is unlikely to occur.	No
Insect					
Paralucia spinifera	Purple Copper Butterfly, Bathurst Copper Butterfly	E	V	Potential The butterfly is found at 35 locations, all within the Greater Lithgow, Bathurst Regional and Oberon local government areas. Habitat consists of sparse understorey that is dominated by the shrub, Blackthorn *Bursaria spinosa* subsp. *lasiophylla*. The butterflies generally remain in the vicinity of *B. spinosa* subsp. *lasiophylla* and are rarely observed more than 10 m distant from the plant.	No No *B. spinosa* subsp. *lasiophylla* shrub in development footprint.
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Unlikely Roosts in caves, no caves will be impacted.	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Potential Generally roosts in eucalypt hollows, but has also been found under loose bark on trees. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hollows will be impacted.	Yes
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		Unlikely Individuals have been sighted within 10km of the study area. However, is a cave dwelling species, no caves will be impacted.	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Unlikely Not known or detected in the broader study area. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy and are easy to detect. No breeding camps were detected.	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Potential Can roost in tree hollows and forages in most habitats across its very wide range, with and without trees.	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Potential Usually roosts in tree hollows and forages over open woodland habitat.	Yes
Cercartetus nanus	Eastern Pygmy-possum	V		Unlikely Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Is threatened by declining shrub diversity in forests and woodlands due to overgrazing by stock and rabbits. No suitable habitat exists in the development footprint as there are no shrubs or heathland plants.	No

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Unlikely Prefers mature wet forest habitat that has been less disturbed. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Is not known to occur nor recorded in the broader study area, habitat is too disturbed to be desirable and no communal latrines were detected.	No
Petaurus australis	Yellow-bellied Glider	V		Unlikely The Yellow-bellied Glider generally prefers reasonable quality, tall open forests which contain a mix of larger older trees containing large hollows for shelter and nesting as well as other eucalypt species to provide a diversity of food resources all year. Three hollow bearing trees will be impacted which area isolated paddock trees and would not be suitable habitat, none of them are desired sap feed trees and no feeding marks were observed.	No
Petaurus norfolcensis	Squirrel Glider	V		Unlikely Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Three hollow bearing trees will be impacted which area isolated paddock trees and would not be suitable habitat.	No
Petauroides volans	Greater Glider		V	Unlikely Individuals have been sighted within 10km of the study area. However greater gliders require large patches of old growth habitat at least 20 ha to sustain a population. They are also very clumsy on the ground, and so have difficulty in crossing open tree-less areas. Three hollow bearing trees will be impacted which area isolated paddock trees and would not be suitable habitat.	No
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Unlikely Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Suitable rocky habitat is not present in the development footprint.	No
Phascogale tapoatafa	Brush-tailed Phascogale	V		Unlikely Is not known to occur nor recorded in the study area. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Three hollow bearing trees will be impacted which area isolated paddock trees which have no suitable groundcover and would not be suitable habitat. Species in unlikely to occur in the development footprint.	No
Phascolarctos cinereus	Koala	V	V	Potential Individuals have been sighted within 10km of the study area. Potential food trees exist within the development footprint.	Yes
Reptile					

Scientific name	Common name	NSW status	Comm status	Likely to occur in the study area?	Potential to be Impacted?
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Unlikely Inhabits woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. Is threatened by habitat degradation through invasion of habitat by weeds or escaped pasture species. No suitable rocks or microclimate exists in the study area which is disturbed and invaded by weeds and escaped pasture species.	No
Varanus rosenbergi	Rosenberg's Goanna	V		Unlikely Is not known to occur nor recorded in the study area. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Is threatened by removal of habitat elements, such as termite mounds and fallen timber. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable microhabitat, this species is unlikely to occur.	No
Delma impar	Striped Legless Lizard	V	V	Unlikely Is not known to occur nor recorded in the study area. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa spp*. and poa tussocks *Poa spp*., and occasionally wallaby grasses *Austrodanthonia* spp. Is threatened by habitat loss and fragmentation through pasture improvement including rock removal, slashing, ploughing and sowing of non-native species, invasion of habitat by weeds or escaped pasture species and intensive grazing by stock. The development footprint is highly disturbed from grazing and quarry activities, there is no suitable microhabitat, this species is unlikely to occur.	No
Fish					
Maccullochella peelii	Murray Cod		V	No The species is considered a main-channel specialist. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags, overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures. There is no suitable habitat in the study area.	No
Macquaria australasica	Macquarie Perch		E	No The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. There is no suitable habitat in the study area.	No

Appendix C – Assessments of Significance

Matters of Environmental Significance (EPBC Act)

MNES - Vulnerable species considered: • *Polytelis swainsonii* Superb Parrot	
Significant impact criteria	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Statement	**Response**
• lead to a long-term decrease in the size of an important population of a species	An important population does not occur in the development footprint. The proposal will not affect a significant area of habitat and will not result in a long term decrease in the size of the population as habitat provided by the development footprint is already highly altered and disturbed. Alternate habitat is available in the area.
• reduce the area of occupancy of an important population	The proposal will not affect a significant area of habitat and will not result in a long term decrease in the size of the population as habitat provided by the development footprint is already highly altered and disturbed. Alternate habitat is available in the area.
• fragment an existing important population into two or more populations	The proposal will not fragment an existing population into two or more population as there are no known populations in the development footprint.
• adversely affect habitat critical to the survival of a species	Critical habitat for this species will not be affected.
• disrupt the breeding cycle of an important population	The proposal will not disrupt the breeding cycle of this species. The development footprint is already highly altered and disturbed. Alternate habitat is available in the area.
• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat. The development footprint is already highly altered and disturbed.
• introduce disease that may cause the species to decline, or	The proposal will not result in disease that is harmful to a vulnerable species becoming established in the vulnerable species' habitat. The development footprint is already highly altered and disturbed.
• interfere substantially with the recovery of the species.	Superb Parrot is not known to occur in the development footprint; therefore, the proposal will not interfere substantially with the recovery of the species.
Summary statement: The proposal will not result in a significant impact to Superb Parrot. The species is not known to occur in the development footprint, which is already highly disturbed and altered by an existing operating quarry and ongoing grazing and farming practices.	
What is an important population of a species? An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity, and/or • populations that are near the limit of the species range.	
What is an invasive species? An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.	
What is habitat critical to the survival of a species or ecological community? 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal	

• for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
• to maintain genetic diversity and long term evolutionary development, or
• for the reintroduction of populations or recovery of the species or ecological community.
Such habitat may be but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

MNES - Vulnerable species considered:

- *Phascolarctos cinereus* Koala

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Statement	Response
• lead to a long-term decrease in the size of an important population of a species	An important population does not occur in the development footprint. The proposal will not affect a significant area of habitat and will not result in a long term decrease in the size of the population as habitat provided by the development footprint is already highly altered and disturbed. Five isolated paddock trees will be impacted. Alternate habitat is available in the area.
• reduce the area of occupancy of an important population	The proposal will not affect a significant area of habitat and will not result in a long-term decrease in the size of the population as habitat provided by the development footprint is already highly altered and disturbed. Alternate habitat is available in the area.
• fragment an existing important population into two or more populations	The proposal will not fragment an existing population into two or more populations. Koala is not known to occur in the development footprint.
• adversely affect habitat critical to the survival of a species	The proposal may remove up to five secondary koala food trees located in a highly disturbed setting surrounded by wooded vegetation. Koala are unlikely to breed in the development footprint. A local population will not be placed at risk of extinction.
• disrupt the breeding cycle of an important population	The proposal will not disrupt the breeding cycle of this species. Koala are unlikely to breed in the development footprint due to existing levels of disturbance.
• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The development footprint is already highly altered and disturbed and Koala are not known to occur there.
• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat. The development footprint is already highly altered and disturbed.
• introduce disease that may cause the species to decline, or	The proposal will not result in disease that is harmful to a vulnerable species becoming established in the vulnerable species' habitat. The development footprint is already highly altered and disturbed.
• interfere substantially with the recovery of the species.	Koala are not known to occur in the development footprint; therefore, the proposal will not interfere substantially with the recovery of the species.

Summary statement:

The proposal will not result in a significant impact to Koala. The species is not known to occur in the development footprint, which is already highly disturbed and altered by an existing operating quarry and ongoing grazing and farming practices.

What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

What is an invasive species?

An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.

What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

Threatened Species Test of Significance (BC Act)

BC Act Threatened Species Test of Significance for birds: • Gang-gang Cockatoo *Callocephalon fimbriatum* • Little Eagle *Hieraaetus morphnoides* • Barking Owl *Ninox connivens* • Scarlet Robin *Petroica boodang* • Superb Parrot *Polytelis swainsonii*	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Statement	**Response**
Adverse effects on the life cycle of a species (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	No viable population of any of these species was found to occur in the development footprint, therefore no viable population is likely to be placed at risk of extinction. The proposal will not affect a significant area of habitat and the development footprint is already highly altered and disturbed.
Adverse effects on ecological communities (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A
Adverse effects on habitats (c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will not affect a significant nor important area of habitat as habitat provided by the development footprint is already highly altered and disturbed. Five isolated paddock trees will be impacted, the development footprint is already highly fragmented by existing quarry operations and farming practices. Alternate habitat is available in the area.
Adverse effects on areas of outstanding biodiversity value (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove three hollow bearing trees and have a negligible contribution to human made climate change.
Summary statement: The proposal will not result in a significant impact to these species. These species are not known to occur in the development footprint, which is already highly disturbed and altered by an existing operating quarry and ongoing grazing and farming practices.	
In determining the nature and magnitude of an impact, it is important to consider matters such as: • pre-construction, construction and occupation/maintenance phases • all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones • all direct and indirect impacts • the frequency and duration of each known or likely impact/action • the total impact which can be attributed to that action over the entire geographic area affected, and over time • the sensitivity of the receiving environment • the degree of confidence with which the impacts of the action are known and understood. All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker	

BC Act Threatened Species Test of Significance for bats:

- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Scoteanax rueppellii* Greater Broad-nosed Bat

Significant impact criteria

An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:

Statement	Response
Adverse effects on the life cycle of a species (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	No viable population of any of these species was found to occur in the development footprint, therefore no viable population is likely to be placed at risk of extinction. The proposal will not affect a significant area of habitat and the development footprint is already highly altered and disturbed.
Adverse effects on ecological communities (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A
Adverse effects on habitats (c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will not affect a significant nor important area of habitat as habitat provided by the development footprint is already highly altered and disturbed. Five isolated paddock trees will be impacted, the development footprint is already highly fragmented by existing quarry operations and farming practices. Alternate habitat is available in the area.
Adverse effects on areas of outstanding biodiversity value (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value as none occur in the Development footprint.
Key threatening processes (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove three hollow bearing trees and will have a negligible contribution to human made climate change.

Summary statement:

The proposal will not result in a significant impact to these species. These species are not known to occur in the development footprint, which is already highly disturbed and altered by an existing operating quarry and ongoing grazing and farming practices

In determining the nature and magnitude of an impact, it is important to consider matters such as:

• pre-construction, construction and occupation/maintenance phases
• all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones
• all direct and indirect impacts
• the frequency and duration of each known or likely impact/action
• the total impact which can be attributed to that action over the entire geographic area affected, and over time
• the sensitivity of the receiving environment
• the degree of confidence with which the impacts of the action are known and understood.

All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker

BC Act Threatened Species Test of Significance for Koala:

- *Phascolarctus cinereus* Koala

Significant impact criteria

An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:

Statement	Response
Adverse effects on the life cycle of a species (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	A viable local population does not occur in the development footprint. The proposal will not affect a significant area of habitat and will not result in a long term decrease in the size of the population as habitat provided by the development footprint is already highly altered and disturbed. Five isolated paddock trees will be impacted, Koala are unlikely to breed in the development footprint. Alternate habitat is available in the area.
Adverse effects on ecological communities (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A
Adverse effects on habitats (c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will remove some habitat in a highly modified environment. It will not fragment an existing population into two or more populations or isolate a population. The importance of habitat affected is limited, its removal will not result in the decline or local extinction of any protected matter.
Adverse effects on areas of outstanding biodiversity value (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove three hollow bearing trees and will have a negligible contribution to human made climate change.

Summary statement:
The proposal will not result in a significant impact to Koala. Koala are not known to occur in the development footprint, which is already highly disturbed and altered by an existing operating quarry and ongoing grazing and farming practices

In determining the nature and magnitude of an impact, it is important to consider matters such as:
• pre-construction, construction and occupation/maintenance phases
• all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones
• all direct and indirect impacts
• the frequency and duration of each known or likely impact/action
• the total impact which can be attributed to that action over the entire geographic area affected, and over time
• the sensitivity of the receiving environment
• the degree of confidence with which the impacts of the action are known and understood.
All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker

Appendix D – Fauna Handling and Rescue Procedure

Purpose

This procedure explains the actions to be taken if an animal or eggs are discovered in the development footprint that require handling or rescue during vegetation and soil clearance and ongoing construction activities. The procedure relates primarily to injured shocked and juvenile individuals but also applies to nocturnal fauna or slow-moving species that may not be capable of moving away from mobile plant and equipment.

Scope

This procedure is applicable to all native and introduced species that are found in the development footprint. Construction staff and contractors will attend a site induction, which will include a section on Fauna.

Procedure

In the event wildlife (including shocked, juvenile animals or eggs) are discovered in the development footprint during vegetation and soil clearance and ongoing construction activities the following steps shall be taken:

1. STOP ALL WORK in the vicinity of the fauna and immediately notify the Works Supervisor, who will then notify the relevant environmental officer.

2. If required, contact project ecologist to obtain positive identification of the subject species.

3. Preferably allow fauna to leave the area without intervention.

4. If immediately available, use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling.

5. To minimise stress to native fauna and remove the risk of further injury an appropriately competent person shall:

    a. If time permits call ecologist or fauna rescue for advice.

    b. Attempt to herd animal into adjoining forest, outside construction area.

    c. If capture is necessary cover larger animals with a towel or blanket and place in a large cardboard box and/or cotton/calico bag

    d. Place smaller animals in a cotton/calico bag tied at the top

    e. Keep the animal in a quiet, warm, ventilated and dark place away from noisy construction activities.

    f. Aquatic fauna are to be placed in plastic aquaria or a moistened plastic bag. Frogs will be transported in moistened plastic bags (1 frog/bag) with a small amount of leaf litter. Handling and translocation of frogs shall be in accordance with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008).

Appendix E – Details of Koala and Koala habitat assessment

Field assessment was conducted over one day on 28 July 2020 by Phil Cameron. All suitable trees were checked for the presence and signs of Koala (Plate 2-1). No direct or indirect evidence of Koala was observed during the assessment.

Oberon, approximately 3.5 kilometres to the east of Middle Creek Quarries, recorded 27.2 millimetres of rain in the 24 hours prior to 9am on the day of the assessment according to the Bureau of Meteorology (http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=063063). Some rain (8.4 millimetres) occurred on the day of assessment.

The area around the base of the trees were checked for scats (but this is not allowable data within 24 hours after rain per Phillips and Callaghan 2011). However, allowable data collected was the trees were checked for scratches and none were identified.

No further search for evidence of Koala's was undertaken apart from consideration of the habitat and previous records.

Summary of AREA project teams' qualifications

Name	Phillip Cameron
Position	Principal consultant
CV Details	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland. • Certified Environmental Practitioner (EIANZ) and practicing member. • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117. • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS17082). • Cert III Captive Vertebrate Management. • NSW OEH Scientific License: 101087. • NSW DPI Ethics Approval 17/459 (3). • Practicing member of the NSW Ecological Consulting Association. • WHS White Card and Blue Card. • Apply First Aid (Parasol) ID: 6007221.
Role in this ecology report and experience	**Role** Ecology assessment and report writing. **Experience** Phil has 30 years of experience with Koala assessment as a consultant for environmental impact assessments and captive management with Taronga Western Plains Zoo and Lone Pine Koala Sanctuary. Phillip has appeared as a Koala Expert Witness in the Land & Environment Court. As an ecologist, accredited Biodiversity Assessment Method assessor and ex-zookeeper Phillip uses: • Threatened Species Survey and Assessment Guidelines draft guidelines 2004 and BioNet Threatened Species database to survey for Koala. • The commonwealth SAT technique to determine presence / absence of Koala • Botanical skills to identify Koala food trees to species level • Zookeeping experience to be able to tell the difference between Koala scats and other scats that are similar Phillip has 16 years of experience as an environmental impact assessment consultant. In the last 10 years Phillip is currently the Principal Consultant for AREA and was the Principal Ecologist for OzArk Environmental & Heritage Management. In these roles Phillip completed 100s of Koala assessments including for more than ten State Significant Developments and has applied searches for Koala scats following (Phillips and Callaghan 2011) the Scat Assessment Technique (SAT) at a maximum grid spacing of 250 m.

•

Plate 0-1: Checking for evidence of Koala in the study area

Habitat assessment

The survey included assessment on foot of existing vegetation in the development footprint. This assessment involved:

- identification, measurement and habitat assessment with focus on trees and habitat most likely to be removed by the proposal
- targeted searches for threatened species to meet biodiversity and impact assessment requirements of Part 7 of the NSW *Biodiversity Conservation Act 2016*

- recording presence of exotic species; High Threat Weeds or Weeds of National Significance were identified.

To capture the value of the vegetation within the study area and to help to inform what native species to recommend for Landscape and Visual Planting, vegetation surveys were completed in line with the Biodiversity Assessment Methodology 2017 (BAM). Two plot-based full floristic surveys were completed, based on a nested 20m × 50m quadrat.

Grassland and other groundcover vegetation areas were assessed using transect-intercept survey methods according to the NSW DPIE's Interim Grasslands and other Groundcover Assessment Method.

There are five large trees in the development footprint, four Broad-leafed Peppermint *Eucalyptus dives* and one Blakely's Red Gum *Eucalyptus blakelyi*. This identification was confirmed using diagnostic features including buds, fruit, leave (adult and juvenile) and bark. *E. dives* and *E. blakelyi* are not listed as feed tree species under Schedule 2 of the 2020 Koala Habitat Protection SEPP. These are the only trees in the development footprint which means 100 percent of trees within the development footprint are not food trees.

The vegetation is sparse, the site has been previously highly disturbed, cleared, grazed and quarried. Grassland areas were highly altered and consisted of greater than 90 per cent exotic weed and grass species and this vegetation was assessed as low conservation value grassland.

No records of Koalas exist within five kilometres of the development footprint, of any age. The closest records are between five and ten kilometres, of which there are two, and these are all reasonably old records from between 1995 and 1998. Details of these records as extracted from BioNet are provided in Table 2-4.

Table 0-1: Details of two Koala BioNet records within 10 kilometres of the development footprint

Record number	Dataset Name	Sighting Key	Date First	Date Last	Number Individuals	Estimate Type	Source Code	Observation
1	DPIE Data from Scientific Licences dataset	SDMPI0243783	21-08-98	21-08-98	1	Exactly	Sighting	O
2	DPIE Data from Scientific Licences dataset	SEXK9904192J	01-07-95	01-07-95	-	-	Sighting	O
Record number	**Status**	**Location Key**	**Descrip.**	**Zone**	**Easting**	**Northing**	**Accuracy**	**Sighting No**
1	Valid and accepted without modification	LDMPI0094795	Oberon	55	757061	6276615	10	-
2	Valid and accepted without modification	LEXK99041901	Oberon	55	764713	6266983	1000	-

This data suggest Koala have occurred in the region in the past. However, they are more likely to be associated with large areas of continuous native vegetation or in an area close to such areas. The largest vegetation close to the development footprint would not be suitable for Koala as it is Essington State Forest, a monocultural softwood pine forest plantation, which lies approximately 200 metres to the northwest.

Appendix F – Biodiversity Assessment Method plot data sheets

BAM Plot – Field Survey Form | Site Sheet no:

		Survey Name	Plot Identifier	Recorders
Date	28/7/20	Middle Ck	1	PJC AJC
Zone 55	Datum	IBRA region	Photo #	Zone ID 1
Easting 760210	Northing 6267454	Plot Dimensions 20 x 20 in 20 x 50	Orientation of midline from the 0 m point.	350° Magnetic °

Likely Vegetation Class			Confidence: H M L
Plant Community Type	PCT 731 BL Peppermint	EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	1
	Grasses etc.	2
	Forbs	3
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	70
	Shrubs	0.1
	Grasses etc.	5.3
	Forbs	0.4
	Ferns	0
	Other	[illegible]
High Threat Weed cover %		0.1

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	Stem Classes and Hollows Euc*	Non Euc	Hollows†
80 + cm	—	—	
50 – 79 cm	8	—	—
30 – 49 cm	18	—	Hollows 20cm+
20 – 29 cm	4	—	
10 – 19 cm	✓	—	—
5 – 9 cm	✓	—	
< 5 cm	✓	—	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	73m		total

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	60, 70, 80, 25, 60	0, 0, 0, 0, 2	0, 0, 0, 0, 0	0, 0, 0, 0, 0
Average of the 5 subplots	59%	0.4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	1	O
Cultivation (inc. pasture)	~~1~~3	O
Soil erosion	1	O
Firewood / CWD removal	1	O
Grazing (identify native/stock)	3	O
Fire damage	–	–
Storm damage	–	–

Free Text Section for brief site description

Representative of PCT 731 Zone 1.

Leaf Litter and end point GPS		
ID	Easting	Northing
End point	760216	6267503

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe   Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017   Printed 21 July 2019

400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	28/3/20	Middle Ck	1	PVC AJC

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	TG	t	Eucalyptus dives Broad-leaf Peppermint	N	70	15	U	—	25
2	—	—	Phalaris aquatica	E	80	>5K	—	—	0.2
3		—	Modiola caroliniana Red Flowered Mallow	E	0.5		L	—	0.2
4	—		Medicago sp	E	5		L	—	0
5	GG	g	Austrostipa scabra Rough Spear Grass	N	5	750	L	–	0.2
6	GG	g	Microlaena stipoides	N	0.3	50	L	–	0.2
7	—	—	~~Unk~~ Arctotheca calendula Cape Weed	E	0.1	70	L	–	0.1
8	FG	f	Einadia hastata Saloop	N	0.1	20	L	–	0.1
9	—	—	Weed sp A	E	0.3	100	L	–	0.1
10	FG	f	Vittadinia cuneata Fuzzweed	N	0.2	100	L	–	0.2
11	FG	f	Oxalis chnoodes	N	0.1	50	L	–	0.1
12	SG	s	Helichrysum diosmifolium Sweet Pill flower	N	0.1	1	M	–	0.3
13	—		Asparagus aethiopicus Asparagus fern	HTE	0.1				
14									
15									
16									
17									
18									
19									
20									
21									
22									
23			Count / Cover						
24			TG / 1 / 70						
25			SG / 1 / 0.1						
26			GG / 2 / 5.3						
27			FG / 3 / 0.4						
28			EG / 0 / 0						
29			OG / 1 / 0.1						
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017 Printed 21 July 2019

BAM Plot – Field Survey Form	Site Sheet no:

		Survey Name	Plot Identifier		Recorders		
Date	28/7/20	Middle Ck	2		PJC AJC		
Zone 55	Datum	IBRA region		Photo #		Zone ID	
Easting 760118	Northing 6267277	Plot Dimensions	20 x 20 in 20 x 50		Orientation of midline from the 0 m point.		Magnetic °
Likely Vegetation Class							Confidence: H M L
Plant Community Type		PCT 731 RL Peppermint				EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	0
	Grasses etc.	1
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	19
	Shrubs	0
	Grasses etc.	30
	Forbs	0.2
	Ferns	0
	Other	0
High Threat Weed cover %		0

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm	1		1
50 – 79 cm	𝍸𝍸		
30 – 49 cm	𝍸 1		Hollows 20cm+
20 – 29 cm	1111		1
10 – 19 cm	1		
5 – 9 cm			
< 5 cm			This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	47m		total

Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*

† For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.
Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	10	15	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	7					0					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	2	O
Cultivation (inc. pasture)	3	O
Soil erosion	1	O
Firewood / CWD removal	2	O
Grazing (identify native/stock)	3	NR
Fire damage	–	–
Storm damage	–	–

Free Text Section for brief site description

representative of small patches left on property ie. Native overstratum, missing mid stratum, Exotic (mostly) ground stratum

Leaf Litter and end point GPS		
ID	Easting	Northing
End point	760123	6267326

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe   Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	28/7/20	Middle Ck	2	PJC AJC

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	Height (m)
1	TG	t	Eucalyptus dives Broadleaf Peppermint	N	15	10	U	—	25
2	TG	t	Eucalyptus dalrympleana Mountain Gum	N	2	1	U	—	4
3	TG	t	Eucalyptus blakelyi Blakely's Red Gum	N	2	1	U	—	4
4	GG	g	Austrostipa scabra Rough Speargrass	N	30	>1K	L	—	0.1
5	—	—	Phalaris aquatica	E	70	>10K	L	—	0.3
6	—	—	Cirsium vulgare Ten Black Spear Thistle	E	0.1	20	L	—	0.1
7	—	—	Malva neglecta Marshmallow Weed	E	0.5	100	L	—	0.2
8	FG	f	Einadia hastata Saloop	N	0.1	50	L	—	0.1
9	—	—	Taraxacum officinale Dandilion	E	0.1	50	L	—	0.1
10	—	—	Medicago sp	E	15	1000	L	—	0.1
11	—	—	Modiola caroliniana Red flowered Mallow	E	0.5	200	L	—	0.2
12	—	—	Arctotheca calendula Cape weed	E	0.5	200	L	—	0.2
13	FG	f	Hydrocotyl Stinking Pennywort	N	0.1	50	L	—	0.2
14	—	—	Lactuca serriola Prickly lettuce	E	0.1	50	L	—	0.3
15	—	—	Sissybrium sp	E	5	200	L	—	0.3
16									
17									
18									
19									
20									
21			Count Cover						
22			TG 3 19						
23			SG 0 0						
24			GG 1 30						
25			FG 2 0.2						
26			EG 0 0						
27			OG 0 0						
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017 Printed 21 July 2019

Koala Assessment Report

Per: Koala Habitat Protection Guideline

State Environmental Planning Policy (Koala Habitat Protection) 2019

Middle Creek Quarries Proposed Modification
Oberon Council LGA, NSW

November 2020 (finalised December 2022)

AREA Environmental Consultants & Communication
(a) 6 Belmore Street Dubbo NSW 2830
(b) "The Old Macquarie Brewery" c.1876, 72 Brisbane Street Dubbo NSW 2830
Ph 0409 852 098
phil@areaenvironmental.com.au

AREA Environmental Consultants & Communication acknowledge Traditional Owners of the country on which we work

Document controls

Proponent	Oberon Earthmoving Pty Limited		
Client	Umwelt (Australia) Pty Ltd		
Document Description	**Koala Assessment Report** Middle Creek Quarries Proposed Modification		
Clients Representative Managing this Document	**AREA Person(s) Managing this Document**		
	Phil Cameron (PJC)		
File Location: Clients>Umwelt>Middle Creek Quarries	**AREA Job No: QU0232**		
Document Status:	**Version**	**Date**	**Action**
Series V1.X = internal edits (Draft)	V1.0 V1.1	24/08/2020 26/08/2020 26/08/2020	GP to NH AREA Internal Edit GP to AW/PJC
Series V2.X = Client internal edits (Draft)	V2.1 V2.2	02/09/2020 16/11/2020	AREA to Client AREA to Client
FINAL (Draft approved by client)	V3.0	01/12/2022	Final to Client
Prepared For			
Jon Novoselac Environmental Consultant **Umwelt (Australia) Pty Limited** 75 York Street Teralba, NSW 2284 Phone: (02) 4950 5322 jnovoselac@umwelt.com.au	**Genevieve Peel** Environment Consultant **AREA Environmental & Heritage Consultants Pty Ltd** 6 Belmore Street Dubbo NSW 2830 E gen@areaenv.com.au ABN:29 616 529 867		

Executive summary

State Environmental Planning Policy (Koala Habitat Protection) 2019 (the SEPP) encourages the conservation and management of Koala habitat to ensure populations remain in their present range and the trend of population decline is reversed.

The SEPP is made under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and replaces the previous State Environmental Planning Policy No 44 - Koala Habitat Protection (SEPP 44).

This Koala Assessment Report is made in accordance with the SEPP. This report is not a pass or fail test, its purpose is to guide consent authorities to understand and implement the requirements of the SEPP. It sets out the requirements for the protection of Koala habitat through the preparation and assessment of development applications to which the SEPP applies.

This Koala Assessment Report follows the template provided in s3.3 of Koala Habitat Protection Guideline (2020) and accompanies a development application for the Middle Creek Quarries Proposed Modification to which the SEPP applies.

Oberon Earthmoving Pty Limited (the proponent) propose a modification to Development Consent DA 10.2016.38.1 for the existing Middle Creek Quarries (the proposal) at 50 Sewells Creek Road, approximately 3.5 kilometres west of Oberon, in the Oberon Council local government area (LGA) of New South Wales.

The proposal aims to modify the development consent to allow for the following:

- Extended resource recovery activities to include concrete for crushing and sale and green waste, biosolids and manure for composting and sale
- Construction of an Additional Stockpiling and Processing Area on which the modified composting activities would be undertaken, and
- Increased truck movements.

AREA Environmental Consultants & Communication (AREA) have been engaged by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving Pty Limited (the proponent / Oberon Earthmoving) to complete a Biodiversity Assessment for this proposal. This Koala Assessment Report considers the likely impact of the proposal to Koala and has been prepared to inform a separate Biodiversity Assessment Report.

This Koala Assessment Report confirms there is some minor potential for Koala to occur in the development footprint. The proposal will have a minor impact on potential Koala habitat. However, the development footprint is highly altered and continually disturbed. Koala are unlikely to use the potential habitat. This report will assist the determining authority to understand the implications of this proposal as it relates to Koalas.

Glossary of terms

Definitions

Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
Indirect impact	Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Matters of NES or MNES	A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact. (OEH 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Population	All the individuals that interbreed within a given area.
Development footprint	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

Abbreviations

BAMCC	Biodiversity Assessment Method Credit Calculator
BC Act	Biodiversity Conservation Act 2016
CEMP	Construction Environmental Management Plan
DPIE	Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Federal).
FBA	Framework for Biodiversity Assessment
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SoEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
TSPD	Threatened Species Profile Database
VIS	Vegetation information system

1 Introduction

1.1 The nature of the proposed development

Oberon Earthmoving Pty Limited (the proponent / Oberon Earthmoving) propose a modification to Development Application (DA) 10.2016.38.1 for the existing Middle Creek Quarries (the proposal). Middle Creek Quarries are located at 50 Sewells Creek Road, approximately 3.5 kilometres west of Oberon, in the Oberon Council local government area (LGA) of New South Wales (Figure 1-1). The quarry operations are entirely contained within Lot 2 DP1112479.

The proposal contains the following anticipated modifications.

- An increase in truck movements (up to 150 per day).
- Importation and crushing waste concrete (up to 25,000 tpa).
- Construction of a new Processing and Stockpiling Area for the purpose of modified composting operations. The modified composting operations would extend the raw materials to be imported and composted to green waste, biosolids, manure and Food Organics Garden Organics (FOGO).
- Importation, crushing and blending of building and demolition (B&D) waste.
- Washing of crushed aggregates / sand.

This Koala Assessment Report considers the following components of the proposal:

- An extension to the west of the previously approved extraction limit for an additional stockpiling and processing area
- Impacts of clearing already undertaken outside the previously approved extraction limit on the southern side of the lower extraction area.

This report will refer to:

- **The proposal**: extension of the existing Middle Creek Quarries
- **Study area**: Lot2 DP1112479 (Figure 1-2)
- **Development footprint**: the total area of impact outside the previously approved extraction limit (Figure 1-3)
- Various sized **buffers** within and around the study area for considering ecological matters.
- ‘**Approved Quarry Extraction Area**’ is the approved extraction boundary previously approved under DA 10.2016.38.1. This boundary is used to indicate Middle Creek Quarries location on some maps in this document for simplicity and illustrative purposes.

The study area consists of an operational quarry, located within land zoned for primary production which been extensively grazed and historically cleared. There are fragmented patches of vegetation within Lot2 DP1112479 and the Essington State Forest lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

Figure 1-1: Middle Creek Quarries Location (Base image source: Google Roads)

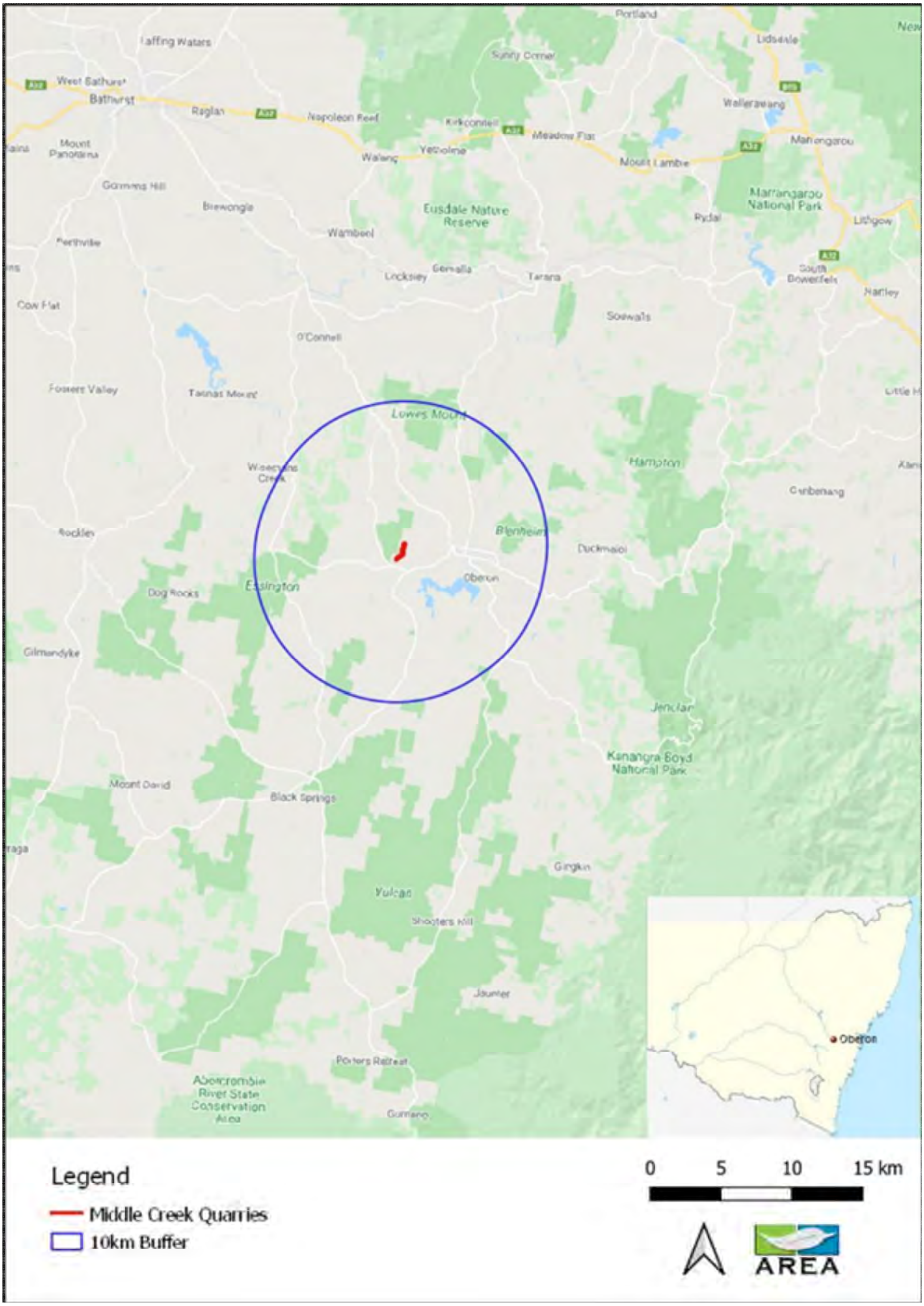


Figure 1-2: The study area

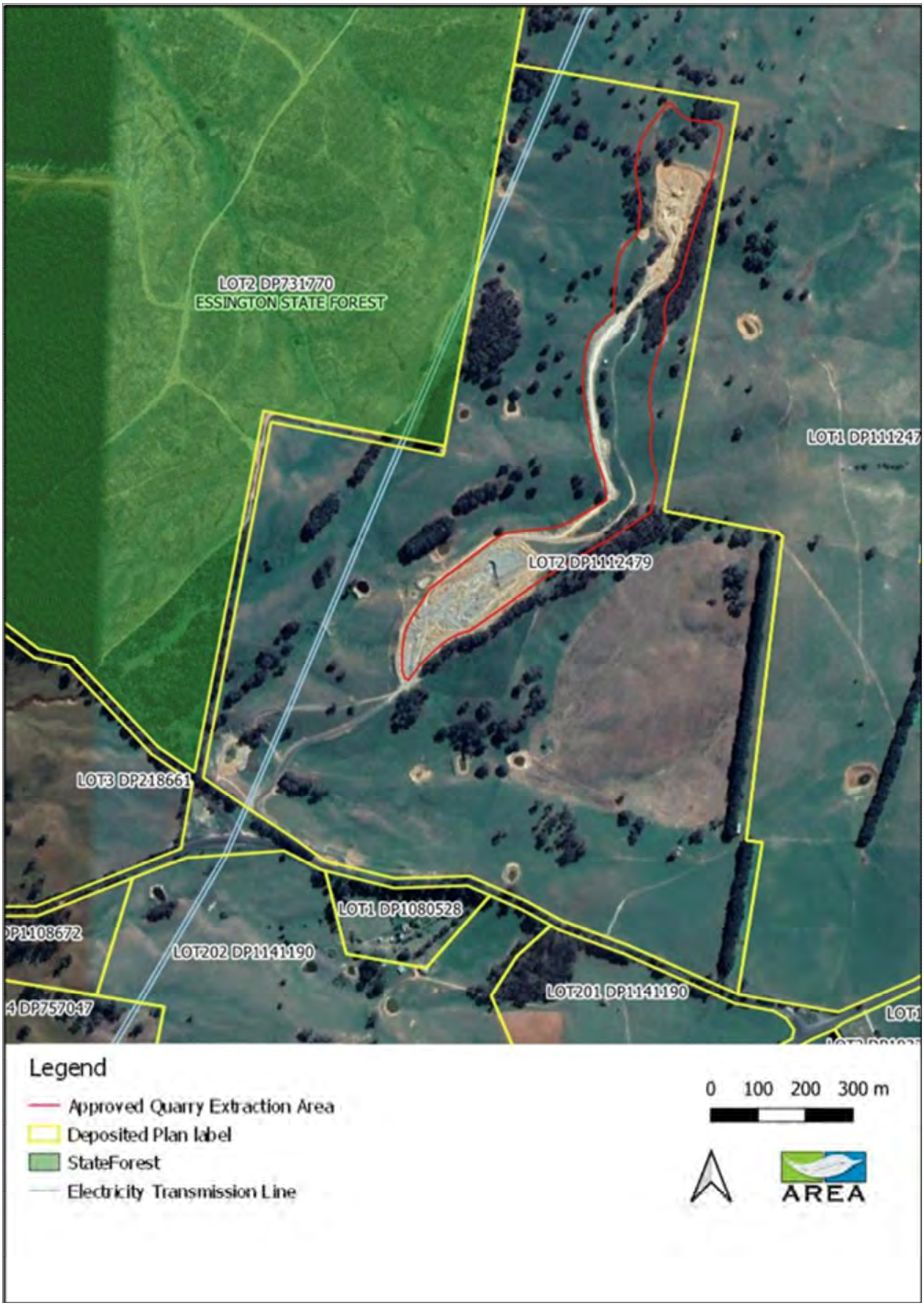
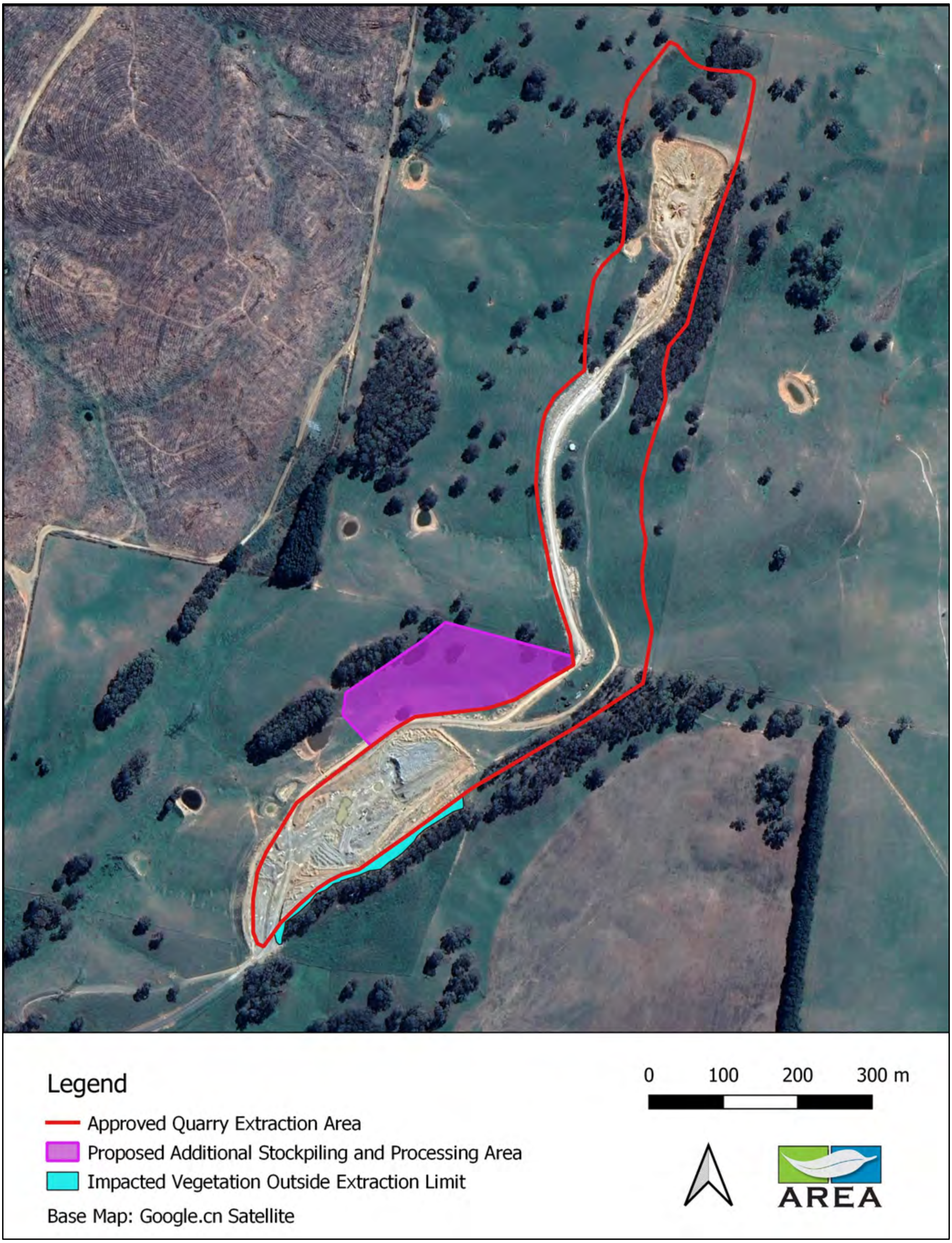


Figure 1-3: The Development Footprint



1.2 How the SEPP applies to the proposed development

SEPP (Koala Habitat Protection 2019) addresses the declining state of Koalas in NSW through better conservation and management of Koala habitat as part of the planning and assessment process. This SEPP applies to development which is not approved under Part 5 of the EP&A Act. This application will be assessed under Part 4 of the EP&A Act. Further, the Oberon Council LGA is listed in Schedule 1 of the State Environmental Planning Policy (Koala Habitat Protection) 2019 therefore this SEPP applies to the proposal.

Koala Habitat Definitions

Definition of Core Koala Habitat under the SEPP

The definition of core koala habitat is specified in clause 4 of the SEPP (see below).

***core koala habitat** means—*

(a) an area of land where koalas are present, or

(b) an area of land—

(i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and

(ii) where koalas have been recorded as being present in the previous 18 years.

Notes about the definition:

- "An area of land" includes both a development footprint and the broader area of land on which the development is proposed (i.e. the subject lot). The controls within the SEPP apply to both direct and indirect impacts and all habitat on the site area. Therefore, the entire lot needs to be considered even if no vegetation is to be cleared.
- Appendix C to this Guideline outlines the survey methodologies to be applied to establish whether an area contains core koala habitat (for councils when preparing KPOMs and development application proponents wishing to undertake a survey to demonstrate their land does not contain core koala habitat). Appendix C also defines *highly suitable habitat and* details the procedure for identifying it.

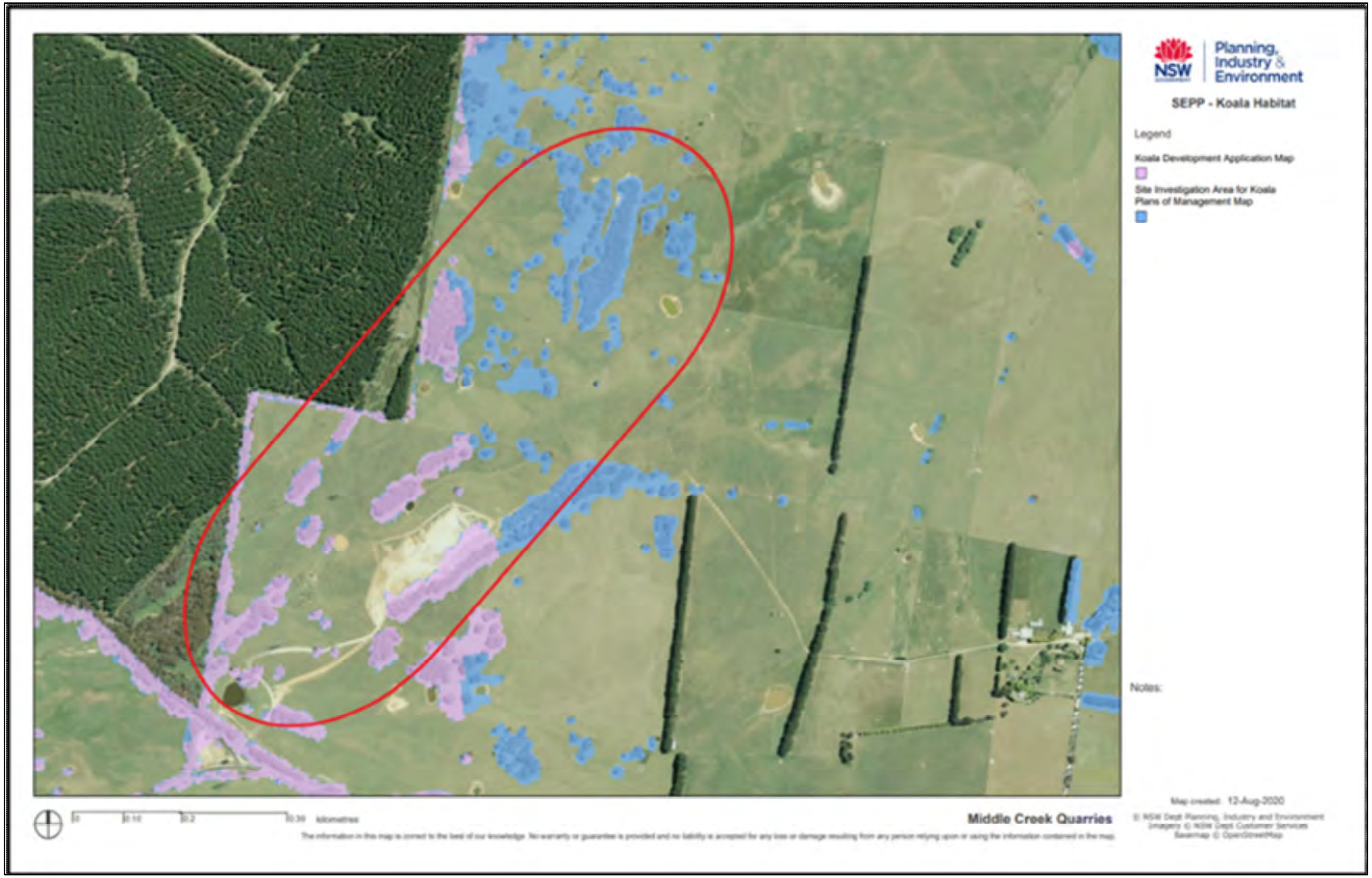
Sourced from Koala Habitat Protection Guideline- Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019.

The provisions of the SEPP apply to applications for development relating to land within a council area listed below:

1. Where there is an approved Koala Plan of Management for the land
   a. the development application must be consistent with the approved Koala plan of management that applies to the land.
2. Where there is no approved Koala Plan of Management for the land if the land
   a. is identified on the Koala Development Application Map, and
   b. has an area of more than one hectare, or
   c. has, together with any adjoining land in the same ownership, an area of more than 1 hectare, whether or not the development application applies to the whole, or only part, of the land.

Figure 1-4 shows the development footprint (red) as having land identified on the Site Investigation Area for Koala Plans of Management Map (light blue) and the Koala Development Application map (pink). Oberon Council does not have a Koala Plan of Management at the time writing this report and the study area is contained within the same Lot and has an area of at least one hectare. This triggers preparation of a Koala Assessment Report (this report) in accordance with the Koala Habitat Protection Guideline (NSW Government 2019).

Figure 1-4: SEPP Koala Habitat Protection map showing location of the study area in red: http://webmap.environment.nsw.gov.au/Html5Viewer291/index.html?viewer=KoalaSEPP.htm5)



2 Koala habitat values addressing Criteria 1 and 2

2.1 Describe the site area, including the general environment and condition, location and extent of the development area and any other areas that may be directly or indirectly impacted by the proposed development.

A summary of vegetation within the development footprint, which may be impacted by the proposal is provided in Table 2-1.

Table 2-1: Hectares of vegetation impacted by the proposal

PCT ID	PCT Name	Hectares in the development footprint
PCT730	Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion in the additional extraction area	0.11
PCT730	Already impacted Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion in the 'impacted vegetation outside extraction limit'	0.31
PCT0	Low conservation value grassland	2.43
	Total	**2.85**

The study area incorporates Lot 2 DP1112479 and consists of an operational quarry, located within land that is zoned for primary production and has been extensively grazed and cleared. There are fragmented patches of vegetation within Lot2 DP1112479 and the Essington State Forest, a monocultural softwood pine forest plantation, lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

Field survey found the native vegetation in the study area is a dry sclerophyll forest with a mostly absent shrub layer and dense grassy, highly weedy groundcover, which has been historically cleared for primary production and quarry operations.

Field assessment determined the vegetation in the study area had a dominance of Broad-leaved Peppermint Eucalyptus dives and Mountain Gum *Eucalyptus dalrympleana* subsp*. Dalrympleana*. Blakely's Red Gum *Eucalyptus blakelyi* was recorded sparsely in the study area. The presence of native ground stratus species, rough spear grass *Austrostipa scabra*, was detected, but an estimate of approximately 90 per cent of groundcover species were not native.

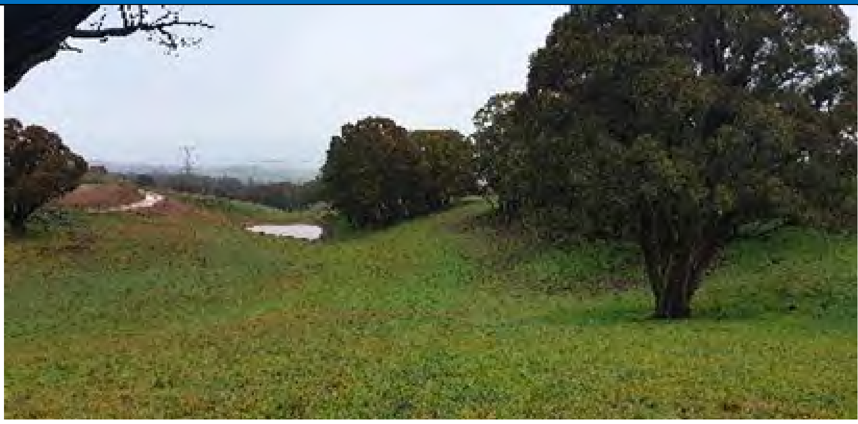
Native vegetation within the development footprint reflects historic severe ground surface disturbance and is highly altered and weed dominated with large areas of exotic grasses and weed species. PCT730 was determined to occur where there are trees only. The remaining grassland areas were highly altered and consisted of greater than 90 per cent exotic weed and grass species and this vegetation was assessed as low conservation value grassland.

Native vegetation (where there are trees) in the development footprint was determined to be PCT730 (Plant Community Type), *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion*. Remaining vegetation in the study area was assessed as low conservation grassland following requisite guidance material, which has been heavily impacted by clearing, intensive grazing and invasive pasture grasses and weeds. Example vegetation in different parts of the study area is illustrated in Table 2-2.

No threatened flora or fauna species, including direct or indirect signs of Koala were identified in the development footprint.

Table 2-2: Example vegetation in, and adjacent to, the development footprint

Location	Vegetation description	Photo
Additional Stockpiling and Processing Area, facing east	Low Conservation Grassland	
Additional Stockpiling and Processing Area, facing north	PCT730 occurs where there are trees, vegetation to the right and tree in centre of picture will not be impacted, tree to the left in this image may be impacted.	

Location	Vegetation description	Photo
Additional Stockpiling and Processing Area, facing south	PCT730 occurs where there are trees, foremost tree and tree in the far left of this picture may be impacted.	
Clearing already undertaken outside the previously approved extraction limit on the southern side of the lower extraction area.	PCT730 adjoining disturbed area	
Clearing already undertaken outside the previously approved extraction limit on the southern side of the lower extraction area.	PCT730 adjoining disturbed area	
Example vegetation surrounding mid section of the Quarry. Will not be impacted by the proposal.	PCT730	

Location	Vegetation description	Photo
Example vegetation surrounding northern extraction area. Will not be impacted by the proposal.	PCT730	

Figure 2-1 shows the location of yet to be impacted native vegetation in the development footprint. Figure 2-2 shows the location of the five trees within the development footprint. The area occupied by these trees equates to 0.11 hectares.

Remaining vegetation in the development footprint has no shrubs and has been completely cleared of trees. It is highly disturbed and degraded from clearing, grazing and quarry operations. Greater than 90 per cent of groundcover was found to be exotic weed and grass species and the vegetation was assessed as low conservation value grassland.

Figure 2-1: Impacted native vegetation

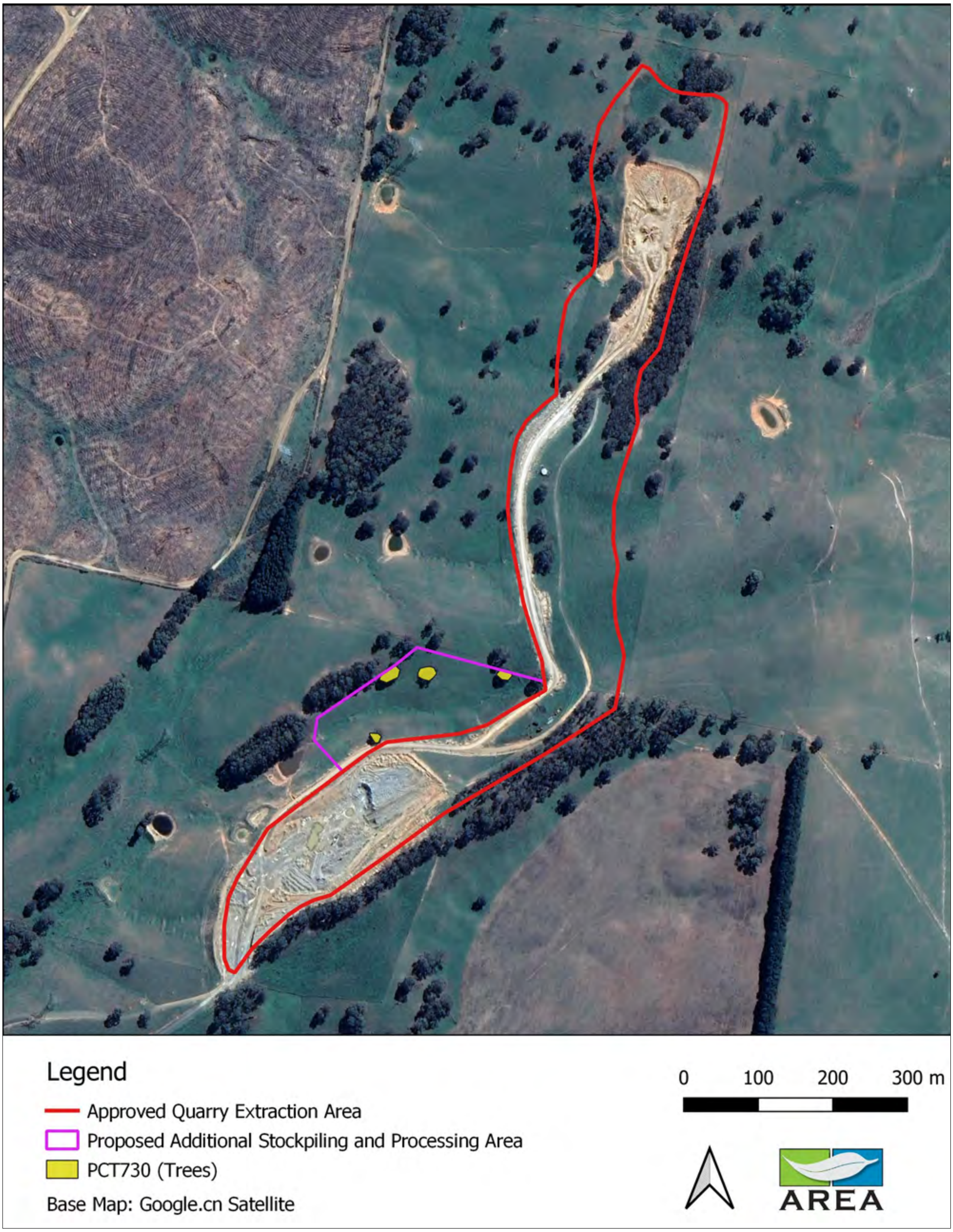
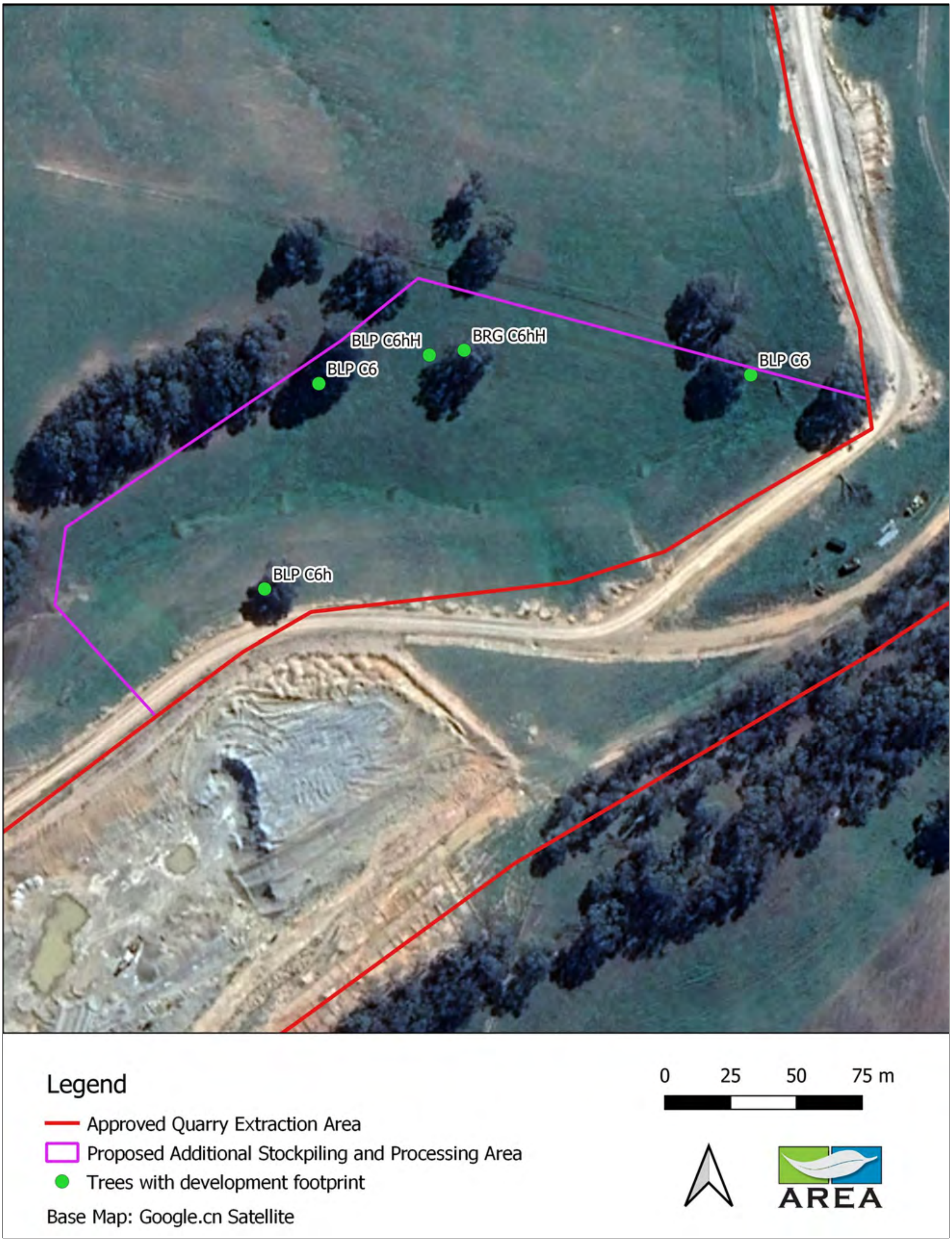


Figure 2-2: Trees within development footprint



Key: BLP (Broadleaved Peppermint), BRG (Blakely's Red Gum), C (Class size of tree following BAM Plot sheet), H (Tree hollow with a diameter of opening > 20cm), h (Tree hollow with a diameter of opening < 20cm but > 10cm).

2.2 Provide details of koala survey as undertaken in accordance with Appendix C of the NSW Government Koala Habitat Protection Guideline. This should include details of the results of the koala surveys, including how the site area meets the definition of core koala habitat and mapping that shows habitat areas and koala records within the site area and adjoining areas. Koala survey as undertaken in accordance with Appendix C.

2.2.1 Assessment personnel

This assessment report was completed by Addy Watson. Addy meets the criterion as a suitably qualified person. Field assessment was conducted by Phillip Cameron (See Table 2-3)

Table 2-3: Summary of AREA project teams' qualifications

Name	Phillip Cameron
Position	Principal consultant
CV Details	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland. • Certified Environmental Practitioner (EIANZ) and practicing member. • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117. • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS17082). • Cert III Captive Vertebrate Management. • NSW OEH Scientific License: 101087. • NSW DPI Ethics Approval 17/459 (3). • Practicing member of the NSW Ecological Consulting Association. • WHS White Card and Blue Card. • Apply First Aid (Parasol) ID: 6007221.
Role in this ecology report and experience	**Role** Ecology assessment and report writing. **Experience** Phil has 30 years of experience with Koala assessment as a consultant for environmental impact assessments and captive management with Taronga Western Plains Zoo and Lone Pine Koala Sanctuary. Phillip has appeared as a Koala Expert Witness in the Land & Environment Court. As an ecologist, accredited Biodiversity Assessment Method assessor and ex-zookeeper Phillip uses: • Threatened Species Survey and Assessment Guidelines draft guidelines 2004 and BioNet Threatened Species database to survey for Koala. • The commonwealth SAT technique to determine presence / absence of Koala • Botanical skills to identify Koala food trees to species level • Zookeeping experience to be able to tell the difference between Koala scats and other scats that are similar Phillip has 16 years of experience as an environmental impact assessment consultant. In the last 10 years Phillip is currently the Principal Consultant for AREA and was the Principal Ecologist for OzArk Environmental & Heritage Management. In these roles Phillip completed 100s of Koala assessments including for more than ten State Significant Developments and has applied searches for Koala scats following (Phillips and Callaghan 2011) the Scat Assessment Technique (SAT) at a maximum grid spacing of 250 m.

Name	Addy Watson
Position	Principal Environment and Community Consultant
CV Details	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW • B. Env. Sc. University of New England. • Diploma Project Management • Cert. III Zoo Keeping • Cert III Animal Studies • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS19066).
Role in this ecology report and experience	**Role** Ecology assessment and report writing. **Experience** Addy has 15 years of experience with Koala assessment as a consultant for environmental impact assessments and captive management with Taronga Zoo and Taronga Western Plains Zoo. As an ecologist, accredited Biodiversity Assessment Method assessor and ex-zookeeper Addy uses: • Threatened Species Survey and Assessment Guidelines draft guidelines 2004 and BioNet Threatened Species database to survey for Koala. • The commonwealth SAT technique to determine presence / absence of Koala • Botanical skills to identify Koala food trees to species level • Zookeeping experience to be able to tell the difference between Koala scats and other scats that are similar Addy has two years of experience as an environmental impact assessment consultant. In this role, Addy completes Koala assessments including for State Significant Developments and has applied searches for Koala scats following (Phillips and Callaghan 2011) the Scat Assessment Technique (SAT) at a maximum grid spacing of 250 m.

2.2.2 Part A assessment – Koala assessment

Field assessment was conducted over one day on 28 July 2020. All suitable trees were checked for the presence and signs of Koala (Plate 2-1). No direct or indirect evidence of Koala was observed during the assessment.

Oberon, approximately 3.5 kilometres to the east of Middle Creek Quarries, recorded 27.2 millimetres of rain in the 24 hours prior to 9am on the day of the assessment according to the Bureau of Meteorology (http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=063063). Some rain (8.4 millimetres) occurred on the day of assessment.

The area around the base of the trees were checked for scats (but this is not allowable data within 24 hours after rain per Phillips and Callaghan 2011). However, allowable data collected was the trees were checked for scratches and none were identified.

No further search for evidence of Koala’s was undertaken apart from consideration of the habitat and previous records.

Plate 2-1: Checking for evidence of Koala in the study area

2.2.3 Part B assessment – Habitat assessment

The survey included assessment on foot of existing vegetation in the development footprint. This assessment involved:

- identification, measurement and habitat assessment with focus on trees and habitat most likely to be removed by the proposal
- targeted searches for threatened species to meet biodiversity and impact assessment requirements of Part 7 of the NSW *Biodiversity Conservation Act 2016*
- recording presence of exotic species; High Threat Weeds or Weeds of National Significance were identified.

To capture the value of the vegetation within the study area and to help to inform what native species to recommend for Landscape and Visual Planting, vegetation surveys were completed in line with the Biodiversity Assessment Methodology 2017 (BAM). Two plot-based full floristic surveys were completed, based on a nested 20m × 50m quadrat.

Grassland and other groundcover vegetation areas were assessed using transect-intercept survey methods according to the NSW DPIE's Interim Grasslands and other Groundcover Assessment Method.

There are five large trees in the development footprint, four Broad-leafed Peppermint *Eucalyptus dives* and one Blakely's Red Gum *Eucalyptus blakelyi*. This identification was confirmed using diagnostic features including buds, fruit, leave (adult and juvenile) and bark. *E. dives* and *E. blakelyi* are both listed in the Koala Tree Species List for the Central and Southern Tablelands Koala management area in the Koala Habitat Protection SEPP, Schedule 2. These are the only trees in the development footprint which means 100 percent of trees within the development footprint are food trees.

The vegetation is sparse, the site has been previously highly disturbed, cleared, grazed and quarried. Grassland areas were highly altered and consisted of greater than 90 per cent exotic weed and grass species and this vegetation was assessed as low conservation value grassland.

No records of Koalas exist within five kilometres of the development footprint, of any age. The closest records are between five and ten kilometres, of which there are two, and these are all reasonably old records from between 1995 and 1998. Details of these records as extracted from BioNet are provided in Table 2-4.

Table 2-4: Details of two Koala BioNet records within 10 kilometres of the development footprint

Record number	Dataset Name	Sighting Key	Date First	Date Last	Number Individuals	Estimate Type	Source Code	Observation
1	DPIE Data from Scientific Licences dataset	SDMPI0243783	21-08-98	21-08-98	1	Exactly	Sighting	O
2	DPIE Data from Scientific Licences dataset	SEXK9904192J	01-07-95	01-07-95	-	-	Sighting	O
Record number	**Status**	**Location Key**	**Descrip.**	**Zone**	**Easting**	**Northing**	**Accuracy**	**Sighting No**
1	Valid and accepted without modification	LDMPI0094795	Oberon	55	757061	6276615	10	-
2	Valid and accepted without modification	LEXK99041901	Oberon	55	764713	6266983	1000	-

This data suggest Koala have occurred in the region in the past. However, they are more likely to be associated with large areas of continuous native vegetation or in an area close to such areas. The largest vegetation close to the development footprint would not be suitable for Koala as it is Essington State Forest, a monocultural softwood pine forest plantation, which lies approximately 200 metres to the northwest.

2.3 Describe the site context (including mapping showing habitat that might be associated with vegetation in the adjoining landscape and records within the vicinity of the site area) and provide an analysis of the koala habitat values (including how koalas might use the site area and the relative importance of the site area to a local koala population).

2.3.1 NSW Koala Information Base (online or spatial mapping tools)

- **Koala Prioritisation Areas**
  - o Koala Prioritisation Areas are Areas of Regional Koala Significance (ARKS) and Functional Habitat.
  - o The ARKS mapping has been designed by the NSW government to provide focus priorities for the profiling and analysis of the landscape values and threats for Koala populations in NSW.

The development footprint is not within a mapped NSW Koala Prioritisation Area.

- **Koala occurrence (likelihood)**
  - o The baseline map of Koala occurrence was developed by the NSW government as part of the Koala mapping program and shows where Koalas are likely to be found across NSW
  - o The map shows the likelihood of Koala occurrence in
    - 5-kilometre grids across north-east NSW
    - 10-kilometre grids across the rest of NSW
  - o Each grid cell is populated with
    - data reflecting the proportion of Koalas relative to other common mammals
    - a measure of statistical confidence associated with data in the cell
    - The statistical confidence and likelihood levels of the baseline map were then used to direct additional survey effort to data deficient areas.

Koala likelihood in a 10-kilometre square area (rest of NSW) is 0 percent. This is with a 0 percent (lower 95 percent confidence level) to 25 percent (upper 95 percent confidence level) overall confidence level. This means at best, there is a 25 percent likelihood a Koala will occur in the 10-kilometre square area.

- **Koala Tree Index**
  - o The purpose of this NSW government layer is to measure the probability of finding a tree species that a Koala is known to use for food or shelter.
  - o The state wide Koala Habitat Information Base (KHIB) has been developed by the NSW government as part of the NSW Koala Strategy. It delivers the best available state wide spatial data on Koala habitat, likelihood, Koala preferred trees and Koala sightings for NSW.

The development footprint has between 0 and 60 percent probability of finding a tree species that a Koala is known to use for food or shelter (Figure 2-3).

- **Koala habitat suitability**
  - o The purpose of this layer is to measure Koala habitat suitability at any location across NSW.

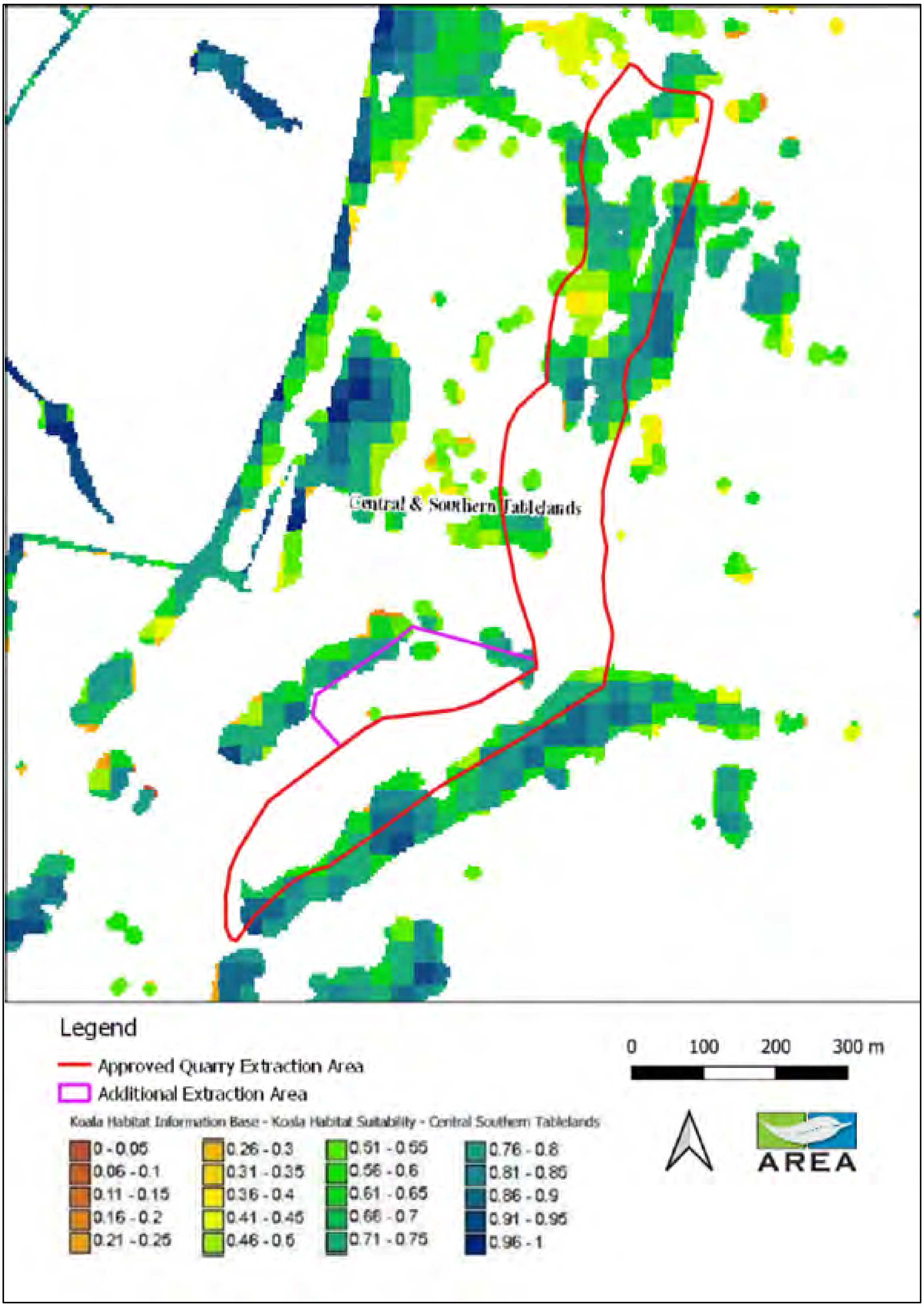
o The state wide Koala Habitat Information Base (KHIB) has been developed as part of the NSW Koala Strategy. It delivers the best available state-wide spatial data on Koala habitat, likelihood, Koala preferred trees and Koala sightings for NSW.

The development footprint has between 21 and 90 percent probability of being suitable for Koalas (Figure 2-4).

In summary, the development footprint appears to offer possible koala habitat, based on remote sensing data collection.

Figure 2-3: Koala Tree Index – likelihood of suitable trees

Figure 2-4: Koala habitat suitability



2.3.2 Vegetation

The NSW Office of Environment and Heritage State Vegetation Type Map: Central Tablelands Version 0.1p0 4778 was accessed via the NSW Government SEED website (https://datasets.seed.nsw.gov.au/). Plant community types (PCTs) on this map are shown on Figure 2-5. Most PCT's on this map are associated with Koalas and therefore may provide Koala habitat. Ground-truthed PCTs are shown in Figure 2-6.

Figure 2-5: Plant Community Types mapped within 1500m of the development footprint

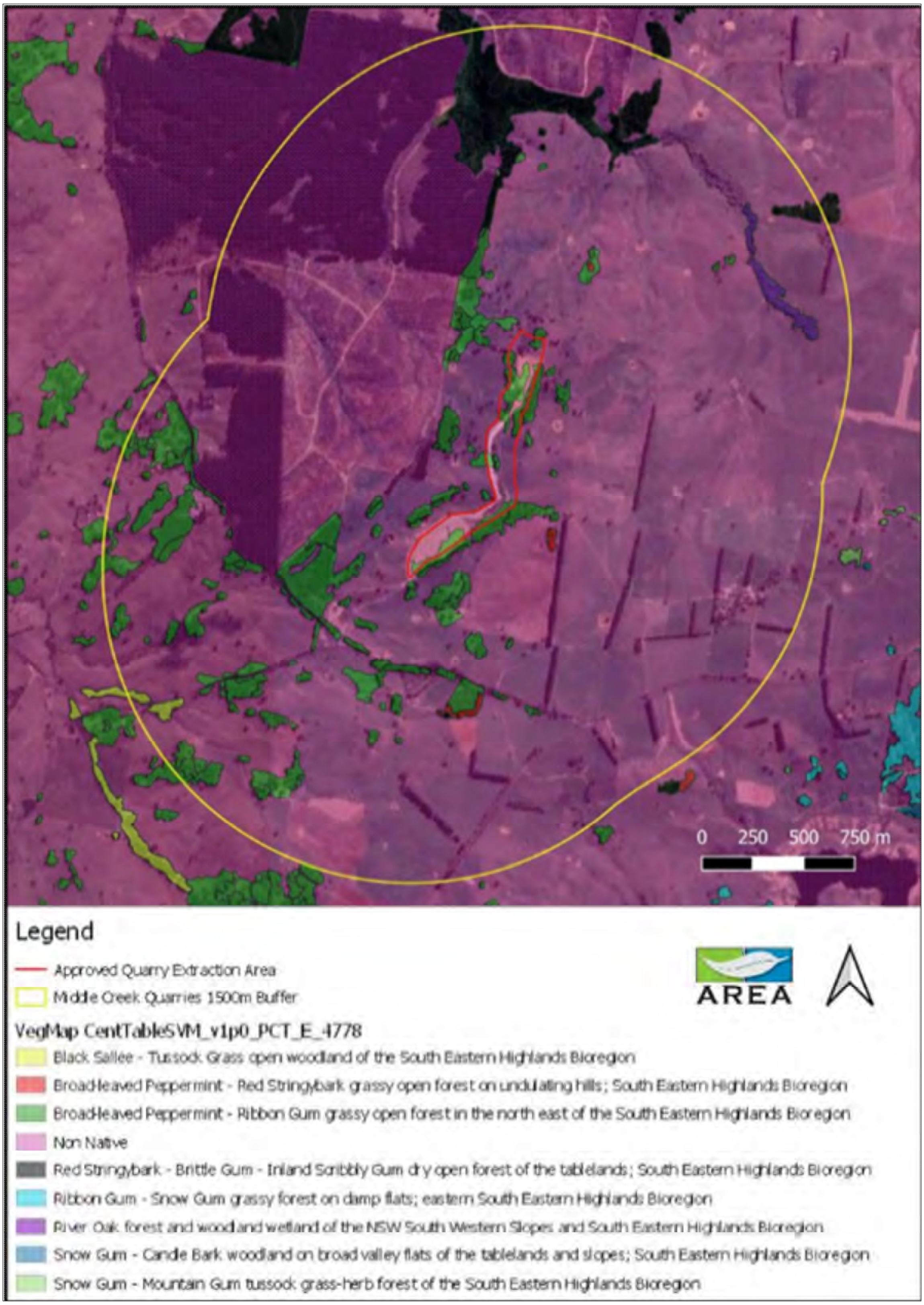
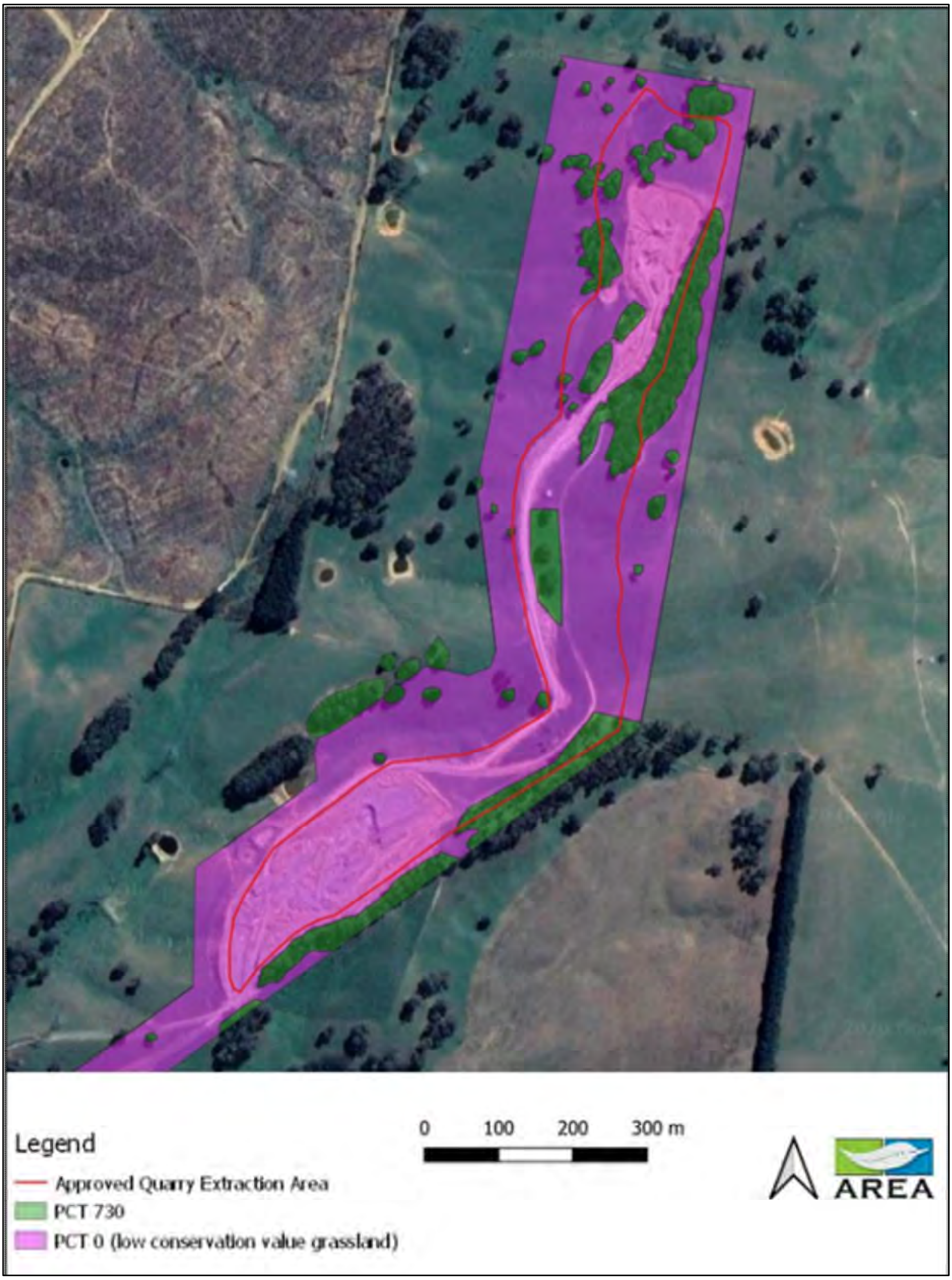


Figure 2-6: Plant Community Types mapped in the development footprint



2.3.3 Koala records

Koala are predicted to occur in the development footprint by NSW and Commonwealth database searches and two Koala records exists within 10 kilometres of the development footprint. All sightings occurred over 20 years ago (Figure 2-7).

Figure 2-7: BioNet Koala sightings records (as at 06/08/2020)

2.3.4 Habitat values

The study area consists of an operational quarry, located within land that is zoned for primary production and has been extensively grazed and cleared. There are fragmented patches of native vegetation within the study area and the Essington State Forest lies approximately 200 metres to the northwest of Middle Creek Quarries. A 330kV transmission line extends in a north-south axis along the western precinct of the study area.

Native vegetation (where there are trees) in the development footprint was determined to be PCT730 (Plant Community Type), *Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion.* Remaining vegetation in the study area was assessed as low conservation grassland, which has been heavily impacted by clearing, intensive grazing and invasive pasture grasses and weeds.

PCT730 can provide habitat for a wide range of terrestrial fauna, including birds, microbats, reptiles, rodents and small marsupials. However, the vegetation is highly disturbed and there are few fallen logs are present in the development footprint.

Five trees, three of which have hollows, will potentially be impacted by the proposal. These tree hollows can provide habitat value for microbats, birds and arboreal mammals and will be retained and/or mitigated where possible. Habitat values such as shade, shelter and food provided by the vegetation to be removed represents some decline in habitat features.

The trees in the development footprint which will be impacted are Koala food tree species. However, these are isolated paddock trees which are unlikely to be utilised by Koala. The existing and proposed development footprint is so highly altered and continually disturbed from ongoing quarry operations and surrounding farming practices, Koala are unlikely to use the potential habitat. The closest large vegetated area to the development footprint in the Essington State Forest, a monocultural softwood pine forest plantation, which is not suitable Koala habitat.

3 Measures taken to avoid impacts to Koalas – addressing criteria 3, 4, 5 ,6, 7 and 8

3.1 Describe the site selection process, including how Koala habitat was taken into account and any avoidance outcomes achieved through this process

The proposal occurs on historically disturbed land associated with the Middle Creek Quarries and primary production. The area selected for the development footprint has been the subject to significant disturbance previously and is adjacent to the existing working quarry.

The proposal will impact five isolated paddock trees, which equates to a total area of 0.11 hectares of PCT730, but will not impact any dense entire patches of native vegetation. Additionally, landscape and visual screen planting is proposed in an area of approximately 2.54 hectares. This will include native species to complement the existing PCT and ensure future food and habitat trees for koala.

The proposal cannot further avoid Koala habitat, any alternative is unlikely to impact less Koala habitat.

3.2 Describe how the proposed development avoids or minimises direct impacts to Koala habitat and habitat function within the site area

- The proposal will not prevent movement of Koala though the landscape. Adjacent vegetation remains intact and accessible.
- The development footprint will not further fragment Koala habitat as Koala will not be excluded from adjacent habitat. The proposal will impact five isolated paddock trees only.
- Habitat values will potentially be improved long term because of active landscape and vegetation screen planting which will include Koala food and habitat tree species.

4 Analysis of potential impacts – addressing criteria 9

4.1 Identify the residual direct impacts to Koalas and Koala habitat within the site area, including the nature and extent of impacts and the likely implications for the viability of a local Koala population.

A local Koala population is unlikely to be present in the study area. The residual impact to Koalas and Koala habitat is the removal of five mature potential food and habitat trees.

The implications of this impact to any local Koala habitat is expected to be minor for the following reasons:

- It will not result in the death of any Koalas – trees will be checked for Koalas prior to removal and an injured fauna response plan is included in Appendix A
- It will not reduce the ability of any Koalas to breed – It will not interfere with animals directly, and it will not remove habitat to the extent breeding cannot occur or will be disturbed
- It will not remove habitat to the level the remaining habitat will provide unviable habitat – the impact is limited to five isolated paddock trees
- Ongoing quarry works it will not increase threats to any Koala population – the development site is already highly disturbed and is unlikely to be desirable Koala habitat.

4.2 Identify the relevant potential indirect impacts to Koalas and Koala habitat within the site area and adjacent habitat areas, including the nature and extent of potential indirect impacts and the likely implications for the viability of a local Koala population.

As per Section 4.1.

5 Plan to manage and protect Koalas and their habitat – addressing criteria 10, 11, 12 and 13

5.1 Describe the management measures that will be implemented as part of proposed construction and operations to manage the direct and indirect impacts identified. These measures should be outcomes focussed and include performance targets

In response to the above:

- A search of each tree will occur immediately before felling to ensure Koala will not be harmed by the proposal
- During clearing the Fauna Handling and Rescue Procedure will be followed (Appendix A).
- If a Koala is present the proponent will contact the project ecologist for advice on 0409 852 098
- Koala sightings will be reported to the NSW Government's BioNet Atlas database using the 'I Spy Koala' app (visit the Apple or Google app stores to download the I Spy Koala app.[DPIE 2019]).

5.2 Describe any compensatory measures that will be delivered, including an analysis of the suitability of these measures against criteria 9 and 10.

Landscape and visual screen plantings are planned to go ahead in an area of approximately 2.54 hectares which will include native species to complement the existing PCT and ensure future food and habitat trees for koala. No further compensatory measures are recommended.

5.3 Outline a plan for monitoring, adaptive management and reporting against the key outcomes and performance targets.

Monitoring and adaptive management will be achieved by:

- During the clearing and project implementation, Koala sightings will be reported to the NSW Government's BioNet Atlas database using the 'I Spy Koala' app (visit the Apple or Google app stores to download the I Spy Koala app.)
- Removal of vegetation will cease if a Koala is present in the vegetation which requires removal. It will be allowed to vacate the area before the vegetation is removed.
- Rehabilitation of the development footprint will be undertaken in accordance with the SoEE.

Given the small scale of vegetation removal in the proposal, no more extensive or detailed monitoring or performance targets have been recommended in this report.

6 References

AREA Environmental (2020b). *Biodiversity Assessment Report: Middle Creek Quarries Proposed Modification*. Report to Umwelt Australia (in prep)

NSW Department of Planning, Industry and Environment (2019) *Koala Habitat Protection Guideline Implementing State Environmental Planning Policy (Koala Habitat Protection)*. Published by NSW Department of Planning, Industry and Environment

NSW Department of Planning, Industry and Environment (2019) *NSW Koala Strategy*. Available at https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/nsw-Koala-strategy/how-to-get-involved

Appendix A – Fauna Handling and Rescue Procedure

Purpose

This procedure explains the actions to be taken if an animal or eggs are discovered in the development footprint that require handling or rescue during vegetation and soil clearance and ongoing construction activities. The procedure relates primarily to injured shocked and juvenile individuals but also applies to nocturnal fauna or slow-moving species that may not be capable of moving away from mobile plant and equipment.

Scope

This procedure is applicable to all native and introduced species that are found in the development footprint. Construction staff and contractors will attend a site induction, which will include a section on Fauna.

Procedure

In the event wildlife (including shocked, juvenile animals or eggs) are discovered in the development footprint during vegetation and soil clearance and ongoing construction activities the following steps shall be taken:

1. STOP ALL WORK in the vicinity of the fauna and immediately notify the Works Supervisor, who will then notify the relevant environmental officer.

2. If required, contact project ecologist to obtain positive identification of the subject species.

3. Preferably allow fauna to leave the area without intervention.

4. If immediately available, use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling.

5. To minimise stress to native fauna and remove the risk of further injury an appropriately competent person shall:

    a. If time permits call ecologist or fauna rescue for advice.

    b. Attempt to herd animal into adjoining forest, outside construction area.

    c. If capture is necessary cover larger animals with a towel or blanket and place in a large cardboard box and/or cotton/calico bag

    d. Place smaller animals in a cotton/calico bag tied at the top

    e. Keep the animal in a quiet, warm, ventilated and dark place away from noisy construction activities.

    f. Aquatic fauna are to be placed in plastic aquaria or a moistened plastic bag. Frogs will be transported in moistened plastic bags (1 frog/bag) with a small amount of leaf litter. Handling and translocation of frogs shall be in accordance with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008).

Appendix B – Assessment criteria

Principle 1. Understand koala habitat values

Criteria 1. The site is established as core koala habitat if it occurs on the Koala Development Application Map or by undertaking a site area survey undertaken in accordance with the methods outlined in Appendix C of this Guideline.

Criteria 2. Further analysis is undertaken in order to understand the broader values of the core koala habitat, including information about the koala population using the habitat and any specific ecological functions the habitat might serve.

Key questions which need to be addressed in meeting this criterion include:

- What is known about the size, health and viability of the koala population?
- What is known about the generational persistence of the local koala populations through an analysis of records to determine population trends and persistence over time?
- What is the broader landscape context of the habitat within the site area? For instance, is it contiguous with broader areas of habitat or relatively isolated, and what are the likely regional movement patterns of koalas using the site area?
- Does the site area contain particular values that are likely to serve an important ecological function for koalas? For instance, providing linkage between other habitats, or serving as a habitat buffer to broader areas?
- Could the habitat area and/or koala population using the site area be important to the recovery of the koala? For instance, does the habitat contain features that might provide refuge during droughts, extreme heat, or fire? Or is the population considered to be healthy, robust or showing relatively low incidence of disease?
- Drawing on evidence presented, what significance are the values of the site to preserving the existing koala population and supporting recovering and expanding populations?

Principle 2. Avoid intensifying land use in koala habitat areas through appropriate landscape planning and site selection

Criteria 3. Site selection takes into account koala habitat values.

In addressing this criterion, the development application needs to show:

- How has the development footprint avoided habitat?
- What feasible alternatives were assessed as part of the process?

Principle 3. Encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas

Criteria 4. Development avoids the direct loss of koala habitat within the site area and avoids fragmentation

Criteria 5. Koala habitat is excluded from the development footprint

Principle 4. Minimise potential direct impacts to koalas through koala sensitive design

Criteria 6. Development avoids direct impacts to koala habitat within the site area. In addressing this criterion, the development application needs to show:

- How will impacts to koala habitat be minimised so as to not fragment existing koala habitat, impact the ability of koalas to move across the landscape or impact the recovery and expansion of populations?

Criteria 7. Where some loss of habitat cannot be avoided (and providing it is consistent with all other criteria set out here), development is designed in a way that retains higher value areas across the site and avoids fragmentation of habitat within the site area and more broadly within the region. For instance, this might mean prioritising the retention of koala trees that are greater than 250 mm DBH, or areas of koala habitat that are in better condition, show signs of koala tree recruitment, are better connected with habitat more broadly, or contain features that might be important for refuge.

Criteria 8. Development is undertaken in a way that maintains the potential function of the koala habitat. For instance, if the koala habitat within the site area has been identified as an important linkage corridor, development should be undertaken in a way that enables the continued movement of koalas.

Principle 4. Implement best practice measures for the management of identified risks to koalas.

Criteria 9. All relevant indirect impacts to koalas and koala habitat associated with the development are identified. Potential indirect impacts which may be relevant include (but are not limited to): dog attacks, vehicle strikes, drowning in pools, increased risk of fire, introduction or spread of disease, disturbance, and impediments to movement. It is important when considering potential indirect impacts to look beyond the site area to any additional areas which are likely to be affected by the proposal to take all potential impacts into account.
Criteria 10. Development uses best practice management measures to address the potential impacts considered likely to pose an increased risk to koalas or their habitat. The types of measures or controls used to address impacts will vary depending on the nature of the development, the relative importance of the site area to koalas, and the extent and magnitude of impacts. The specific requirements may be guided by development control plans relevant to each council area. Examples of the types of measures that might be used to address the indirect impacts identified here are provided in Table 1 above.

Principle 5. Use compensatory measures only where they can be shown to better promote the aim of the SEPP

Criteria 11. Compensatory measures are only used once it has been demonstrated that options to avoid, minimise and manage impacts to koala habitat have been exhausted.
Criteria 12. Where there is any direct loss of habitat or compromise in the potential function of a koala habitat area (and providing it is consistent with all other criteria outlined here), suitable compensatory measures are provided. Determining the suitability of any proposed compensatory measures should be guided by the overall aim of the SEPP.

Principle 6. Use adaptive management strategies to monitor, evaluate and deliver appropriate planning outcomes for koalas

Criteria 13. Development application includes a monitoring, adaptive management and reporting component against the key outcome

AREA Landscape Design Consultants Pty Ltd ABN: 56 646 194 176
- ✓ Commercial external landscape designs for built or natural environments
- ✓ Vegetation Management Plans
- ✓ Stakeholder and community engagement
- ✓ Peer review / project briefs / budgeting assistance

AREA Environmental & Heritage Consultants ABN: 29 616 529 867
- ✓ Environmental impact assessments and approvals : REFs, MW REFs, PEAs
- ✓ Ecology, Aboriginal and historic heritage assessments
- ✓ Biodiversity assessment method (BAM) assessments (BDAR) and offsetting (BSAR)
- ✓ Plans of Management
- ✓ Aboriginal community engagement
- ✓ Stakeholder and community engagement
- ✓ Peer review / project briefs / budgeting assistance / expert witness

Job:	**Biodiversity Assessment: Middle Creek Quarries**
Business:	AREA Environmental & Heritage Consultants
Department:	**Ecology**
Detail:	Update to Middle Creek Quarry Biodiversity Assessment Report
To:	Alex Irwin | Umwelt (Australia) Pty
Date:	1 December 2022
Prepared by:	Rohan Saunders I Environmental consultant (cadet)
Reviewed by:	Phillip Cameron | Managing Director

Dear Alex,

Since the formation of AREA November 2020 Biodiversity Assessment Report (BAR), the State Environmental Planning Policy (SEPP) for Koala habitat protection has been repealed and reissued.

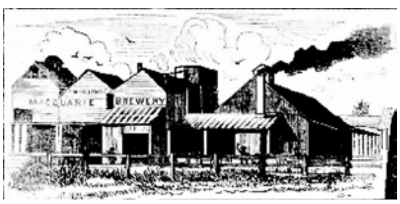
As the BAR referred to now repealed legislation, the BAR needs to be updated to support the proposed modification of Development Consent DA 10.2016.38.1 for the existing Middle Creek Quarries located at Lot 2 DP1112479.

SEPP (Koala Habitat Protection) 2020 applies to proposal because:

- The Lot is larger than one hectare
- The Oberon local government area is listed in Schedule 1 of SEPP (Koala Habitat Protection) 2020. Schedule 1 outlines the local government areas to which the policy applies
- The proposal is located on land zoned RU1 and occurs outside metropolitan Sydney, Blue Mountains, and Central Coast areas.

The 2020 SEPP does not require a Koala Assessment Report or further management plans to be conducted for the proposal. With regard to this, the Koala Assessment Report provided in the AREA BAR is redundant, and document has been updated to meet the requirements of SEPP 2020.

SEPP 2020 requires a suitable qualified and experienced person(s) to determine if the location of the proposal is consistent with the following definitions:



AREA - Biodiversity | Heritage | Landscape Design
a: "The Old Macquarie Brewery" c1876, 72 Brisbane Street, Dubbo, NSW, 2830
e: phil@areaenv.com.au
w: www.areaenvironmental.com.au
Instagram: areaenvironmental
m:0409 852 098

- **Core koala habitat** means an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population.

- **Potential koala** habitat means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

A field assessment was conducted on 28 July 2020. Details of persons conducting field assessment are outlined in Table 1. The field assessment determined the location of the proposal was not consistent with the definitions of Core or Potential Koala habitat.

Table 1: Details of person(s) conducting field assessment

Name	Phillip Cameron
Position	Managing Director
CV Details	• BSc. Macquarie University • Ass Dip App Sci. University of Queensland. • Certified Environmental Practitioner (EIANZ) and practicing member. • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117. • NSW Biodiversity Assessment Method Assessor: accreditation number BAAS17082). • Cert III Captive Vertebrate Management. • NSW OEH Scientific License: 101087. • NSW DPI Ethics Approval 17/459 (3). • Practicing member of the NSW Ecological Consulting Association. • WHS White Card and Blue Card. • Apply First Aid (Parasol) ID: 6007221.
Role in this ecology report and experienc e	**Role** Ecology assessment and report writing. **Experience** Phil has 30 years of experience with Koala assessment as a consultant for environmental impact assessments and captive management with Taronga Western Plains Zoo and Lone Pine Koala Sanctuary. Phillip has appeared as a Koala Expert Witness in the Land & Environment Court. As an ecologist, accredited Biodiversity Assessment Method assessor and ex-zookeeper Phillip uses: • Threatened Species Survey and Assessment Guidelines draft guidelines 2004 and BioNet Threatened Species database to survey for Koala. • The commonwealth SAT technique to determine presence / absence of Koala • Botanical skills to identify Koala food trees to species level • Zookeeping experience to be able to tell the difference between Koala scats and other scats that are similar Phillip has 18 years of experience as an environmental impact assessment consultant. In the last 15 years Phillip is currently the Managing Director for AREA and was the Principal Ecologist for OzArk Environmental & Heritage Management. In these roles Phillip completed 100s of Koala assessments including for more than 15 State Significant Developments and has applied searches for Koala scats following (Phillips and Callaghan 2011) the Scat Assessment Technique (SAT) at a maximum grid spacing of 250 m.

The development footprint is not considered potential habitat due to the recorded tree species *Eucalyptus dalrympleana subsp. dalrympleana* (Mountain Gum), *Eucalyptus dives* (Broad-leaved Peppermint), *Eucalyptus blakelyi* (Blakely's Red Gum) not being listed in Schedule 2 of SEPP 2020. Schedule 2 outlines trees Koala's use for foraging. No Koalas or evidence of Koalas was noted during field assessment. Desktop assessment determined no historical records within five kilometres of the development footprint. Historical records exist within 10 kilometres of the proposal, but the records are older than 20 years. Historical records are only considered when they are within the last 18 years. Therefore, no further management plans would be required, and consent would not be prevented because of SEPP (Koala Habitat Protection) 2020. Further details of assessment procedure are outlined below and in Appendix E of the BAR.

Other changes to the BAR include the removal of the EPBC Act referral guidelines for the vulnerable koala which were made redundant 12 February 2022. The koala is now an endangered species.

The BioNet search was reconducted to ensure no Koalas have been recorded in the vicinity of the proposal since the original BAR.

While undertaking the abovementioned task, additions to the BioNet species records in 2021 were noted, all of which were more than 1500 metres and within 10 kilometres of the development footprint.

These include *Scoteanax rueppellii* (Greater Broad-nosed Bat), *Daphoenositta chrysoptera* (Varied Sittella) *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) which were not previously recorded within 10 kilometres of the development footprint and new records of *Miniopterus orianae oceanensis* (Large Bent-winged Bat), *Gallinago hardwickii* (Latham's Snipe) and Hieraaetus morphnoides (Little Eagle). These species were all reconsidered under the BC Act and EPBC Act test of significance processes as applicable.

If you have any further questions, please feel free to contact me.

Regards

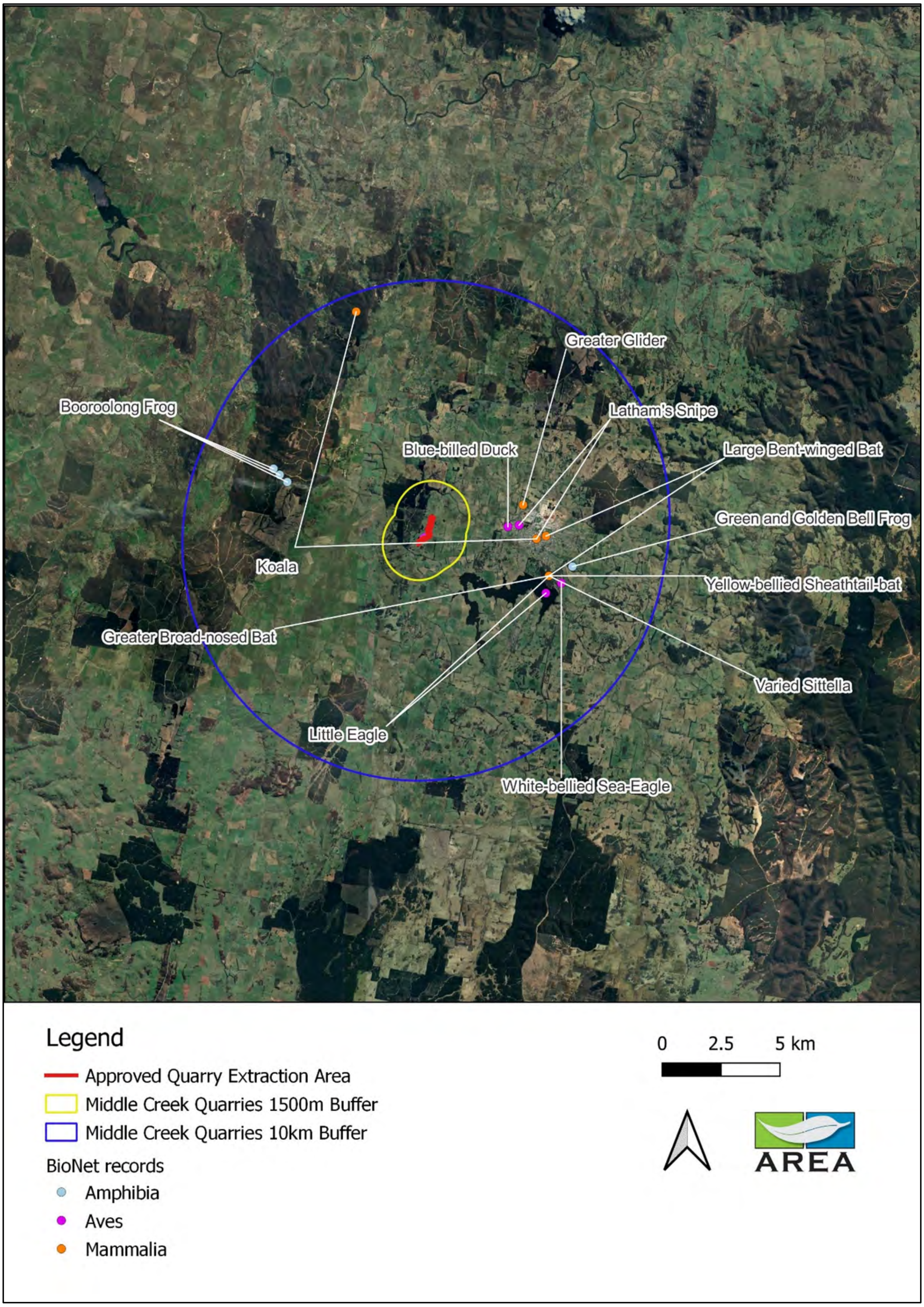
Phil Cameron
Managing Director
CEnvP, NSW Biodiversity Assessment Method (BAAS17082) & Biobanking (0117) accredited

AREA Environmental & Heritage Consultants
AREA Landscape Design Consultants

P 0409 852 098
E phil@areaenvironmental.com.au
a) 'The Old Macquarie Brewery c1876", 72 Brisbane Street Dubbo NSW 2830

We acknowledge Traditional Owners and Custodians and their ancestors

Plate 1: Updated BioNet Records



umwelt

APPENDIX 13

Aboriginal Cultural Heritage Assessment

Middle Creek Quarries Proposed Modification

Aboriginal Cultural Heritage Due Diligence Assessment

Oberon Shire Council LGA NSW

November 2020 (Final issued December 2022)

AREA Environmental & Heritage Consultants

(1) 6 Belmore Street Dubbo NSW 2830

(2) "The Old Macquarie Brewery, c1876, 72 Brisbane Street Dubbo NSW 2830

Ph 0409 852 098

phil@areaenvironmental.com.au

ABN:29 616 529 867

Advanced Regional Environmental Assessments (AREA)

- Environmental impact assessment, auditing and approvals
- Preliminary environmental assessment (PEA)
- Review of environmental factors (REF)
- Peer review
- Community engagement
- Biobanking and biodiversity offsetting assessments
- Aboriginal heritage assessments and community walkovers
- Landscape design

AREA Environmental & Heritage Consultants acknowledges Traditional Owners of the country on which we work

Document Controls

Proponent	Oberon Earthmoving		
Client	Umwelt Pty Ltd		
Document Description	Middle Creek Quarries Proposed Modification Aboriginal Cultural Heritage Due Diligence Assessment		
Clients Representative Managing this Document	**AREA Person(s) Managing this Document**		
	Phil Cameron (PJC)		
Location: Clients>Umwelt Pty Ltd> Middle Creek Quarry Oct 2019	AREA Job No: QU0232		
Document Status: Final	Version	Date	Action
Series V1.X = internal edits	V1.0 V1.1	11/08/2020 11/08/2020	AD to NH AREA Internal Edit
Series V2.X = Client internal edits	V2.0 V2.1	18/08/2020 16/11/2020	AREA to Client AREA to Client
FINAL when draft is approved by client	V3.0	01/12/2022	Final to Client
Prepared For	**Prepared By**		
Jon Novoselac Environmental Consultant **Umwelt (Australia) Pty Limited** 75 York Street Teralba, NSW 2284 Phone: (02) 4950 5322 jnovoselac@umwelt.com.au	Anna Darby Environmental Consultant AREA Environmental & Heritage Consultants Pty Ltd 6 Belmore Street Dubbo NSW 2830 E anna@areaenv.com.au ABN:29 616 529 867		

EXECUTIVE SUMMARY

Umwelt (Australia) Pty Limited (Umwelt) have been engaged by Oberon Earthworking Pty Limited (Oberon Earthworking) to submit a proposal for a modification to an existing consent (DA 10.2016.38.1) for Middle Creek Quarries (the Quarry) located at 50 Sewells Creek Road, Oberon NSW (Lot 2 DP 1112497).

AREA Environmental have been engaged by Umwelt to conduct an Aboriginal cultural heritage Due Diligence assessment in accordance with *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) of the proposed Additional Stockpiling and Processing Area, and Landscape and Visual Screen Planting area (study area).

No Aboriginal objects or areas of potential archaeological depots were identified during the site inspection, within the study area.

Due diligence has been applied through a desktop assessment and field survey. Further assessment is not considered to be a reasonable step. If any objects of suspected Aboriginal heritage origin are encountered during the proposed work, work in the area of the find should cease and the unanticipated finds protocol (Appendix B) should be followed.

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FIGURES

TABLES

1 Introduction

1.1 Background

Umwelt (Australia) Pty Limited (Umwelt) have been engaged by Oberon Earthworking Pty Limited (Oberon Earthworking) to submit a proposal for a modification to an existing consent (DA 10.2016.38.1) for Middle Creek Quarries (the Quarry) located at 50 Sewells Creek Road, Oberon NSW (Lot 2 DP 1112497).

The Quarry was originally approved as a non-designated development (DA 10.2010.66.1) to supply gravel products for Council and State Forest roadwork projects. DA 10.2010.66.1 limited operations to production of 30 000 metres square from a disturbance area of two hectares (ha). In 2018 the new development consent (DA 10.2016.38.1) was approved by the Western Regional Planning Panel. The Quarry is classed as designated development under Schedule 3 of the *Environment Planning and Assessment Regulation 2000*.

AREA Environmental have been engaged by Umwelt to conduct an Aboriginal cultural heritage Due Diligence assessment in accordance with *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) of the proposed Additional Stockpiling and Processing Area, and Landscape and Visual Screen Planting area (study area; Figure 1-1).

1.2 Project description

In 2018 the new development consent (DA 10.2016.38.1) was approved by the Western Regional Planning Panel. Following legal challenge, the development consent was confirmed, with some modification to conditions, under a Notice of Orders Made of the NSW Land and Environment Court on 3 December 2018 (Umwelt 2019). The development consent permits the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and Excavated Natural Material (ENM). Oberon Earthmoving currently have approval for the following:

- Extraction of up to 150,000 tonnes per annum
- Combined production of all products up to 250,000 tonnes per annum
- Total extraction from the site shall not exceed 5,000,000 tonnes
- Up to 50 truck loads/100 movements per weekday and 30 truck loads/60 movements per Saturday
- Importing and accepting the following waste materials for stockpiling and sale
- Raw mulch up to 25,000 tonnes per annum
- Treated drilling mud up to 60,000 tonnes per annum
- Excavated natural material up to 50,000 tonnes per annum

The key components of the proposed modification include:

- Relocation of the composting area (new location proposed at the head of a water course)
- Importation of concrete for recycling/crushing and sale
- Importation, composting and sale of green waste and manures (up to 15,000 tonnes per annum)
- Increased truck movements (due to concrete and green waste importation) (up to 150 movements per weekday and 100 movements per Saturday).

Figure 1-2 outlines the proposed location of the composting area/manure stockpile (Additional Stockpiling and Processing Area). The concrete crusher is proposed to operate within the existing composting area. Over the first 12 months of operation under DA 10.2016.38.1, tree planting and bund construction around the perimeter of the extraction area will be undertaken in accordance with the Quarry Rehabilitation and Landscape Management Plan (RLMP). These works will be completed to provide visual screens from vantage points surrounding the Quarry Site prior to commencement of disturbance (Umwelt 2019).

Figure 1-1: Locality of the study area

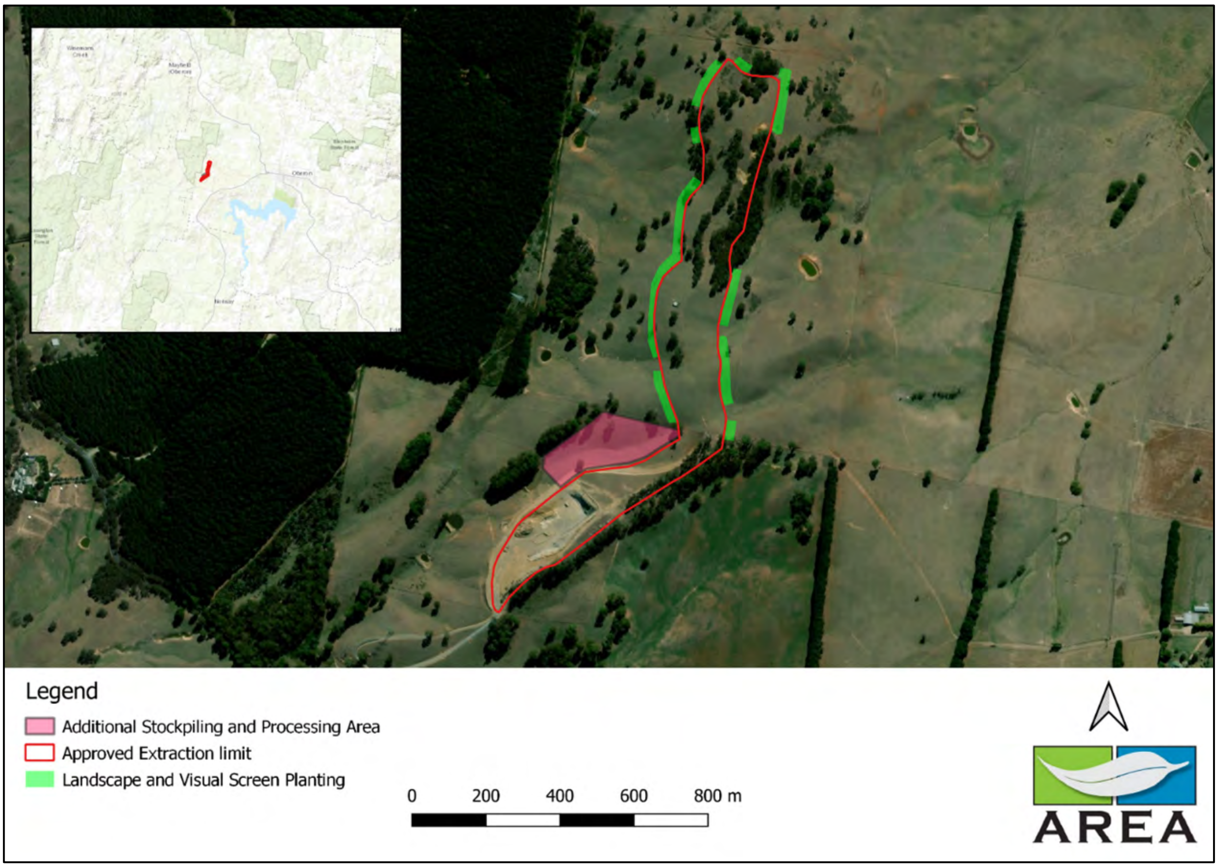
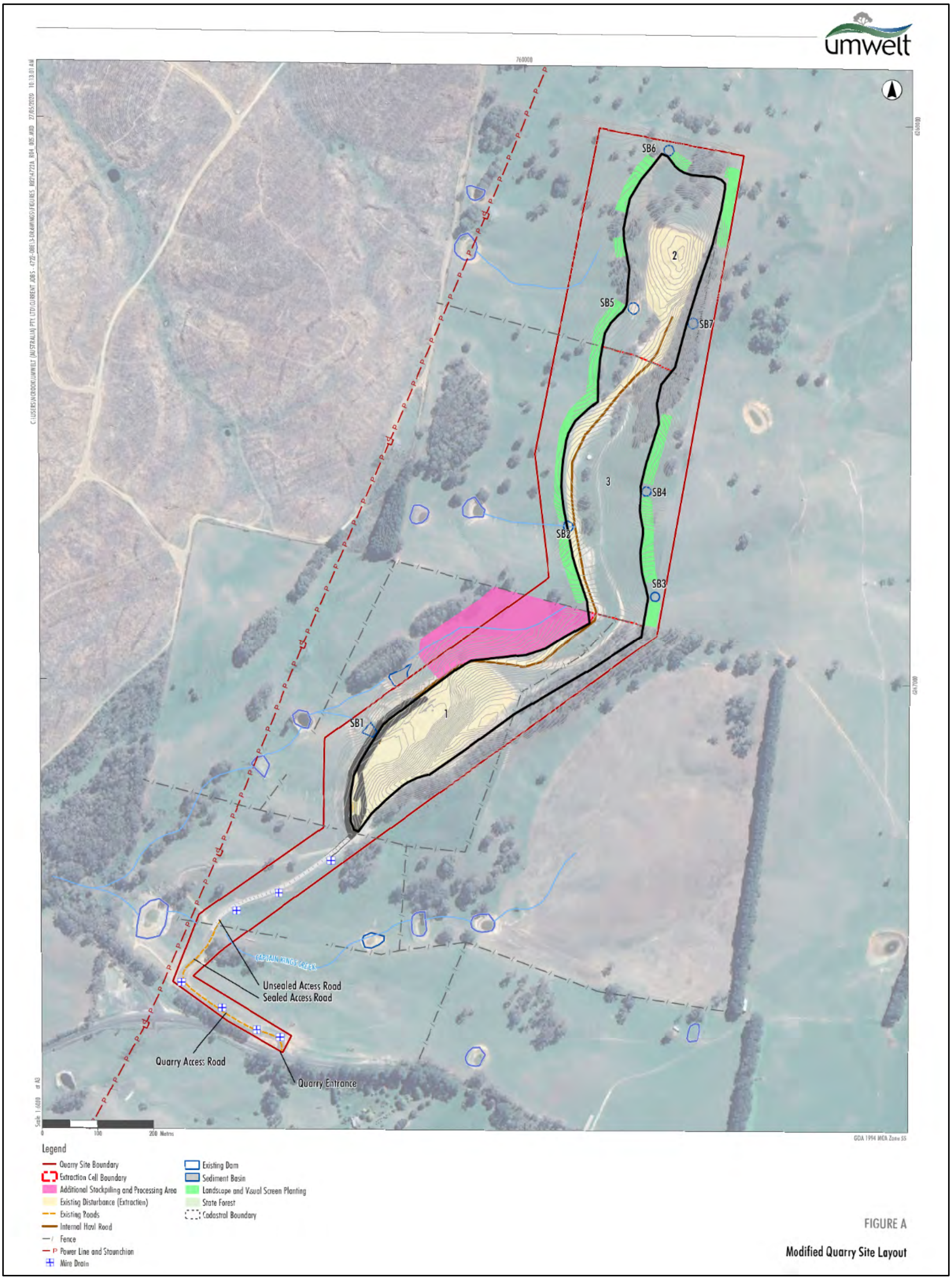


Figure 1-2: proposed works (image supplied by Umwelt)



1.3 Local environment

The study area is located approximately 5 km west of Oberon in Central West NSW. The landscape of the study area and surrounds are typically undulating to rolling hills with red earths on the mid to upper slopes and yellow podzolic soils on the lower slopes. Captain Kings Creek flows 520m south of the study area with an ephemeral drainage line dissecting the additional stock piling area.

The geographical context of the subject site is summarised in **Error! Reference source not found.**.

Table 1-1: Geographical context of the study area

Criteria	Value
Interim Biogeographic Regionalisation for Australia (IBRA Region)	South Eastern Highlands, Oberon Sub Region
State	New South Wales
Local Government Area	Oberon Shire Council LGA
Nearest town / locality	Oberon
Accessed from nearest town by	Sewells Creek Road
Land use / disturbance	Quarry Grazing
Nearest Waterway	520 m Captain Kings Creek
Australian Height Datum (AHD)	1130 to 1160 AHD
Surrounding land use	Existing quarry operation, pine plantation/ state forest, grazing and other primary production and rural residential.

1.4 Project personnel

This due diligence assessment has been prepared by Anna Darby, Environmental Consultant AREA, with the fieldwork lead by Phil Cameron, Principal consultant of AREA. Nick Harrop Project Manager AREA provided project management and reviewed this report. The qualifications of the project personnel are listed in Table 1-2.

Table 1-2: AREA staff contributing to this risk assessment

Name	Position	CV Details
Nick Harrop	Project Manager	Bachelor of Arts (Hons) in Prehistoric and Historic Archaeology. University of Sydney Master of Teaching. University of New England National Railtrack Safety Induction (ARTC and John Holland Inductions) WHS White Card Cert 4 in 4WD training (Nationally recognised training)
Phillip Cameron	Principal consultant & QMS (review)	BSc. Major in Biology. Macquarie University Ass Dip App Sci. University of Queensland Certified Environmental Practitioner (EIANZ) NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117 NSW OEH Biodiversity Assessment Method Assessor Accreditation Number BAAS17082 NSW OEH Scientific License: 101087 NSW DPI Ethics Approval 11/5475 Practicing member of the NSW Ecological Consulting Association Practicing member of the Environment Institute of Australia and New Zealand (EIANZ) WHS White Card and Blue Card Apply First Aid (Parasol) ID: 6007221
Anna Darby	Environmental consultant	Bachelor of Arts and Bachelor of Science (Archaeology, Paleoanthropology and Forensic Science). University of New England Bachelor of Science (Honours). University of New England WHS White Card RIW Card

2 Archaeological Context

2.1 Local archaeological context

The results of cultural heritage database searches are presented in this section. The objective of these searches is to identify any existing, recorded Aboriginal heritage within the subject site and to provide archaeological context for the proposal.

2.1.1 Database search results

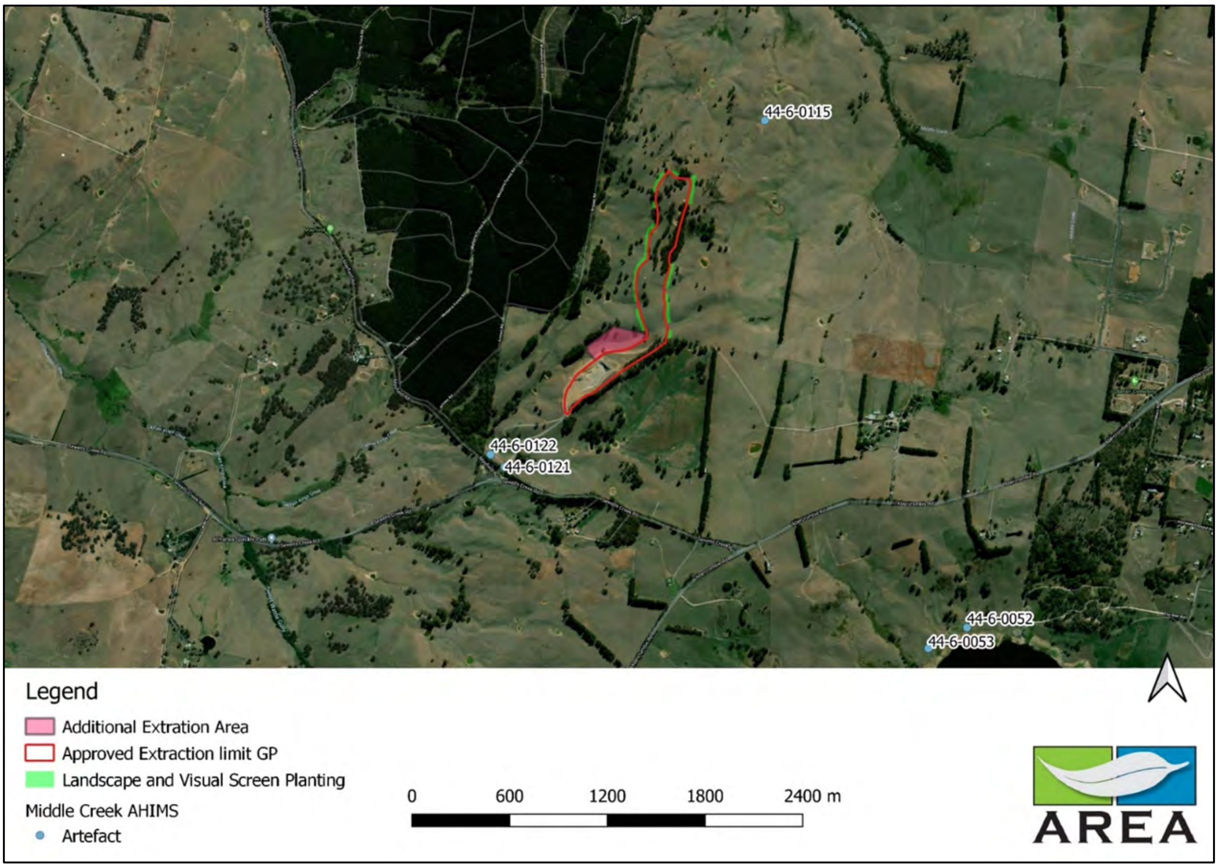
The results of the database searches are summarised in Table 2-1. No sites of Aboriginal heritage are recorded within the study area. There are also no Native Title determinations or Native Title claims within the study area.

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 11 August 2020 (Client ID: 526588). The AHIMS search provides archaeological context for the area and identifies whether any previously recorded Aboriginal sites are located within or near the study area. A total of five sites were recorded within the search area and are all recorded as the site type 'Artefact'. The distribution of recorded sites is shown in Figure 2-1. The full list of results is provided in Appendix A.

Table 2-1: Summary of database searches for Aboriginal cultural heritage

Database	Date of Search	Parameters	Results
Aboriginal Heritage Information Management System (AHIMS) Client ID: 526588	11/08/20	GDA94 Zone 55 758072 – 762072 mE 6265081 – 6269081 mS	A total of 5 recorded sites are within the search area (**Error! Not a valid result for table.**). No sites are within the study area; two sites are located 500 m south west of the study area.
Oberon LEP 2013	11/08/20	Schedule 5: Environmental Heritage	No items relative to Aboriginal heritage within the study area are listed on the LEP.
Native Title Vision https://nntt.maps.arcgis.com/	12/08/20	NSW	No native title claims are within the study area.
State Heritage Register http://www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx	12/08/20	Oberon Shire LGA	No items relative to Aboriginal heritage within the study area are listed on the State Heritage Register

Figure 2-1: Aboriginal sites recorded on AHIMS within 2 km of the study area



2.1.2 Previous archaeological assessments

Aboriginal Heritage Due Diligence Assessment, Proposed Quarry Extension Middle Creek Quarries Sewells Creek Road, Oberon

Environmental Assessments Pty Ltd were engaged by Oberon Earthmoving to conduct an Aboriginal Heritage Due Diligence Assessment for the proposed extension to the existing Middle Creeks Quarries, which is the same area as the current study area. An inspection of the study area was conducted in conjunction with representatives from the Pejar Local Aboriginal Land Council. Two sites were identified (AHIMS ID 44-6-0122 and AHIMS ID 44-6-0121). Both sites are outside the current study area.

2.2 Predictive modeling

Areas of archaeological potential are regarded as any sensitive landform with a reasonable level of intactness (i.e. little to no disturbance or minor ground surface disturbance only and in areas not on self-mulching soils). The definition of disturbance used here follows that of the *NPW Regulation 2009* (Clause 80B, Subclause 4). Sensitive landforms follow the definitions supplied in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010):

- within 200m of waters
- located within a sand dune system
- located on a ridge top, ridge line or headland
- located within 200m below or above a cliff face
- within 20m of or in a cave, rock shelter, or a cave mouth.

Areas nearby to waterways are typically more likely to contain Aboriginal archaeological remains. Any sections within 200 metres of waterways exposed to little or no previous impacts are more likely to contain intact sites. Captain Kings Creek flows within 520 metres south of the study area. The study area does not contain any sensitive landforms as defined by the Due Diligence code of practice. Based on the background research, desktop assessment and previous archaeological assessments the following predictions can be made.

There is a low risk of previously-unrecorded, intact sites within the study area. The proposal is mostly within land that has been significantly impacted by land clearing and intensive quarrying. However, it is possible that there are intact sites in discrete locations where impacts are low.

The most common recorded site type within 400 m of the study area, artefact, may occur within the study area in areas that are intact and less disturbed.

3 Fieldwork Results

3.1 Background to fieldwork

The fieldwork component of this assessment was undertaken on 8 July 2020 by Alex Cameron, Environmental Research Assistant of AREA and Phil Cameron, Principal Consultant, of AREA. The purpose of the field assessment was to identify sections of the subject site with archaeological potential and physically inspect them.

3.2 Methods

The entire study area was inspected by pedestrian survey. Particular attention was paid to exposed ground surfaces to increase the chances of locating any stone artefact scatters. All mature trees were inspected in order to identify culturally scars. Ground surface visibility and existing levels of disturbance were noted.

Recordings were made of ground surface visibility and existing levels of disturbance. Recording included photographs, mapping, written records and GPS coordinates.

3.2.1 Limitations

Potential sub-surface archaeological sites cannot be directly detected and the detectability of Aboriginal sites with surface remains is contingent on ground surface visibility (GSV). GSV was generally low (less than 5%) across the study area (Figure 3-3).

3.3 Results

The landscape within the study area consisted of gullies and steep slopes with exposures associated with quarry-related disturbance. Several mature trees were present within the study area. No culturally modified scars were observed on the trees (Figure 3-1).

No Aboriginal objects or areas of potential archaeological depots were identified during the site inspection, within the study area.

Figure 3-1: View south west across the study area

Figure 3-2: View north east across the study area

Figure 3-3: Example of low GSV in the study area

3.4 Discussion

The results of the field work were consistent with the predictive model outlined in section 2.2. GSV was low across the study area making it difficult to identify stone artefacts. There is an ever-present possibility of stone artefacts remaining undetected where GSV is not total.

No Aboriginal objects or areas of potential archaeological depots were identified within the study area.

4 Recommendations

No sites of cultural heritage are recorded within the study area or are likely to occur within it. Due diligence has been applied through a desktop assessment and site inspection. Further assessment is not considered to be a reasonable step.

If any objects of suspected Aboriginal heritage origin be encountered during the proposed works, work in the area of the find should cease and the unexpected finds protocols (Appendix B) should be implemented.

5 References

Department of Environment, Climate Change and Water (DECCW). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. 2010.

Umwelt, 2019. Middle Creek Quarries, Project Overview and Preliminary Environmental Assessment of a Proposed Modification to DA 10.2016.38.1. Report to Oberon Earthworking

Appendix A: AHIMS Search Results

Results of AHIMS extensive search within 5 km of the subject site

AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/PO Number : Middle Quarry (Umwelt)
Client Service ID : 526588

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
44-6-0052	Suntop Foreshore 2;	AGD	55	761600	6265400	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	O Turner					Permits		
44-6-0053	Suntop Foreshore 1;	AGD	55	761400	6265300	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	O Turner					Permits		
44-6-0115	OB1	GDA	55	760748	6268190	Open site	Valid	Artefact : -		
	Contact Searle	Recorders	Mr.Justin Boney					Permits		
44-6-0121	Captain Kings Ck IF1	AGD	55	759258	6266281	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Daniel O'Brien,Environmental Assesments Pty Ltd					Permits		
44-6-0122	Captain Kings Ck Lithic Scatter	AGD	55	759188	6266347	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Daniel O'Brien,Environmental Assesments Pty Ltd					Permits		

Report generated by AHIMS Web Service on 11/08/2020 for Anna Darby for the following area at Datum :GDA, Zone : 55, Eastings : 758072 - 762072, Northings : 6265081 - 6269081 with a Buffer of 0 meters. Additional Info : Report. Number of Aboriginal sites and Aboriginal objects found is 5

Page 1 of 1

Appendix B: Unanticipated Finds Protocol

Unanticipated Finds Protocol

The protocol to be followed in the event previously unrecorded or unanticipated Aboriginal object(s) are encountered during the proposed works is as follows:

- All ground surface disturbance in the area of the finds should cease immediately the finds are uncovered.
- If the finds are of human remains, contact the local police.
- Seek verification of the finds from a suitably qualified person, such as a heritage consultant.
- If the finds are verified or very likely to be Aboriginal in origin notify NSW Heritage, Department of Premier and Cabinet and the relevant local Aboriginal community representatives.
- All finds should be professionally recorded and registered on appropriate databases.
- A management strategy will be required according to best practice and consultation with the local Aboriginal community. All management will require approval from the relevant determining authority.

Environmental & Social Consultants

SUBMISSION REPORT

Middle Creek Quarries Modification

FINAL

June 2024

SUBMISSION REPORT

Middle Creek Quarries Modification

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Oberon Earthmoving Pty Ltd

Project Director:	Paul Douglass
Project Manager:	Jon Novoselac
Report Author:	Mia Groves
Report No.	24402/R01
Date:	June 2024

umwelt
Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Jon Novoselac	4 June 2024	Paul Douglass	5 June 2024

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Appendices

1.0 Introduction

Oberon Earthmoving Pty Ltd proposes a modification of operations at Middle Creek Quarry (the Quarry). The Quarry is located on Lot 2, DP 1112479 at 50 Sewells Creek Road approximately 4 kilometres (km) west of Oberon, within the Oberon Council Local Government Area (LGA). Middle Creek Quarry operates under development consent DA 10.2016.38.1 which was approved by the Western Regional Planning Panel (WRPP) on 21 March 2018, consisting of the extraction of gravel and the importation of waste materials for on-site disposal or processing.

Oberon Earthmoving proposes to modify the existing development consent to allow for the following (the Proposed Modification):

- construction of a new pad for the relocation of composting operations and supplementary stockpiling.
- a washing circuit to produce finer aggregates / sand from the crushed gravel:
  - concrete crushing.
  - plasterboard.
- an increase in maximum extraction and production rates.
- an increase in truck movements between current operational hours.

On 11 May 2023 Oberon Earthmoving submitted an application to Oberon Council regarding the Proposed Modification as outlined above (PAN-328532).

Oberon Council evaluated the merits of the Proposed Modification Statement of Environmental Effects (SEE) (Umwelt, 2023), and identified issues that require additional information or clarification in an email dated 18 March 2024. This report provides additional information about the following issues raised by Oberon Council and community members:

- Substantially the same development.
- Traffic.
- Water Access Licence.
- Waste Receival, Handling and Compost Management Plan.
- Biosecurity.
- Rehabilitation and Landscape Management Plan.
- Surface Water and Sediment Management Plan.
- Bush fire.
- Compliance with existing conditions of consent.
- Individual community submissions.

2.0 Response to Oberon Council and Agency Submissions

The following sections respond to specific matters raised by Oberon Council and Transport for NSW (TfNSW) in regard to the Proposed Modification.

2.1 Substantially the Same Development

In the email dated 18 March 2024, Oberon Council requested justification that the Proposed Modification is substantially the same development that operates under development consent DA 10.2016.38.1. The SEE notes that in 2017 D2016-482 was classified as a designated development and may be modified under Section 4.56 of the EP&A Act on the basis that the development as modified remains substantially the same to the development. The SEE displayed no additional activities proposed, with increases to extraction, production and transportation limits managed to minimise impacts.

In addition, an independent legal opinion was sought by Minter Ellison and notes that the Proposed Modification is “substantially the same” as the 2016 Consent. Minter Ellison also noted that the Proposed Modification will not substantially change and does not seek any changes with respect to:

- extraction methods.
- extraction area.
- extraction design feature.
- overburden management.
- Composting.
- rehabilitation and final landform.
- hours of operation.

The independent legal opinion appears in full in **Appendix 1**.

2.2 Traffic

A request for information in relation to the Proposed Modification SEE was authored by Transport for NSW (TfNSW) on 16 October 2023. Pavey Consulting Services prepared a report in response to the points raised in the TfNSW request for information. This section summarises the Pavey Consulting Services report and the full report appears in **Appendix 2** which also includes a copy of the TfNSW request for information.

The traffic assessment concludes that there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from PCS report include:

- The speed environment is adequate for the available sight distance.
- Current traffic counts take into account the existing developments within the area.

- The 3% growth rate takes into account any increase in development in the surrounding area.
- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- Level of service remains level A for all modes tested.
- The current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.3 Water Access Licence

In the email dated 18 March 2024, Oberon Council requested a copy of the Water Access Licence. As a point of clarification, at the time the SEE was drafted, it was expected that Oberon Earthmoving would have secured a 50 ML Water Access Licence. Unforeseen delays in securing the Water Access Licence have occurred since then. Oberon Earthmoving is currently in the process of securing a 50 ML Water Access Licence, a copy of which will be provided to Council prior to construction.

It is also reiterated, as per the SEE (Umwelt, 2023), that water extraction will not be increased as a result of the Proposed Modification, and water management will be improved through a Pollution Control Dam serving the following functions:

- for the storage of water which accumulates within the completed extraction area under high rainfall, with a nominal capacity of 16 ML.
- for the collection of water diverted from upslope of the new pad and delivered to the PCD via a rock-lined spillway.
- as a secondary control for water contained and stored on the relocated composting area.

2.4 Waste Receival, Handling and Compost Management Plan

In the email dated 18 March 2024, Oberon Council requested that the Quarry Waste Receival, Handling and Compost Management Plan (WRHCMP) be updated to address all proposed waste materials relating to the Proposed Modification.

It is proposed that the updating of the WRHCMP requirement to be included as a condition of consent. Oberon Earthmoving proposes that the updated WRHCMP then be approved by Oberon Council prior to construction. The updated WRHCMP will include relevant information relating to the additional plasterboard waste material.

2.5 Biosecurity

In the email dated 18 March 2024, Oberon Council requested more information regarding biosecurity measures to be taken by Oberon Earthmoving, noting that expanding the sourcing of green waste may result in the spread of weeds or disease.

All green waste compost and storage will be in accordance with applicable guidelines including, the *Biosecurity Act 2015*, *Mulch Order 2016*, Protection of the Environment Operations (Waste) Regulation 2014 and the Waste Receival, Handling and Compost Management Plan. Through the modification, the expanding source of green waste will be traced from the source point and enforcements such as risk management protocol will be upheld.

According to s. 393B(5)(b) of the *Biosecurity Act 2015*, the biosecurity measure is appropriate and adapted to prevent, or reduce the risk of, the disease or pest entering, or emerging, establishing itself or spreading in, Australian territory or a part of Australian territory.

Relevant suppliers must provide Oberon Earthmoving with documentation to confirm that processor requirements have been satisfied, in some instances a written risk management protocol (s.6(6.3)) must also be confirmed before accepting product. The *Mulch Order 2016* risk management protocol must contain measures that minimise the potential for the land application of mulch to cause the introduction, presence, spread or increase of any weed, disease, or pest (s. 6(6.1)).

2.6 Rehabilitation and Landscape Management Plan

In the email dated 18 March 2024, Oberon Council requested that the Rehabilitation and Landscape Management Plan (RLMP) be updated to address details relating to the Proposed Modification. Specifically, the request included that the RLMP be updated to address the final rehabilitation and landscaping of the expanded area for waste storage and compost, and associated pollution control dam and sediment basin.

It is proposed that the updating of the RLMP be included as a condition of consent. Oberon Earthmoving then proposes that the updated RLMP be approved by Oberon Council prior to construction.

The updated RLMP will be aligned with the 2018 version of the RLMP, which will be required to meet the substantially the same development test.

The RLMP will be revisited and will comprehensively rectify the expanded areas required including but are not limited to:

- waste storage
- compost
- pollution control dam
- sediment basin.

2.7 Surface Water and Sediment Management Plan

In the email dated 18 March 2024, Oberon Council requested that the Quarry Sediment Management Plan (SMP) be updated to take into consideration the Proposed Modification.

It is proposed that the updating of the SMP be included as a condition of consent. Oberon Earthmoving then proposes that the updated SMP be approved by Oberon Council prior to construction. The updated SMP will include information relating to the Proposed Modification.

2.8 Bush fire

In the email dated 18 March 2024, Oberon Council indicated that a bush fire assessment has not been completed for the Proposed Modification. It is noted that a bush fire assessment was not required by Oberon Council prior to preparation of the SEE, as per Appendix 3 in the SEE (Umwelt, 2023).

It is proposed that the bush fire assessment be included as a condition of consent. Oberon Earthmoving then proposes that the bush fire assessment be approved by Oberon Council prior to construction.

2.9 Compliance with Existing Conditions of Consent

The email received from Oberon Council dated 18 March 2024 requested a copy of the most recent report addressing compliance with the existing conditions of consent. The Environment Protection Authority – NSW (EPA) Annual Return for Oberon Earthmoving (licence number 21098) for the reporting period ending 3 February 2024 appears in **Appendix 3.**

2.10 Response to Community Submissions

There were eight community submissions lodged (**Appendix 4**) with Oberon Council. Issues raised by community members were provided to Oberon Council and passed on to Oberon Earthmoving. Issues from each submission are noted in the following sections (within text boxes) and are addressed with all relevant knowledge applicable.

2.10.1 Community Submission Number One

Community submission number one lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- air quality
- noise impacts
- increased in truck movements
- impact to amenity.

2.10.1.1 Air Quality

"The harmful effects of increased dust emanating from the site. There is currently a large amount of dust coming from the site. This has increased over the time the quarry has been in operation and will undoubtedly increase as the quarry expands. Efforts to reduce the amount of dust being generated (if any) have clearly failed. Silicosis caused by inhalation of dust is increasingly being recognised as a major health risk especially among younger members of the population, of which there are increasing number sin the Bracken Estate and immediate surrounds."

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material, and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**).

In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (**Appendix 6**) (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- Continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.
- Blast fume management, including
  - explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013)
  - blasting will be restricted to confined and competent formations
  - blasting will occur above the groundwater table
  - the depth of blast holes will be less than 20 metres (m)
  - blast zones and holes will be maintained appropriately
- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

2.10.1.2 Noise Impacts

"The effects of increased noise pollution on the amenity of the surrounding areas."

A Noise Impact Assessment (NIA) for the Proposed Modification was completed by Muller Acoustic Consulting Pty Ltd (MAC) (refer to **Appendix 7**) to evaluate noise associated with construction, operations, and traffic/haulage (Umwelt, 2023).

The NIA was undertaken in accordance with the Noise Policy for Industry (NPI) (EPA, 2017), NSW Road Noise Policy (RNP) (DECCW, 2011) and the Draft Construction Noise Guideline (DCNG) (EPA, 2020).

The NIA noted that construction noise levels would remain below the relevant noise management levels (NML) at all receiver locations. Further, the NIA demonstrated that operational noise levels would comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

The noise mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse noise impacts related to the Proposed Modification. In summary, these include:

- Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers.
- Training (of employees to conduct quieter work practices).
- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity
- Avoid queuing of vehicles adjacent to any receivers.
- Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers.
- Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm.
- Minimising the need for reversing or movement alarms.

2.10.1.3 Increase in Truck Movements

“Damage and associated repair costs of increased truck movements on roads clearly not constructed to cope with the weight and volume of traffic to which they are currently being subjected and which would be exacerbated by the approval of this proposal.”

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

With increased truck movements, the existing Basic Right (BAR) turn treatment is considered sufficient for the Proposed Modification, and no further upgrade is required.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states that there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from the PCS report include but are not limited to:

- The speed environment is adequate for the available sight distance.
- Current traffic counts take into account the existing developments within the area.
- The 3% growth rate takes into account any increase in development in the surrounding area.
- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- Level of service remains level A for all modes tested.
- The current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.1.4 Impact to Amenity

"The amenity of a semi-rural setting is continually being eroded by the impact of the existing quarry. This variation and any further variations can only have a greater impact."

Regarding the maintenance of amenity, the SEE (Umwelt, 2023) notes:

- The Proposed Development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.2 of the NPI, for residences that are private dwellings.
- In order to minimise land use conflicts and avoid undue interference with the amenity of residents, Development Control Plan 2001 (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries. The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities. In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.
- The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).

- In addition to proposed mitigation measures and management procedures relating to amenity aspects including noise, air quality, visibility, and transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised:

  Social and Community

  - Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.
  - Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
  - Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
  - Advertise and maintain a community complaints telephone line.

  Economic Contribution and Development

  - Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.

  Agricultural Lands

  - Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
  - Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

  General

  - Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.
  - Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained, and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

2.10.2 Community Submission Number Two

Community submission number two lodged with Oberon Council noted issues relating to the Proposed Modification. Transparency issues regarding Oberon Earthmoving were noted in this submission.

2.10.2.1 Transparency

"It should also be noted that the owner / Director of Oberon Earthmoving is also the CEO of Bettergrow Oberon, a composting and Fertiliser Company that is also a subsidiary of Borg Manufacturing. This must raise the question if there a connection between the Middle Creek Quarry D.A modification application and the current expansion of the Bettergrow plant, and if the intentions for the Middle Creek Quarry bite are transparent?"

Regarding transparency, Oberon Earthmoving has complied with all requirements in submitting relevant application documentation for the Proposed Modification and has complied with all legislative framework requirements, including the EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). It is noted that company ownership does not affect operational requirements related to environmental and social issues, which are set out in development consent DA 10.2016.38.1 (refer to Umwelt, 2023). Further, Oberon Earthmoving regularly publishes all required environmental performance reporting on its website (https://www.oberonearthmoving.com.au/).

2.10.3 Community Submission Number Three

Community submission number three lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- substantially the same development
- reports and supporting documentation supplied by Oberon Earthmoving were created prior to 2016
- air quality
- increase in truck movements
- noise impacts.
- composting and fertiliser production.

2.10.3.1 Substantially the Same Development

"The initial development application (DA 10.2016.38.1) was for consideration of the operation of an extractive industry focusing on gravel extraction, with the ability to receive and store small amounts of bio-waste. I question how this application can be considered as a modification application, when such significant changes are being proposed?"

As discussed in **Section 2.1**, the SEE noted that the Proposed Modification displayed no additional activities proposed with increases to extraction, production and transport limits managed to minimise impacts. Further an independent legal opinion secured by Minter Ellison noted that the Proposed Modification is "substantially the same" as the 2016 Consent (refer to **Appendix 1**). As well, the SEE submitted to Oberon Council comprehensively addresses all potential environmental and social impacts related to the Proposed Modification, and includes proposed measures to mitigate and manage impacts (Umwelt, 2023).

2.10.3.2 Reports and Supporting Documentation Supplied by Oberon Earthmoving Were Created Prior to 2016

"It is also of concern that the majority of reports and supporting documentation supplied by Middle Creek Quarries were created prior to 2016. There have been extensive changes in the surrounding land use and environment over the last 6 years and it is difficult to believe these reports would still hold relevance and accurately reflect the current impacts, given the amount of change that has occurred."

Section 2.0 of this report requests that updates to the WRHCMP, RLMP and SMP be included as conditions of consent. Oberon Earthmoving then proposes that the updated management plans be approved by Oberon Council prior to construction.

2.10.3.3 Air Quality

> **"The Modification SEE states that water spray is the preferred control measure, however, this only has an efficiency rating of 70%. Due to the Bracken Glen Estate subdivision, there have been 15 new dwellings built within a 3.5 km proximity to the site, with a 13-lot section recently finalised, which adds 13 potential new homes within a short distance from the Quarry."**
> **"Those living in close proximity to the Quarry risk long term exposure, it is highly likely that there will still be, at a minimum, around 30% of dust released into the surrounding atmosphere. Are there requirements in place for receptors within close residential areas to monitor the ongoing pollution concerns of residents?"**

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material, and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**). In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- Continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.
- blast fume management, including
    - explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013)
    - blasting will be restricted to confined and competent formations

- blasting will occur above the groundwater table
- the depth of blast holes will be less than 20 metres (m)
- blast zones and holes will be maintained appropriately

- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

2.10.3.4 Increase in Truck Movements

"An increase in truck movements each weekday from 100-180 is of concern. The traffic data used was compiled in 2015 and relies on historical figures and predictions. A more current report on traffic volumes should be required prior to any consideration."

The road capacity for the Proposed Modification was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

Further, on 16 May 2024 a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of the Proposed Development. Key findings from the PCS report include:

- The speed environment is adequate for the available sight distance.
- Current traffic count takes into account the existing developments within the area.
- The 3% growth rate takes into account any increase in development in the surrounding area.
- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- Level of service remains level A for all modes tested.
- The current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.3.5 Noise Impacts

"It is noted in the Noise Impact Assessment that there were no receivers placed within the Bracken Glen Estate vicinity. This estate has the highest density of housing within the closest proximity to the Quarry. The proposed increase in operations will unquestionably increase the noise impact on surrounding landholders, including those located within Bracken Glen Estate."

A Noise Impact Assessment (NIA) (refer **Appendix 7**) for the Proposed Modification was completed by Muller Acoustic Consulting Pty Ltd (MAC) to evaluate noise associated with construction, operations, and traffic/haulage (Umwelt, 2023). The NIA was undertaken in accordance with the Noise Policy for Industry (NPI) (EPA, 2017), NSW Road Noise Policy (RNP) (DECCW, 2011) and the Draft Construction Noise Guideline (DCNG) (EPA, 2020).

The NIA noted that construction noise levels would remain below the relevant noise management levels (NML) at all receiver locations. Further, the NIA demonstrated that operational noise levels would comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

The noise mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse noise impacts related to the Proposed Modification. In summary, these include:

- Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers.
- Training (of employees to conduct quieter work practices).
- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity.
- Avoid queuing of vehicles adjacent to any receivers.
- Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers.
- Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm.
- Minimising the need for reversing or movement alarms.

The construction noise levels would remain below the relevant NML's at all receiver locations. The results of the NIA demonstrated that operational noise levels comply with the relevant NPI criteria for all assessment periods at the most affected sensor locations.

Four receivers (R2a, R2b, R2c and R6) are located in the same direction as Bracken Glen Estate and are approximately 200-300 m closer to the Quarry to which all receivers were in compliance with the relevant criteria and guidelines.

2.10.3.6 Composting and Fertiliser Production

"The proposed relocation and development of an area to establish a composting space and windrows which will allow for the importing and anaerobic processing of organic green waste, drilling mud and other materials also raises concerns, in particular, the lack of reporting on practices to be employed to control associated odours and pollution."

The Quarry undertakes operations in accordance with an AQMP which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) (refer to **Section 2.10.3.3**) will mitigate any adverse air quality impacts related to the Proposed Modification, including odour impacts.

2.10.4 Community Submission Number Four

Community submission number four lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- air quality and contamination
- impact to amenity
- increase in truck movements.

2.10.4.1 Air Quality and Contamination

"Recent dust emissions from the existing quarry suggest non-compliance or mismanagement of mitigation responsibilities, or both."

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**). In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions
- blast fume management, including
  - explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013)
  - blasting will be restricted to confined and competent formations
  - blasting will occur above the groundwater table
  - the depth of blast holes will be less than 20 metres (m)
  - blast zones and holes will be maintained appropriately
- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

2.10.4.2 Impact to Amenity

"If granted, it will seriously affect our health, lifestyle, property sales and our general welfare and liveability in the Oberon township and area."

Regarding the maintenance of amenity, the SEE (Umwelt, 2023) notes:

- The Proposed Development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.2 of the NPI, for residences that are private dwellings.
- In order to minimise land use conflicts and avoid undue interference with the amenity of residents, Development Control Plan 2001 (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries. The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities. In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.
- The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).

- In addition to proposed mitigation measures and management procedures relating to amenity aspects including noise, air quality, visibility, and transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised:

Social and Community

- Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.
- Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
- Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
- Advertise and maintain a community complaints telephone line.

Economic Contribution and Development

- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.

Agricultural Lands

- Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
- Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

General

- Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.
- Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained, and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

2.10.4.3 Increase in Truck Movements

"The addition of many heavy vehicles on inadequate roads will also impact our lifestyle and safety"

The road capacity was assessed for the Proposed Modification with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

With increased truck movements, the existing Basic Right (BAR) turn treatment is considered sufficient for the Proposed Modification, and no further upgrade is required.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

In the most recent 5-year crash history (2016–2020), one crash has occurred at the Abercrombie Road/Sewells Creek Road intersection. The crash occurred in 2019 when a vehicle turning right into Sewells Creek Road collided with a passing vehicle, resulting in a moderate injury.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of this application. Key findings from the PCS report include:

- The speed environment is adequate for the available sight distance.
- Current traffic count takes into account the existing developments within the area.
- The 3% growth rate takes into account any increase in development in the surrounding area.
- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- Level of service remains level A for all modes tested.
- The current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.5 Community Submission Number Five

Community submission number five lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- traffic impacts
- air quality
- suitability of location for the Proposed Modification.

2.10.5.1 Traffic Impacts

"If Heavy Vehicles are travelling from other areas, where are they able to wait for admission into the Quarry if they arrive before business hours? We live off Abercrombie Road and have noted Quarry trucks waiting in groups out the front of our residence, clearly waiting for entry to Middle Creek Quarry. This is noisy and disruptive, especially in early morning hours."

"What extra precautions would be taken to make sure loads of hazardous material are being secured to prevent 'fall off' onto the roads and surrounding environment of travel. Just covering a load will not prevent fine dust and debris from escaping the load. Some of the proposed materials for transportation are hazardous in nature to humans, animals, and the environment."

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

The compliance of heavy vehicles will be ensured through a series of precautions to decrease issues regarding to traffic and transport impacts, implemented management and mitigation techniques include but are not limited to:

- The proponent will enforce the hours of operation for transport, drivers who do not comply (arrive early/exit late) will be subject to further action.
- The site access road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.
- All vehicles will exit via the Quarry weighbridge, with overweight vehicles returned to the Stockpiling Area to have product removed. Reliance would be placed on drivers to advise the Proponent of the relevant load limits for non-Proponent owned vehicles.
- A covered load policy will be maintained to prevent loose materials falling onto the roadway or the creation of excessive dust.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from the PCS report include but are not limited to:

- The speed environment is adequate for the available sight distance.
- Current traffic count takes into account the existing developments within the area.
- The 3% growth rate takes into account any increase in development in the surrounding area.

- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- Level of service remains level A for all modes tested.
- The current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.5.2 Air Quality

"Since Middle Creek Quarry was established, there has been a new Large Lot Residential Estate (Bracken Estate) established within close proximity to this area. Some of these lots are within 2.5 kms (Distanced sourced on SIX Maps) from the proposed expansion site. There have been a number of new homes built in this estate and they have the potential to be directly impacted by Middle Creek Quarry's operations.

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material, and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**). In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.
- blast fume management, including.

- explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013).
  - blasting will be restricted to confined and competent formations.
  - blasting will occur above the groundwater table.
  - the depth of blast holes will be less than 20 metres (m).
  - blast zones and holes will be maintained appropriately.
- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

Four receivers (R2a, R2b, R2c and R6) are located in the same direction as Bracken Glen Estate and are approximately 200-300 m closer to the Quarry to which all receivers were in compliance with the relevant criteria and guidelines and demonstrated the modification is not expected to cause any adverse air quality impacts.

2.10.5.3 Suitability of Location for the Proposed Modification

"We would like to further note the proximity of Middle Creek Quarry to Oberon Township and surrounding homes. We consider this not a suitable placement for such an expansion of this size and business type being surrounded by residential homes and rural grazing property."

As stated in Section 6.2 Suitability of the Site in the SEE (Umwelt, 2023) the Quarry is located within a transitional environment surrounded by agricultural activities, forestry, and low-density residential development. The site is considered suitable for the Proposed Modification for the following reasons:

- The site contains extensive gravel resources, waste importation and processing facilities and composting facilities, and is located within proximity to markets for these resources and products.
- The site has been used for the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud, and excavated natural material since approval was granted in 2018.
- The Proposed Modification is located on land largely disturbed by previous agricultural activities and involves only minor additional disturbance to native vegetation communities and fauna habitat.
- The Proposed Modification is compatible with surrounding land uses and can co-exist with these existing uses.
- Topography, planted and remnant vegetation, and constructed bunds provide some visual shielding from the surrounding area.
- Suitable safe access to Sewells Creek Road is provided from the Quarry without impacting adversely on the local road network.

2.10.6 Community Submission Number Six

Community submission number six lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- importation of mulch or clean fill to Quarry.
- reports and supporting documentation supplied by Oberon Earthmoving were created prior to 2016.
- substantially the same development.
- composting and fertiliser production.
- visual amenity.
- noise impacts.
- Crystalline Silica.
- increase in truck movements.
- relationship between Oberon Earthmoving and Bettergrow Oberon.
- alleged works undertaken (road sealing).

2.10.6.1 Importation of Mulch or Clean Fill to Quarry

"The above DA was approved by the Western Regional Planning Panel (WRPP) in 2018 and allows for the extraction of 150,000 TPA of gravel, the importation of 25,000 TPA of green waste (mulch), 75,000 TPA VENM/ENM and up to 60,000 TPA of drilling mud for the production of compost. I note the revamped community information pamphlet on Public Exhibition on Oberon Council Website states "that no mulch or clean fill has been imported to the quarry to date". Is this a correct statement?"

Oberon Earthmoving confirms that no mulch or clean fill has been imported to the Quarry to-date.

2.10.6.2 Reports and Supporting Documentation Supplied by Oberon Earthmoving Were Created Prior to 2016

"I note that all reports and documents supporting the Modification Application were sourced in 2015/16 or earlier. Much has changed since then."

Section 2.0 requests that updates to the WRHCMP, RLMP and SMP be included as conditions of consent. Oberon Earthmoving proposes that the updated management plans be approved by Oberon Council prior to construction.

2.10.6.3 Substantially the Same Development

"It is my view that the development is not substantially the same as that approved under development consent DA 10.2016.38.1 which was approved by the WRPP on 21 March 2018. There is no justification, other than a letter from a junior Council staff member stating the application "may" be substantially the same. The applicant should justify why this application should be considered a modification in this instance."

As discussed in **Section 2.1**, the SEE noted that the Proposed Modification displayed no additional activities proposed with increases to extraction, production and transport limits managed to minimise impacts.

Further an independent legal opinion provided by Minter Ellison noted that the Proposed Modification is "substantially the same" as the 2016 Consent (refer to **Appendix 1**). As well, the SEE submitted to Oberon Council comprehensively addresses all potential environmental and social impacts related to the Proposed Modification, and includes proposed measures to mitigate and manage impacts (Umwelt, 2023).

2.10.6.4 Composting and Fertiliser Production

"The modification application includes the proposed relocation and development of an area to establish a composting space and windrows which will allow for the importing and anaerobic processing of organic green waste, drilling mud and other materials. It is stated in both the Community Information Sheet and the SEE currently on public exhibition."

"The relocation and establishment of a new composting area under this modification would open the way for a future DA or modification to allow this. It has been identified in the SEE document that the addition of organic food wastes etc. to the composting process would require additional buildings and infrastructure to deal with potential odour, air, and water pollution etc."

The Quarry undertakes operations in accordance with an AQMP which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) (refer to **Section 2.10.3.3**) will mitigate any adverse air quality impacts related to the Proposed Modification, including odour impacts.

2.10.6.5 Visual Amenity

"An assessment of visual impact has not been included in the modification application – this report would enable a fair assessment of impacts upon visual amenity. This should be considered."

Regarding the maintenance of visual amenity, the SEE (Umwelt, 2023) notes:

- In order to minimise land use conflicts and avoid undue interference with the amenity of residents, Development Control Plan 2001 (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries. The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities. In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.
- The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).
- In addition to proposed mitigation measures and management procedures relating to amenity aspects including noise, air quality, visibility, and transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised:

Social and Community

  - Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.

- Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
- Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
- Advertise and maintain a community complaints telephone line.

Economic Contribution and Development

- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.

Agricultural Lands

- Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
- Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

General

- Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.
- Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained, and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

2.10.6.6 Noise Impacts

"The application will undoubtably have increased noise impact on adjoining land use, however the assessment does not appropriately consider these impacts on the adjacent residential land use. The noise report, for example, does not consider the newly constructed subdivision (Bracken Glen Estate) along Abercrombie Road as potential sensitive receivers."

A Noise Impact Assessment (NIA) (refer to **Appendix 7**) for the Proposed Modification was completed by Muller Acoustic Consulting Pty Ltd (MAC) to evaluate noise associated with construction, operations, and traffic/haulage (Umwelt, 2023). The NIA was undertaken in accordance with the Noise Policy for Industry (NPI) (EPA, 2017), NSW Road Noise Policy (RNP) (DECCW, 2011) and the Draft Construction Noise Guideline (DCNG) (EPA, 2020).

The NIA noted that construction noise levels would remain below the relevant noise management levels (NML) at all receiver locations. Further, the NIA demonstrated that operational noise levels would comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

Four receivers (R2a, R2b, R2c and R6) are located in the same direction as Bracken Glen Estate and are approximately 200-300 m closer toward the Quarry, to which all receivers were in compliance with the relevant criteria and guidelines.

The noise mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse noise impacts related to the Proposed Modification. In summary, these include:

- Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers.
- Training (of employees to conduct quieter work practices).
- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity.
- Avoid queuing of vehicles adjacent to any receivers.
- Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers.
- Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm.
- Minimising the need for reversing or movement alarms.

2.10.6.7 Air Quality

"The Modification SEE (Jacobs Report) relies on data obtained from Buttai Gravel NSW to for its emission control measures. I note the SEE states water spray is a preferred control measure I also note this has a 70% efficiency rating. Due to major subdivision, there are an ever-increasing number of dwellings within the proximity of the quarry. 70% efficiency is too low and should be reassessed specific to the quarry site and not rely on historical data from elsewhere."

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**). In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

Four receivers (R2a, R2b, R2c and R6) are located in the same direction as Bracken Glen Estate and are approximately 200-300 m closer toward the Quarry, to which all receivers were in compliance with the relevant criteria and guidelines.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- Continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.
- blast fume management, including
  - explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013)
  - blasting will be restricted to confined and competent formations
  - blasting will occur above the groundwater table
  - the depth of blast holes will be less than 20 metres (m)
  - blast zones and holes will be maintained appropriately
- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

2.10.6.8 Increase in Truck Movements

"An increase of 80% in truck movements per weekday from 100-180 is of concern. The traffic data used was compiled in 2015 or earlier and relies on historical data and predictions. A more current report on traffic volumes should be considered. The extent of the current impact and the impact in the future, should this modification be approved, is not clear in the SEE."

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was been prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from the PCS report include but are not limited to:

- The speed environment is adequate for the available sight distance.
- current traffic count takes into account the existing developments within the area;
- the 3% growth rate takes into account any increase in development in the surrounding area.
- total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- level of service remains level A for all modes tested.
- the current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.6.9 Relationship between Oberon Earthmoving and Bettergrow Oberon

“The DA for the Bettergrow development was approved by the WRPP on December 20, 2019 (10.2019.43.1) with a modification approved on August 31 2022 (10.2021.49.1) is there a connection between the Middle Creek Quarry modification application and the expansion of the Bettergrow plant currently under construction?”

Regarding transparency, Oberon Earthmoving has complied with all requirements in submitting relevant application documentation for the Proposed Modification and has complied with all legislative framework requirements, including the EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). Further, Oberon Earthmoving regularly publishes all required environmental performance reporting on its website (https://www.oberonearthmoving.com.au/). It is noted that company ownership does not affect operational requirements related to environmental and social issues, which are set out in development consent DA 10.2016.38.1 (refer to Umwelt, 2023).

2.10.6.10 Alleged Works Undertaken

“From the diagrams included in the SEE there appears that work has been undertaken (road sealing) within an area mapped as having High Biodiversity Value. Any works undertaken within an area so mapped should trigger a Biodiversity Development Assessment Report (BDAR).”

Oberon Earthmoving confirms that all work undertaken at the Quarry has complied with the relevant conditions of consent (DA 10.2.16.38.1) (refer to Umwelt, 2023), including but not limited to conditions associated with:

15. EPA General Terms of Approval

30. Protection of flora and fauna.

Accordingly, no Biodiversity Development Assessment Report (BDAR) has been required for work undertaken at the Quarry since development consent DA 10.2016.38.1 was approved.

2.10.7 Community Submission Number Seven

Community submission number seven lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- Composting and fertiliser production.
- noise impacts.
- air quality.
- increase in truck movements.

2.10.7.1 Composting and Fertiliser Production

"The future intent of the applicant to import highly odorous organic food waste, bio solids and manure for incorporation into the process is of high concern. Any composting process would require infrastructure to ensure potential odour, air and water pollution etc. is appropriately managed."

The Quarry undertakes operations in accordance with an AQMP which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) (refer to **Section 2.10.3.3**) will mitigate any adverse air quality impacts related to the Proposed Modification, including odour impacts.

2.10.7.2 Visual Amenity

"In addition, any importing of organic waste allows for potential odour emissions which will travel within 200 metres of our home and be housed in close proximity to our property."

Regarding the maintenance of visual amenity, the SEE (Umwelt, 2023) notes:

- In order to minimise land use conflicts and avoid undue interference with the amenity of residents, Development Control Plan 2001 (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries. The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities.

- In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.
- The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).
- In addition to proposed mitigation measures and management procedures relating to amenity aspects including noise, air quality, visibility, and transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised:

Social and Community

  - Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.
  - Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
  - Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
  - Advertise and maintain a community complaints telephone line.

Economic Contribution and Development

  - Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.

Agricultural Lands

  - Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
  - Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

General

  - Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.
  - Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained, and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

2.10.7.3 Noise Impacts

"The application will have increased noise impact on our property which is located directly opposite the quarry site. An increase in the quarry operations, and in particular the proposed increase traffic movements will substantially increase the current noise levels from the operations. The noise from trucks entering and existing the operation site is already disturbing to our amenity and this increase will have substantial impact to us as a close neighbour."

A Noise Impact Assessment (NIA) (refer **Appendix 7**) for the Proposed Modification was completed by Muller Acoustic Consulting Pty Ltd (MAC) to evaluate noise associated with construction, operations, and traffic/haulage (Umwelt, 2023). The NIA was undertaken in accordance with the Noise Policy for Industry (NPI) (EPA, 2017), NSW Road Noise Policy (RNP) (DECCW, 2011) and the Draft Construction Noise Guideline (DCNG) (EPA, 2020).

The NIA noted that construction noise levels would remain below the relevant noise management levels (NML) at all receiver locations. Further, the NIA demonstrated that operational noise levels would comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

The noise mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse noise impacts related to the Proposed Modification. In summary, these include:

- Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers.
- Training (of employees to conduct quieter work practices).
- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity
- Avoid queuing of vehicles adjacent to any receivers.
- Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers.
- Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm.
- Minimising the need for reversing or movement alarms.

2.10.7.4 Air Quality

"Oberon often experiences windy conditions, and the prevailing winds often carry dust from the existing extraction site across neighbouring properties for a significant distance. Water spray is a noted as the preferred control measure however is not very effective and the impact on human health is of major concern."

Monthly dust deposition monitoring results going back to January 2022 indicate that insoluble solids, combustible material and ash were observed below the criteria level of 4 units on all but one occasion (noting that the monitoring results for the month of August 2022 are not available, also reiterating that no exceedances occurred in that month) (refer to **Appendix 5**). In January 2022, exceedances for insoluble solids and combustible matter at gauge number 1 were observed, which were explained as likely contamination from bird droppings and organic matter. The most recent EPA Annual Return (for licence number 21098, for the reporting period ending 3 February 2024) indicates that no complaints were received regarding air quality during the reporting period (refer to **Appendix 3**). Further, Oberon Earthmoving has not received any formal complaints regarding air quality at the Quarry at any other time.

The Air Quality Impact Assessment (AQIA) for the Proposed Modification completed by Jacobs Pty Ltd and included within the SEE (Umwelt, 2023) found that air quality concentrations are predicted to comply with the relevant criteria for annual average emissions, 24-hour emissions, total suspended particulates, deposited dust, and gas emissions, and are not expected to significantly differ from background concentrations even when cumulative emissions are considered.

As stated in the SEE, monitoring from a similar site and results from modelling indicate the Proposed Modification is not expected to cause adverse air quality impacts with respect to crystalline silica (Umwelt, 2023). A comparative analysis of crystalline silica concentration with a much larger quarry (Martins Creek Quarry) indicates that the concentration would not exceed 0.6 µg/m3, well below the noted criteria of 3 µg/m3.

The air quality mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse air quality impacts related to the Proposed Modification. In summary, these include:

- Continued implementation of the Air Quality Management Plan (AQMP) which outlines the key controls and management measures to reduce air emissions and odour, along with triggers for corrective actions.
- blast fume management, including
    - explosive formulation and quality assurance (as per the *NSW Explosives Act 2003* and NSW Explosives Regulations 2013)
    - blasting will be restricted to confined and competent formations
    - blasting will occur above the groundwater table
    - the depth of blast holes will be less than 20 metres (m)
    - blast zones and holes will be maintained appropriately
- exhaust gas management, including appropriate servicing and maintenance of Quarry machinery.

2.10.7.5 Increase in Truck Movements

"The substantial increase in traffic movements has already created many near misses on the Sewells Creek Road, particularly near the Abercrombie Road intersection where sight distance along Sewells Creek Road is minimal. An updated traffic assessment and review of the current road conditions to determine if they would be suitable to meet safety requirements along this route to the quarry would be required should the modification application be approved."

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from the PCS report include but are not limited to:

- The speed environment is adequate for the available sight distance.
- current traffic count takes into account the existing developments within the area.
- the 3% growth rate takes into account any increase in development in the surrounding area.
- total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- level of service remains level A for all modes tested.
- the current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.8 Community Submission Number Eight

Community submission number eight lodged with Oberon Council noted issues relating to the Proposed Modification. These issues have been or will be assessed prior to construction and include:

- substantially the same development.
- increase in truck movements.
- water source.

- noise impacts.
- impact to amenity.

2.10.8.1 Substantially the Same Development

"We do not accept that this is a modification of the existing development consent. It is in fact a new development, as is evidenced by the substantial change in scope and scale."

As discussed in **Section 2.1**, the SEE noted that the Proposed Modification displayed no additional activities proposed with increases to extraction, production and transport limits managed to minimise impacts. Further, an independent legal opinion secured by Minter Ellison noted that the Proposed Modification is "substantially the same" as the 2016 Consent (refer to **Appendix 1**). As well, the SEE submitted to Oberon Council comprehensively addresses all potential environmental and social impacts related to the Proposed Modification, and includes proposed measures to mitigate and manage impacts (Umwelt, 2023).

2.10.8.2 Increase in Truck Movements

"Amongst our many concerns is the impact of an 86% increase in truck movements."

The road capacity was assessed with reference to the Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements, which provides turn warrants and guide treatments for various intersections. A prior upgrade to the Quarry Access Road/Sewells Creek Road intersection was designed and constructed with sufficient capacity for the proposed traffic volume increases.

During peak hour traffic, the number of vehicle movements is well under capacity of the existing roads and will not require any upgrade to accommodate for the increased truck movements. Sewells Creek Road and Abercrombie Road are classed as single lane Level of Service A roads with a capacity of 200 vehicles per hour per lane. The forecast peak hour traffic with the Modification is 214 vehicles, with 107 movements in each direction. The Site Access Road will be regularly inspected and maintained to prevent excessive dust emissions and prevent degradation of the road surface.

Further, a Supplementary Integrated Transport Assessment (refer to **Appendix 2**) was prepared by Pavey Consulting Services (PCS). Based on a variety of assessments the outcome states there are no traffic engineering related matters that should prohibit approval of the Proposed Modification. Key findings from PCS report include but are not limited to:

- The speed environment is adequate for the available sight distance.
- current traffic count takes into account the existing developments within the area.
- the 3% growth rate takes into account any increase in development in the surrounding area.
- total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon.
- level of service remains level A for all modes tested.

- the current instruction operates well within the requirements of a rural BAR, and such does not need to be upgraded to a complying rural BAR type intersection based on the findings of the report.

2.10.8.3 Water Source

"Amongst our many concerns is…the installation of a processing plant and the sourcing of water, including groundwater."

As a point of clarification, at the time the SEE was drafted, it was expected that Oberon Earthmoving would have secured a 50 ML Water Access Licence. Unforeseen delays in securing the Water Access Licence have occurred since then. Oberon Earthmoving is currently in the process of securing a 50 ML Water Access Licence, a copy of which will be provided to Council prior to construction.

It is also reiterated, as per the SEE (Umwelt, 2023), that water extraction will not be increased through the Proposed Modification, and water management will be improved through a Pollution Control Dam (PCD) serving the following functions:

- For the storage of water which accumulates within the completed extraction area under high rainfall, with a nominal capacity of 16 ML.
- For the collection of water diverted from upslope of the new pad and delivered to the PCD via a rock-lined spillway.
- As a secondary control for water contained and stored on the relocated composting area.

2.10.8.4 Noise Impacts

"The crushing of concrete will also have acoustic impacts that have not properly been considered. Even if the overall acoustic impact in terms of acoustic levels does not exceed the Industrial Noise Policy or what is provided in the Acoustic Management Plan that applies to the site (which we do not accept), this does not account for the constancy of higher levels of noise that will occur."

A Noise Impact Assessment (NIA) (refer to **Appendix 7**) for the Proposed Modification was completed by Muller Acoustic Consulting Pty Ltd (MAC) to evaluate noise associated with construction, operations, and traffic/haulage (Umwelt, 2023). The NIA was undertaken in accordance with the Noise Policy for Industry (NPI) (EPA, 2017), NSW Road Noise Policy (RNP) (DECCW, 2011) and the Draft Construction Noise Guideline (DCNG) (EPA, 2020).

The NIA noted that construction noise levels would remain below the relevant noise management levels (NML) at all receiver locations. Further, the NIA demonstrated that operational noise levels would comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

The noise mitigation measures outlined in the SEE (Umwelt, 2023) will mitigate any adverse noise impacts related to the Proposed Modification. In summary, these include:

- Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers.
- Training (of employees to conduct quieter work practices).

- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers.
- Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers.
- The quietest suitable machinery reasonably available will be selected for each work activity.
- Avoid queuing of vehicles adjacent to any receivers.
- Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers.
- Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm.
- Minimising the need for reversing or movement alarms.

2.10.8.5 Impact to Amenity

"There has already been an impact on our use and quiet enjoyment of our rural property as noise from Middle Creek Quarry and truck traffic has increased tangibly over recent years notwithstanding the COVID19 Pandemic."

Regarding the maintenance of amenity, the SEE (Umwelt, 2023) notes:

- The Proposed Development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.2 of the NPI, for residences that are private dwellings.
- In order to minimise land use conflicts and avoid undue interference with the amenity of residents, Development Control Plan 2001 (DCP) (as last amended and adopted 23 September 2010) requires that residential development be located so as to ensure a 500 m buffer from the footprint of operations of extractive industries. The closest residence is located approximately 610 m south of the closest point of the proposed extraction and processing activities. In any event, Oberon Earthmoving has endeavoured to meet the objectives of the DCP through designing the proposed operations to meet accepted criteria regardless of the distance from the footprint of operations.
- The Proposed Modification does not involve any changes which would alter the visibility of the Quarry (as approved).
- In addition to proposed mitigation measures and management procedures relating to amenity aspects including noise, air quality, visibility, and transportation, Oberon Earthmoving would implement management and mitigation measures to ensure that Proposed Modification-related benefits for the community surrounding the Quarry are maximised and adverse impacts are minimised:

Social and Community

- Engage landowners and residents surrounding the Quarry in dialogue in relation to Quarry operations.
- Proactively and regularly consult throughout the life of the Quarry with those landowners, land users and residents most likely to be adversely impacted by the Quarry.
- Continue implementing environmental monitoring program and provide access to the results of monitoring to the local community. The results of environmental monitoring would be regularly reviewed to identify where improvement in performance can be made.
- Advertise and maintain a community complaints telephone line.

Economic Contribution and Development

- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the Oberon LGA.

Agricultural Lands

- Maintain agricultural operations on land not required for extraction, processing, stockpiling or biodiversity conservation purposes.
- Continue to appropriately manage weeds, pests and bush fire risks on land held by Oberon Earthmoving in consultation with surrounding landowners.

General

- Adhere to all operating conditions including restrictions on hours of operation and the required standard of facility.
- Notably, the Quarry is now an established feature of the local setting and on the basis that tree planting and amenity bunds are maintained, and dust is managed, no additional impact is considered likely as a result of the Proposed Modification.

3.0 References

Department of Environment, Climate Change and Water (DECCW), 2011. NSW Road Noise Policy

Environment Protection Authority – NSW (EPA), 2017. Noise Policy for Industry (NPI)

Environment Protection Authority – NSW (EPA), 2020. Draft Construction Noise Guideline

Umwelt (Australia) Pty Ltd (Umwelt), 2023. Middle Creek Quarries Modification Statement of Environmental Effects.

APPENDIX 1

Independent Legal Opinion

From:	Zac Rowlandson <zac@oberonearthmoving.com.au>
Sent:	Monday, 3 June 2024 4:18 PM
To:	Jon Novoselac
Subject:	Fwd: Oberon Earthmoving
Attachments:	4722B_R06_SEE_Final_REDUCED SIZE_10MB.pdf; s34 Agreement and Annexures (signed by Turnbull_ Counci(155111340.1).pdf

*This message originated from outside of Umwelt - **BE CAUTIOUS** opening any link or attachment.*

Zac Rowlandson
Director
0411729732

From: Alexander Beale <Alexander.Beale@minterellison.com>
Sent: Wednesday, February 28, 2024 12:12
To: Zac Rowlandson <zac@oberonearthmoving.com.au>
Cc: Simon Ball <Simon.Ball@minterellison.com>
Subject: Oberon Earthmoving

Hi Zac

We refer to our recent discussion in relation to the proposed modification of Development Consent DA 10.2016.38.1 (the **2016 Consent**).

As discussed, you have submitted a modification application to modify the 2016 Consent under s 4.56 of the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**). As the 2016 Consent was ultimately granted by the Land and Environment Court, the modification application will be lodged under s4.56 of the EP&A Act.

The question you have asked us to consider is whether the proposed modification satisfies the "*substantially the same development*" test and can in fact be submitted and assessed as a modification application, rather than a fresh development application.

In our view, and for the reasons below:

- the Proposed Modification satisfies the "substantially the same" test and constitutes a modification application; and
- for the avoidance of doubt, the Western JRPP is the correct consent authority.

The proposed modification application

The development authorised by the 2016 Consent was for an "extractive industry and waste management facility", subject to the conditions of that consent. The development under the 2016 Consent was described in the statement of reasons for approval by the Western JRPP as:

> *"Extractive industry involving the continued operation and extension of Middle Creek Quarries up to 15 hectares; crushing and screening of extracted materials; establishment of waste management facility; importation of raw mulch; excavated natural material and treated drilling mud; composting, blending and screening of imported materials; rehabilitation of site to create final landform suitable for agricultural activities".*

We have considered the statement of environmental effects (**SEE**) prepared by Umwelt dated May 2024 "Middle Creek Quarries Modification" (attached) for the purpose of answering the present question.

Page 16 of the SEE sets out a useful summary of the proposed modifications, as follows:

"*Oberon Earthmoving is seeking to modify the development consent to allow for the following:*

- *Inclusion of a washing circuit for the preparation of washed sand and aggregate products.*
- *Extended resource recovery limits and activities including waste concrete importation and crushing for sale.*
- *The construction of a new pad for the relocation of composting operations and supplementary stockpiling.*
- *An increased maximum annual production level (to account for the additional resource recovery and processing operations proposed).*
- *An increase in the number of allowable daily truck movements.*"

Table 3.1 sets out a useful summary of the proposed changes to the 2016 Consent proposed by the modification application:

Element	Approved	Proposed	Section
Extraction Method	Drill and blast	No change	N/A
Extraction Area	As identified on **Figure 2.1**	No change	N/A
Extraction Design Features	Refer to **Section 2.4**	No change	N/A
Extraction Rate	Up to 150,000 tpa	Up to 200,000 tpa (increase of 33%)	**3.6**
Overburden Management	Sale as select fill Void backfill (rehabilitation)	No change	N/A
Resource Recovery	Importation of VENM, ENM, Treated Drilling Muds for land application or processing and sale	Importation of waste concrete for crushing and sale Importation of plasterboard under Resource Recovery Exemption	**3.3**
	Importation of organic (green) waste with a limit of 25,000 tpa. Importation of treated drilling mud with a limit of 60,000 tpa.	Up to 45,000 tpa (increase of 80%) Up to 15,000 tpa (decrease of 75%)	**3.4**
Composting	Aerobic windrow composting of mulch within the completed extraction area	No change	N/A
Processing Operations	Campaign crushing and screening	Addition of a washing circuit	**3.2**
Production Rate	Up to 250,000 tpa	Up to 315,000 tpa (increase of 26%)	**3.6**
Transport Operations	Maximum of 100 truck movements per day (Monday to Friday) Maximum 60 truck movements per day (Saturday)	Maximum of 180 truck movements per day (Monday to Friday) Maximum 90 truck movements per day (Saturday)	**3.5**
Rehabilitation and Final Landform	Retained void with stable final slopes	No change to residual voids	**3.7**
Hours of Operation	• Monday–Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 2.00 pm • Sunday & Public Holidays: No work.	No change	N/A

The above constitutes the "**Proposed Modification**".

We make a few high level observations in relation to the Proposed Modification:

- There is no proposed change to the fundamentals of the development as it is authorised under the 2016 Consent – the site will still operate for the purpose of an "extractive industry and waste management facility";
- There is no proposed change to the extraction area; and
- While there is an intensification of the use in respect of the extraction rate and production rate (which in turn lead to an increase in truck movements per day), there is a net decrease in the importation of material for the purpose of resource recovery.

The Substantially the Same Development Test

The limits on the power to modify a development consent are those found in s 4.55 of the Act (in the case of development consents granted by a consent authority) and 4.56 of the Act (in the case of development consent granted by the Court – which, as above, applies here).

Importantly, the reference point for the test of substantially the same development is *"the development to which the consent as modified relates is substantially the same development as the development for which was originally granted and before that consent as originally granted was modified (if at all)"* (see s4.56(1)(a) of the Act). As this is the first time the 2016 Consent has been modified, the comparison between the proposed modification and the original consent is straightforward.

The leading authorities on the substantially the same test are *Vacik v Penrith City Council* [1992] NSWLEC 8 (***Vacik***) and *Moto Projects (No 2) Pty Ltd v North Sydney Council* (1999) 106 LGERA 298 (***Moto***).

In *Vacik*, Stein J held that the term "*substantially*" means "*essentially have the same essence*". If a development as modified involves an additional and distinct use it is not substantially the same development. On this point, Stein J held: "*…substantially when used in the section means essentially or materially or having the same essence.*"

In *Moto*, Bignold J set out the following principles for consideration in satisfying the precondition of substantially the same:

"*The requisite factual finding obviously requires a comparison between the development, as currently approved, and the development as proposed to be modified…*" (at [55]).

"*The result of the comparison must be a finding that the modified development is 'essentially or materially' the same as the (currently) approved development*" (at [55]).

The comparative task involves a quantitative as well as qualitative appreciation of the differences – a numeric or quantitative evaluation of the modification when compared to the original consent absent any qualitative assessment will be "*legally flawed*" (at [52]).

"*The comparative task does not merely involve a comparison of the physical features or components of the development as currently approved and modified where that comparative exercise is undertaken in some type of sterile vacuum. Rather, the comparison involves an appreciation, qualitative, as well as quantitative, of the developments being compared in their proper contexts (including the circumstances in which the development consent was granted)*" (at [56]).

The comparative task needs to assess the physical features as well as the environmental impacts of the changes (at [57]-[62]).

Consideration should be given to any feature of the development which is important, material or essential. A change to such a feature is likely to mean that it is not substantially the same development (at [64]).

The term "*substantially*" in "*substantially the same development*" means "*essentially or materially or having the same essence*". The applicant is responsible for demonstrating that a modification is substantially the same development, but the consent authority is the one who ultimately must be satisfied whether a modification falls within the scope of s 4.56(1) of the Act. To assess whether a consent is modified will be substantially the same development requires a comparison of the before and after situations. Differences may involve differences of the result or outcome, as well as differences of the process of implementation which have environmental implications or differences in outcomes.

A development, as modified, is not substantially the same development as originally approved simply because it is for the same use. But if the development, as modified, involves an additional and distinct use, it is not substantially the same development as originally approved (*Vacik*).

Modification and Satisfaction of the Test

In our view, the Proposed Modification is "substantially the same" as the 2016 Consent.

From a quantitative perspective, we are of the view that the 2016 Consent will not substantially change. We note that while there is an intensification of some aspects of the operations, there is a decrease in others.

Importantly, the Proposed Modification <u>does not</u> seek any changes with respect to:

extraction methods;

extraction area;

extraction design features;

overburden management;

composting;

rehabilitation and final landform; or

hours of operation.

From a qualitative perspective, the Proposed Modification is for the <u>same use</u> as the 2016 Consent.

In the context of the development authorised under the 2016 Consent as a whole, we consider that these proposed modifications to the volumes to be accepted and operations on the Site are relatively minor. The consent authority is capable of satisfying itself that the Proposed Modification is "substantially the same development" as the 2016 Consent.

Consent Authority

We understand there has been some confusion in relation to the identify of the correct consent authority for the purpose of assessing the modification application.

Section 4.56(1) of the Act relates to modification by consent authorities of consents granted by the Court and provides that –

> *"(1) A **consent authority may**, on application being made by the applicant or any other person entitled to act on a consent granted by the Court and subject to and in accordance with the regulations, modify the development application…"*

In the present circumstances, the relevant "consent authority" is the Western Joint Regional Planning Panel by virtue of the development being a "regionally significant development" pursuant to the Act, *Environmental Planning and Assessment Regulation 2021* and *State Environmental Planning Policy (Planning Systems) 2021* (**Planning Systems SEPP**).

Section 4.5(b) of the Act provides that the relevant consent authority for a "regionally significant development" is:

> "*…the Sydney district or regional planning panel for the area in which the development is to be carried out*".

Part 2.4 of the Planning Systems SEPP relates to regionally significant development. In particular, section 2.19 specifies –

"*(1) Development specified in Schedule 6 is declared to be regionally significant development for the purposes of the Act*".

We have considered Schedule 6 of the Planning Systems SEPP and consider the development meets the threshold for regionally significant development. In this regard we note section 7 of the Planning Systems SEPP:

7 Particular designated development

(1) Development for the purposes of—

(a) ***extractive industry facilities*** *that meet the requirements for designated development under the Environmental Planning and Assessment Regulation 2021, Schedule 3, section 26…*

We have further considered section 26 of Schedule 3 of the Regulations and are of the view that the proposed development satisfies the requirements for designated development for an extractive industry. In this regard, we note section 26(1) which provides –

"(1) Development for the purposes of an extractive industry facility is designated development if the facility obtains or processes for sale, or reuse, more than 30,000 cubic metres of extractive material per year"

In light of the above provisions, we are of the view that the development is correctly characterised as a "regionally significant development" and the consent authority is the Western Regional Planning Panel. We understand the current form of the modification application is presently being assessed by this Panel.

Regards
Alex

——

Alexander Beale
Senior Associate
T +61 2 9921 4523 M +61 434 181 006
alexander.beale@minterellison.com
MinterEllison Governor Macquarie Tower 1 Farrer Place Sydney NSW 2000
minterellison.com Follow us on **LinkedIn**

MinterEllison.

APPENDIX 2

Supplementary Integrated Transport Assessment

Transport for NSW

16 October 2023

TfNSW reference: WST10/00085/11 | SF2015/105895
Your reference: DA10.2016.38.1 (CNR-59300)

General Manager
Oberon Shire Council
By Email: council@oberon.nsw.gov.au

Attention: Bennett Kennedy, Senior Town Planner

DA 10.2016.38.1 – Modification to increase extraction at Sewells Creek Road Quarry– Lot: 2 DP1112479 – 50 Sewells Creek Road, Oberon

Dear Bennett,

Transport for NSW (TfNSW) is responding to DA 10.2016.38.1 referred via the NSW Planning Portal on 25 August 2023 inviting comment in accordance with s.2.122 of *SEPP (Transport and Infrastructure) 2021.*

TfNSW has reviewed the information and has identified several deficiencies in the information provided relating to the classified road network and the potential impacts the proposal may have on road users. As a result, TfNSW does not support the proposal at this time and requests Council review the request for amendments contained within **Attachment 1**.

On request, TfNSW can participate in a meeting with Council and the Applicant to further discuss the information in Attachment 1.

If you have any questions, please contact Brendan Croft, Development Services Case Officer, on 1300 019 680 or email development.west@transport.nsw.gov.au.

Yours faithfully,

Kylie-Anne Pont

Kylie-Anne Pont
Team Leader Development Services (West)
Community & Place
Regional and Outer Metropolitan

Lvl 1, 51-55 Currajong Street, Parkes NSW 2870
E. development.west@transport.nsw.gov.au

1300 207 783
transport.nsw.gov.au

Attachment 1

DA 10.2016.38.1 – Modification to increase extraction at Sewells Creek Road Quarry– Lot: 2 DP1112479 – 50 Sewells Creek Road, Oberon

This attachment relates to TfNSW's response dated 16 October 2023 reference WST10/00085/11.

Context

TfNSW understands:

- The development proposes modification to increase amount of gravel extraction from 250,000tpa to 315,000tpa and increase resource recovery activities by importing waste concrete for crushing and sale resulting in a maximum of 180 truck movements per weekday and 90 truck movements on Saturdays.
- The affected classified (Regional) road is Abercrombie Road (MR256) noting that transporting materials via Mayfield Road is prohibited.
- Council is seeking advice from TfNSW to assist in its assessment under s.2.122 of the *SEPP (Transport and Infrastructure) 2021.*
- The quarry has a lifespan until 2046.

TfNSW response and comments

TfNSW raises the following concerns that should be addressed by the proponent prior to Council's determination of the application:

1. The *Road Capacity Assessment* in Section 4.8 contained within the Traffic Impact Assessment (TIA) advises there is an existing Basic Right turn treatment (BAR) for movements from Abercrombie Road via the intersection with Sewells Creek Road. Assessment of the site confirms that there is no BAR treatment at the intersection. Furthermore, TfNSW is not satisfied with the justification from the proponent that a hypothetical BAR would be adequate to address the proposed upgrades. Further analysis should be undertaken to confirm suitable turning treatment at this intersection.

   Note: When considering the turn treatment warrants for the intersection at Abercrombie Road/Sewells Creek Road, it is important to recognise that consideration for intersection treatments should go beyond plotting basic traffic volumes on the warrant graphs to identify minimum treatments in light of the need to consider the overall safety and operational performance. This includes the need to consider sight distance, road user type (e.g. high percentage of heavy vehicles) and potentially the 85th percentile speed which is often higher than the signposted speed on rural roads. Abercrombie Road is signposted as 100km/h and the accepted design speed by TfNSW is +10km/h.

2. Cumulative traffic impacts from nearby development should be considered in background traffic predictions noting that changes in development in the vicinity of the site in recent years

following original approval may have influenced increased background traffic and may not align with growth forecasting (e.g. Mayfield Gardens, other primary industry development in the vicinity). Council should liaise with the proponent about development that may have contributed to the background traffic. Alternatively, traffic counts should be undertaken at the affected intersection.

3. In relation to Section 4.6 – Traffic Distribution contained within the submitted TIA, the assumption of an '80-20 split' being only 80% of heavy vehicles travelling northbound on Abercrombie Road (via Sewells Creek Road) should be justified with evidence provided (i.e. 20% assumption for southbound travel along Abercrombie Road seems high).

TfNSW may provide further consideration of the application following the submission of information addressing the above.

David Pavey Pty Ltd trading as Pavey Consulting Services
Specialising in

- **Traffic Impact Assessments and Transportation Planning**
- **Road Safety, Traffic Management Plans and Traffic Control Plans**
- **Civil and Structural Design**
- **Project Management and Contract Administration**
- **Mediation and Government Relations**

Supplementary Integrated Transport Assessment

Oberon Earth Moving Pty Ltd

Modification to increase extraction at Sewells Creek Road Quarry

50 Sewells Creek Road, Oberon

16 May 2024 Rev 0

Restrictions on Use
This report has been prepared specifically for Oberon Earth Moving Pty Ltd as the client. No part of this report may be referred to or quoted in any way without the express written approval of David Pavey Pty Ltd.
No party other than Oberon Earth Moving Pty ay rely upon any representation in this report for any purpose whatsoever, and David Pavey Pty Ltd accepts no liability for any such party relying upon this report.

Prepared By
David Pavey
Director
B.E (Civil) Grad Dip LGE. LGE Cert, MAICD, MAITPM
Authorised SafeWork NSW - Prepare a Work Zone Plans - No TCT1017730
NSW Department of Planning and Environment Secretary's approval as suitably qualified person to prepare the Traffic Management Plan (TMP)

Pavey Consulting Services
Email; paveyconsulting@iinet.net.au
Phone: 0419696212

David Pavey Pty Ltd
23 Stanley Street
Merewether
NSW 2291
ABN 12 150 774 413
ACN 150 774 413

Table of Contents

INTRODUCTION

Pavey Consulting Services (PCS) has been commissioned by Oberon Earth Moving Pty to provide supplementary Intergraded Transport Assessment (ITA) to support an application for expansion of Middle Creek Quarry.

Middle Creek Quarry is located on 50 Sewells Creek Road, which is approximately 6 kilometres northwest of Oberon in the Oberon Council Local Government Area. This site is classified as a designated development under the Environmental Planning and Assessment Regulation 2000 Schedule 3.

This report includes consideration of issued raised in TfNSW letter of 16 October 2023.

LIMITS OF REPORT

This report considers the instructions and requirements of our client. Pavey Consulting Services (PCS) has taken care in the preparation of this report, however it neither accepts liability nor responsibility whatsoever in respect of:

- Any use of this report by any third party,
- Any third party whose interests may be affected by any decision made regarding the contents of this report, and/or
- Any conclusion drawn resulting from omission or lack of full disclosure by the client, or the clients' consultants.

BASIS OF INTEGRATED TRANSPORT ASSESSMENT

This Supplementary Integrated Transport Assessment (ITA) has been prepared in accordance with the relevant governmental assessment requirements, guidelines and policies, and in consultation with the relevant Government Agencies.

The ITA has been developed in accordance with:

- Austroads Guide to Traffic Management Part 3 Traffic Studies and Analysis.
- Austroads Guide to Traffic Management Part 12 Traffic Impacts of Developments
- Austroads Guide to Traffic Management Austroads Part 6 Intersections Interchanges and Crossings;
- Austroads Guide to Road Design Part 4 Intersections and Crossings General Ed2.2 and
- NSW Roads and Maritime Services (RMS) Guide to Traffic Generating Developments (2002).

The supplementary ITA builds on the existing Traffic Impact Assessment developed by Cardno (NSW/ACT) Pty Ltd now Stantec 30 September 2022.

ISSUES RAISED BY TfNSW

As outline in the TfNSW requirements the following aspects are address in this report as they relate to Traffic &Transport issues.

TfNSW raises the following concerns that should be addressed by the proponent prior to Council's determination of the application:

> 1. *The Road Capacity Assessment in Section 4.8 contained within the Traffic Impact Assessment (TIA) advises there is an existing Basic Right turn treatment (BAR) for movements from Abercrombie Road via the intersection with Sewells Creek Road. Assessment of the site confirms that there is no BAR treatment at the intersection.*
>
> *Furthermore, TfNSW is not satisfied with the justification from the proponent that a hypothetical BAR would be adequate to address the proposed upgrades. Further analysis should be undertaken to confirm suitable turning treatment at this intersection.*
>
> *Note: When considering the turn treatment warrants for the intersection at Abercrombie Road/Sewells Creek Road, it is important to recognise that consideration for intersection treatments should go beyond plotting basic traffic volumes on the warrant graphs to identify minimum treatments in light of the need to consider the overall safety and operational performance. This includes the need to consider sight distance, road user type (e.g. high percentage of heavy vehicles) and potentially the 85th percentile speed which is often higher than the signposted speed on rural roads. Abercrombie Road is signposted as 100km/h and the accepted design speed by TfNSW is +10km/h.*
>
> *2. Cumulative traffic impacts from nearby development should be considered in background traffic predictions noting that changes in development in the vicinity of the site in recent years following original approval may have influenced increased background traffic and may not align with growth forecasting (e.g. Mayfield Gardens, other primary industry development in the vicinity). Council should liaise with the proponent about development that may have contributed to the background traffic. Alternatively, traffic counts should be undertaken at the affected intersection.*
>
> *3. In relation to Section 4.6 – Traffic Distribution contained within the submitted TIA, the assumption of an '80-20 split' being only 80% of heavy vehicles travelling northbound on Abercrombie Road (via Sewells Creek Road) should be justified with evidence provided (i.e. 20% assumption for southbound travel along Abercrombie Road seems high).*

EXISTING SITE CONDTIONS

Site Location

The location of the site is shown as **Figure 1** and **2** below.

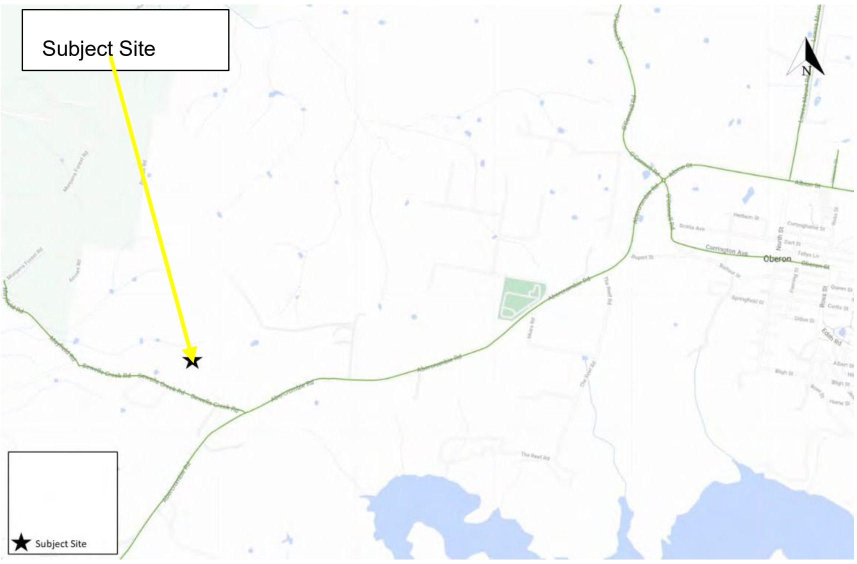


Figure 1 Site Location

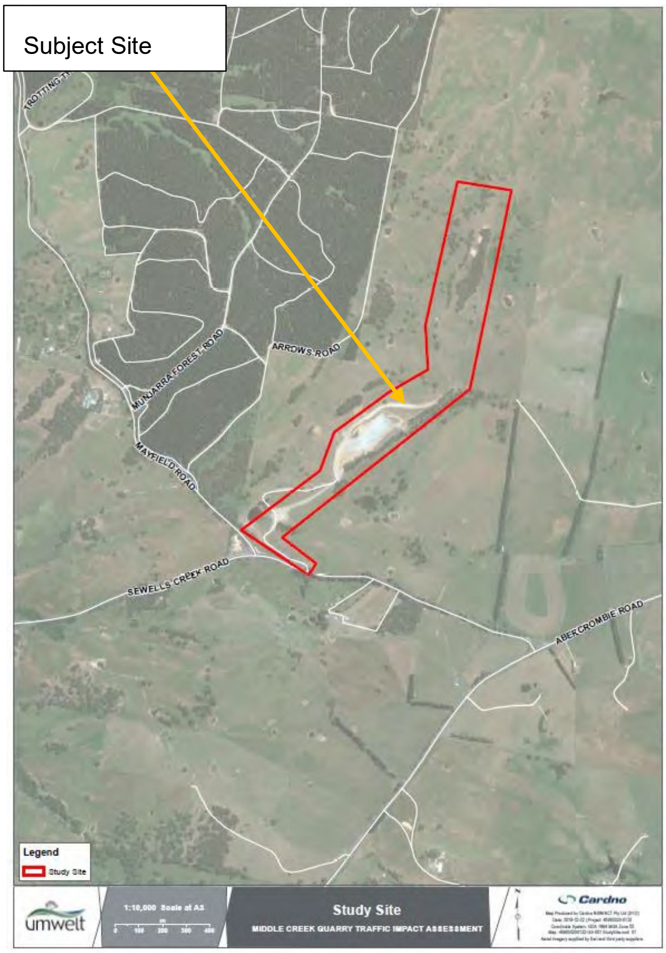


Figure 2 Site Context

Operating Hours and Workforce

The Quarry is approved for the following hours of operation:

- Monday–Friday: 7:00 am to 6:00 pm.
- Saturday: 8:00 am to 2:00 pm.
- Sunday & Public Holidays: No work permitted.

The Quarry Site has a current workforce of 2 to 3 people, and up to 5 people during peak production periods.

Site Access and adjoining Road Network.

The quarry entrance is situated on Sewells Creek Road. From the quarry entrance, Sewells Creek Road provides connection to Abercrombie Road 1km to the east, and Mayfield road 150m to the west.

The Middle Creek Quarry access road connects to Sewells Creek Road.

Abercrombie Road

Abercrombie Road is a regional road under the care and maintenance of the local council with a speed limit of 100 km/hr.

The road is configured as a sealed two-lane carriageway with one lane provided for each direction. Abercrombie Road provides connections to the regional township of Oberon to the west.

Sewells Creek Road

Sewells Creek Road is a local road under the care and maintenance of the local council.

There are no speed limit marked along Sewells Creek Road nearby the subject site, hence a default speed limit of 100 km/hr applies.

The road is sealed and configured as a two-lane carriageway with one lane provided for each direction, separated by a double centre line.

Mayfield Road

Mayfield Road is a local road under the care and maintenance of the local council.

There are no speed limit marked along Mayfield Road nearby the subject site, hence a default speed limit of 100 km/hr applies.

The road is sealed configured as a two-lane carriageway with one lane provided for each direction separated by a double centre line

Intersection of Abercrombie Road and Sewells Creek Rd

The current configuration of the intersection (**Figures 3,4,5 and 6**) is a standard T junction (with a give way sign) with a widened shoulder of 2 to 3 m in the vicinity of the junction.

Whist not meeting the requirements of a BAR type intersection (as per Austroads design) the shoulder widening provides room for a vehicle to pass safely on the inside of a turning vehicle.

Figure 3 Intersection of Abercrombie Rd and Sewells Rd

Figure 4 Intersection of Abercrombie Rd and Sewells Rd

Figure 5 Intersection of Abercrombie Rd and Sewells Rd

Figure 6 Intersection of Abercrombie Rd and Sewells Rd

Heavy Vehicles

Abercrombie Road and Sewells Creek Road are approved 26m B-Double Routes.

PROPOSED DEVELOPMENT

Oberon Earthmoving is seeking to modify the development consent to allow for the following:

- Inclusion of a washing circuit for the preparation of washed sand and aggregate products.
- Extended resource recovery limits and activities including waste concrete importation and crushing for sale.
- The construction of a new pad for the relocation of composting operations and supplementary

stockpiling.

- An increased maximum annual production level (to account for the additional resource recovery and processing operations proposed).
- An increase in the number of allowable daily truck movements.

Table 1 provides a comparative analysis of the Proposed Modification against the current approved Quarry operations.

Element	Approved	Proposed
Extraction Rate	Up to 150,000 tpa	Up to 200,000 tpa (increase of 33%)
Resource Recovery	Importation of VENM, ENM, Treated Drilling Muds for land application or processing and sale	Importation of waste concrete for crushing and sale Importation of plasterboard under Resource Recovery Exemption
	Importation of organic (green) waste with a limit of 25,000 tpa. Importation of treated drilling mud with a limit of 60,000 tpa.	Up to 45,000 tpa (increase of 80%) Up to 15,000 tpa (decrease of 75%)
Composting	Aerobic windrow composting of mulch within the completed extraction area	No change
Processing Operations	Campaign crushing and screening	Addition of a washing circuit
Production Rate	Up to 250,000 tpa	Up to 315,000 tpa (increase of 26%)
Transport Operations	Maximum of 100 truck movements per day (Monday to Friday) Maximum 60 truck movements per day (Saturday)	Maximum of 180 truck movements per day (Monday to Friday) Maximum 90 truck movements per day (Saturday)
Hours of Operation	• Monday–Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 2.00 pm Sunday & Public Holidays: No work.	No change

Table 1 Proposed Modifications

There is no change in the heavy vehicle types that access the site, which is predominantly truck and dog trailer combinations, however rigid trucks and B-Doubles may also be utilised on occasions.

Traffic Generation

The current operation has approval for 250,000tpa total production and 50 vehicle loads (100 two-way movements). The proposal for 315,000tpa total production is equivalent to a 26% increase, whilst the peak truck activity is proposed to be 90 vehicle loads (180 two-way truck movements), reflective of an 80% increase in site generated trucks across the day.

Based on the transport hours of 7:00am to 6:00pm (11 hours), this would equate to 16 -17 vehicle movements per hour proposed compared to 9-10 vehicles per hour existing. I.e. a maximum increase of 7 per hour.

Traffic Distribution

The origin and destination for the distribution of various products (both incoming and outgoing) will vary day to- day

Based on discussions with the operator and the intersection traffic count (see below) the distribution of traffic leaving the site is as follows.

- 90% of heavy vehicles travel to / from Oberon, north along Abercrombie Road with the remaining 10% being south.
- 100% of light vehicles travel to / from Oberon.

Traffic Impact at Intersections

Effect on Intersection Performance

Establishment of current traffic volumes

A traffic count was carried out on the 10 April 2024 between the hours of 7:00 am and 5:00pm to determine all traffic movements including peak times at the intersection.

Results of count are provided in **Appendix A** and peak movements area summarised below indicated below in **Table 2**.

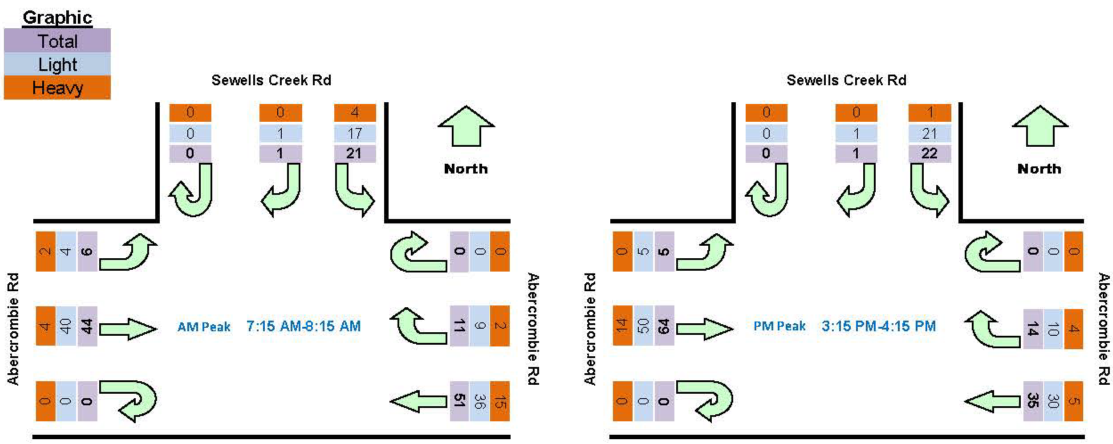


Table 2 Summary of Traffic Count

Intersection Operation

How adequate the capacity of an intersection is judged by whether it can physically and operationally cater for the traffic using it.

The performances of the intersections relevant to the proposal have been assessed using the intersection modelling SIDRA software. The model provides parameters of the performance of an intersection including the degree of saturation (DoS) and the average delay per vehicle. It provides an accurate and consistent guide to the performance of an intersection under the different traffic flow scenarios. The recommended criteria for evaluating capacity of intersections are shown in Table 3.

Level of Service	Degree of Saturation (DoS)	Ave. Delay/ Veh. (Secs)
A/B - good operation	less than 0.80	Less than 28
C - satisfactory	0.80 to 0.85	29-42
D - poor but manageable	0.85 to 0.90	43-56
E- at capacity	0.90 to 1.0	57-70
F - unsatisfactory, extra capacity required	Over 1.0	Over 70

Table 3 Criteria for Evaluating Capacity of Intersection

In the absence of historical growth figures, a conservative 3% traffic growth rate was applied to the 2024 traffic counts to determine a 10-year forecast.

To determine if the proposed movements would have an effect on the operations of the existing intersection a SIDRA analysis was carried out.

The analysis has been carried out for the following scenarios:

- Existing 2023,
- Existing 2023 with proposed development, and
- 10-year planning horizon with proposed development.

Traffic Modelling Assumption

- Analysis was carried out for the maximum hour flow as shown in table 3 only as tis is worst case scenario for traffic,
- Existing intersection geometry, including lane lengths and widths were measured
- SIDRA default values were adopted,
- Level of Services Method is set to RTA NSW,
- Speed environment 100km/hr
- Existing intersection count and growth rate includes the cumulative traffic impacts from nearby development both now and into the future.

Traffic Modelling Outputs

Full details of the outputs are found in **Appendix B**. however a summary of this analysis is provided below.

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	0.1	0.1	0.1
Level of Service	A	A	A

Table 4 Intersection Performance (AM) Abercrombie Rd East - Through

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	5.9	6.3	6.4
Level of Service	A	A	A

Table 5 Intersection Performance (AM) Abercrombie Rd East - Right

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	0.0	0.0	0.0
Level of Service	A	A	A

Table 6 Intersection Performance (AM) Abercrombie Rd west - Through

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	5.9	6.0	5.9
Level of Service	A	A	A

Table 7 Intersection Performance (AM) Abercrombie Rd west - left

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	6.0	6.3	6.2
Level of Service	A	A	A

Table 8 Intersection Performance (AM) Sewells Creek Rd Left

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	6.0	6.0	6.2
Level of Service	A	A	A

Table 9 Intersection Performance (AM) Sewells Creek Rd Right

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	0.2	0.2	0.2
Level of Service	A	A	A

Table 10 Intersection Performance (PM) Abercrombie Rd East - Through

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	6.1	6.4	6.3
Level of Service	A	A	A

Table 11 Intersection Performance (PM) Abercrombie Rd East - Right

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	0.0	0.0	0.0
Level of Service	A	A	A

Table 12 Intersection Performance (PM) Abercrombie Rd west - Through

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	5.6	5.7	5.6
Level of Service	A	A	A

Table 13 Intersection Performance (PM) Abercrombie Rd west - left

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	6.0	6.2	6.1
Level of Service	A	A	A

Table 14 Intersection Performance (PM) Sewells Creek Rd Left

Criteria	Base	Base with Development	10 Years with Development
Av. Delay (sec)	6.0	6.0	6.1
Level of Service	A	A	A

Table 15 Intersection Performance (PM) Sewells Creek Rd Right

The modelling outputs as shown in Table 4 through Table 15 illustrate that there is no deterioration of the Level of Service below A when development traffic is added to either of the 2024 or 2034 simulations of the intersection for all movements at the intersection.

Crash History

The most recent 5-year crash history (2026-2020) is shown in **Figure 7**.

There has been one crash at the Abercrombie Road / Sewells Creek Road intersection.

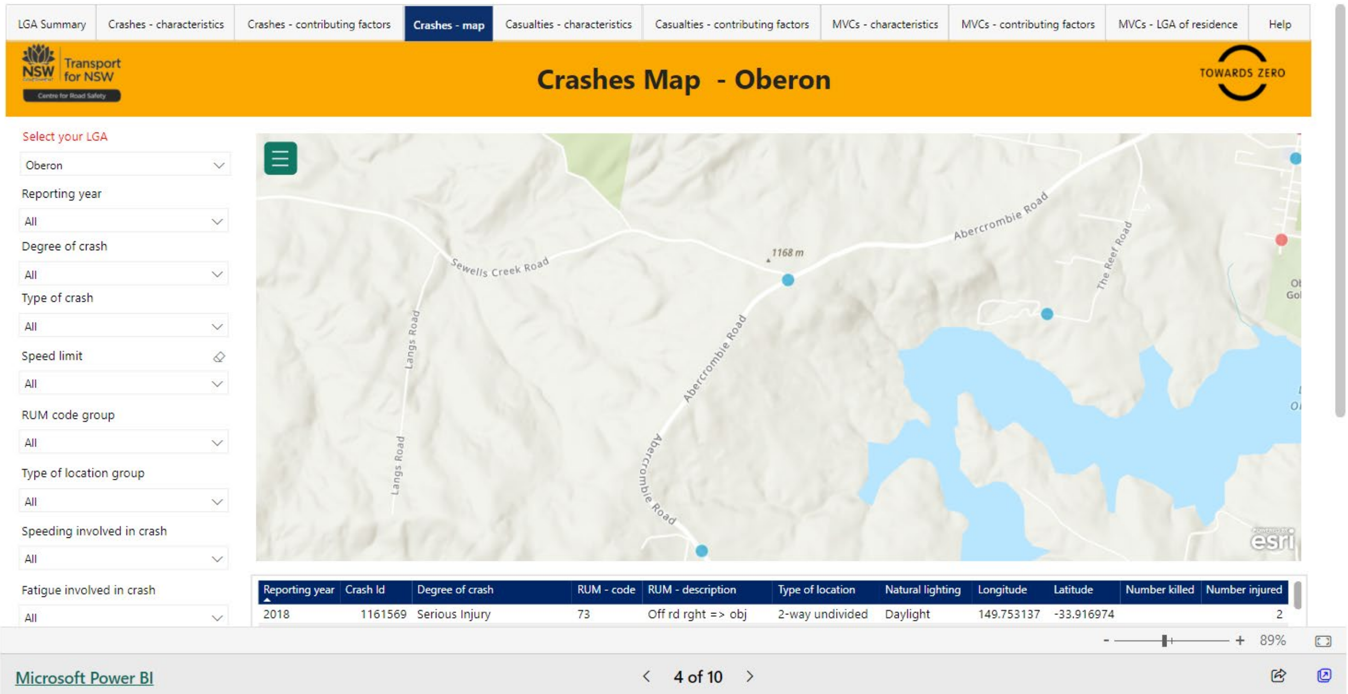


Figure 7 NSW Crash Data

This crash occurred in 2019 resulting in a moderate injury, where a vehicle turning right into Sewells Creek Road collided with a through vehicle.

There are no other recorded crashes in the vicinity of the Quarry, nor is there any crash cluster or road safety issued identified at this location.

Sight Distance

Austroads guidelines provide general parameter values, which they refer to as the Normal Design Domain (NDD).

This report discusses the existing intersection in terms of Normal Design Domain criteria only.

As illustrated in **Figure 8** (below) , Safe Intersection Sight Distance (SISD) is measured from a driver eye height of 1.1 m above the road to a point 1.25 m above the road, which represents the upper part of a car. It is measured along the carriageway from the approaching vehicle to a conflict point.

Austroads SISD allows the use of a 1.5 seconds' or 2.0 seconds observation time for T-intersections on single carriageway roads that have a traffic volume less than 4,000 vehicles per day with the minor road having a traffic volume of less than 400 vehicles per day.

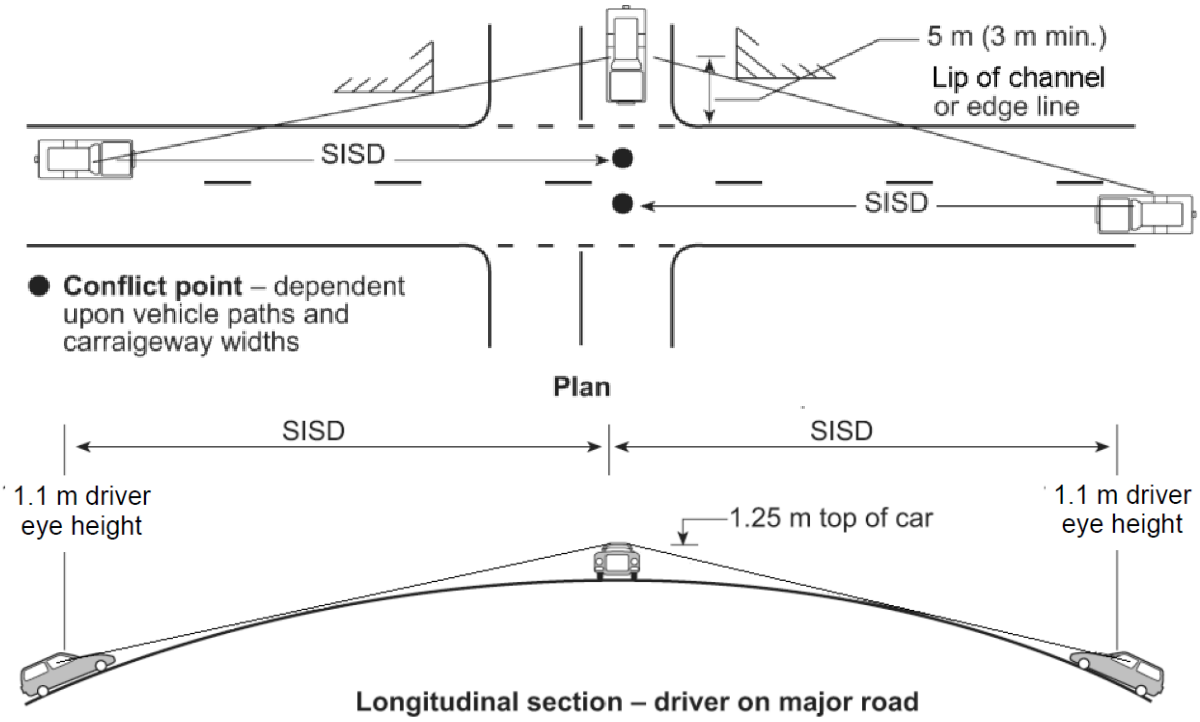


Figure 8 SISD diagrams from Austroads, Figure 3.2

Safe Intersection Sight Distance values are: Design speed (km/h)	Reaction time (seconds)	SISD (m)
sign posted speed 100km/hr Design speed 110kn/hr	1.5	n/a
sign posted speed 100km/hr Design speed 110kn/hr	2.0	285
sign posted speed 100km/hr Design speed 110kn/hr	2.5	300

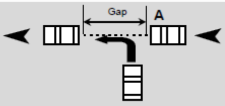
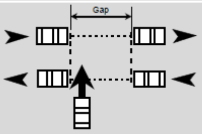
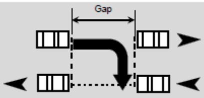
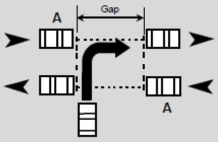
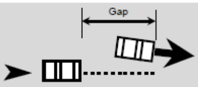
Table 3.2: Safe intersection sight distance (SISD) and corresponding minimum crest vertical curve size for sealed roads (S < L)

Design speed (km/h)	Based on safe intersection sight distance for cars[1] h_1 = 1.1; h_2 = 1.25, d = 0.36[2]; Observation time = 3 sec					
	R_T = 1.5 sec[3]		R_T = 2.0 sec		R_T = 2.5 sec	
	SISD (m)	*K*	SISD (m)	*K*	SISD (m)	*K*
40	67	4.9	73	6	–	–
50	90	8.6	97	10	–	–
60	114	14	123	16	–	–
70	141	22	151	25	–	–
80	170	31	181	35	–	–
90	201	43	214	49	226	55
100	234	59	248	66	262	74
110	–	–	285	87	300	97
120	–	–	324	112	341	124
130	–	–	365	143	383	157

1 If the average grade over the braking length is not zero, calculate the safe intersection sight distance (SISD) values

Gap Acceptance : Design speed (km/h)	Reaction time (seconds)	Min Gap acceptance distance (m)
sign posted speed 100 km/hr Design speed 110kn/hr	5	153

Table 3.5: Critical acceptance gaps and follow-up headways

Movement	Diagram	Description	t_a[1] (sec)	t_f[2] (sec)
Left turn		Not interfering with A Requiring A to slow	14–40 5	2–3 2–3
Crossing		Two lane/one way Three lane/one way Four lane/one way Two lane/two way Four lane/two way Six lane/two way	4 6 8 5 8 8	2 3 4 3 5 5
Right turn from major road		Across one lane Across two lanes Across three lanes	4 5 6	2 3 4
Right turn from minor road		Not interfering with A One way Two lane/two way Four lane/two way Six lane/two way	14–40 3 5 8 8	3 3 3 5 5
Merge		Acceleration lane	3	2

1 t_a = critical acceptance gap (sec).
2 t_f = follow-up headway (sec).

Table 3.6: Table of minimum gap sight distances ('*D*' metres) for various speeds

Critical gap acceptance time (t_a) (secs)	85th percentile speed of approaching vehicle (km/h)										
	10	20	30	40	50	60	70	80	90	100	110
4	11	22	33	44	55	67	78	89	100	111	122
5	14	28	42	55	69	83	97	111	125	139	153
6	17	33	50	67	83	100	117	133	150	167	183
7	19	39	58	78	97	117	136	155	175	194	214
8	22	44	67	89	111	133	155	178	200	222	244
9	25	50	75	100	125	150	175	200	225	250	275
10	28	56	83	111	139	167	194	222	250	278	305

Available sight distance was measure on site (using car odometer) as being greater than 350 m in either direction along Abercrombie Rd from the centre line of Sewells Street.

Adequate Safe Intersection Sight Distance (SISD) values is greater than 300m and as such meets the Austroads Guide to Road Design Part 3: Geometric Design for both reaction time of 2.0 and 2.5 seconds.

Minimum Gap Site Distance (MGSD) is 153 (based on Design speed and 5 sec gap acceptance) or 139m (based on sign posted speed and 5 sec critical gab acceptance) and as such meets the Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections

INTERSECTION REVIEW

From a technical perspective and in accordance with AUSTROADS Guidelines Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Movements intersection upgrades are warranted of

- if there are significant delays in vehicles waiting to turn or
- there is a sight line issue that prevents vehicles traveling at the nominated speed limit to stop prior to impacting a vehicle waiting to turn.
- There is an adverse accident history

It is noted that the application of turning warrants is based on the construction of new roads (i.e. for Greenfield sites). For existing roads, the warrants may be used as a reference however is not a strict application

The suitability of the proposed access driveway with respect to accommodating passenger vehicles and delivery is assessed based on guidelines provided within the Australian Standard for Off-Street Car parking (AS2890.1-2004) or if it is considered an intersection within AUSTROADS Guide to Traffic Management Part 6 Intersection Section 2 (including figure 2.25) which is provided in **Figure 9** (below). This figure provides guidance for when a standard T junction type intersection is appropriate and when traffic volumes would lead to the need to increase to a high order intersection such as a BAR (Basic Right Turn) or CHS (channelised intersection). Both types of intersection would require substantial pavement widening works to accommodate the upgrade at this location.

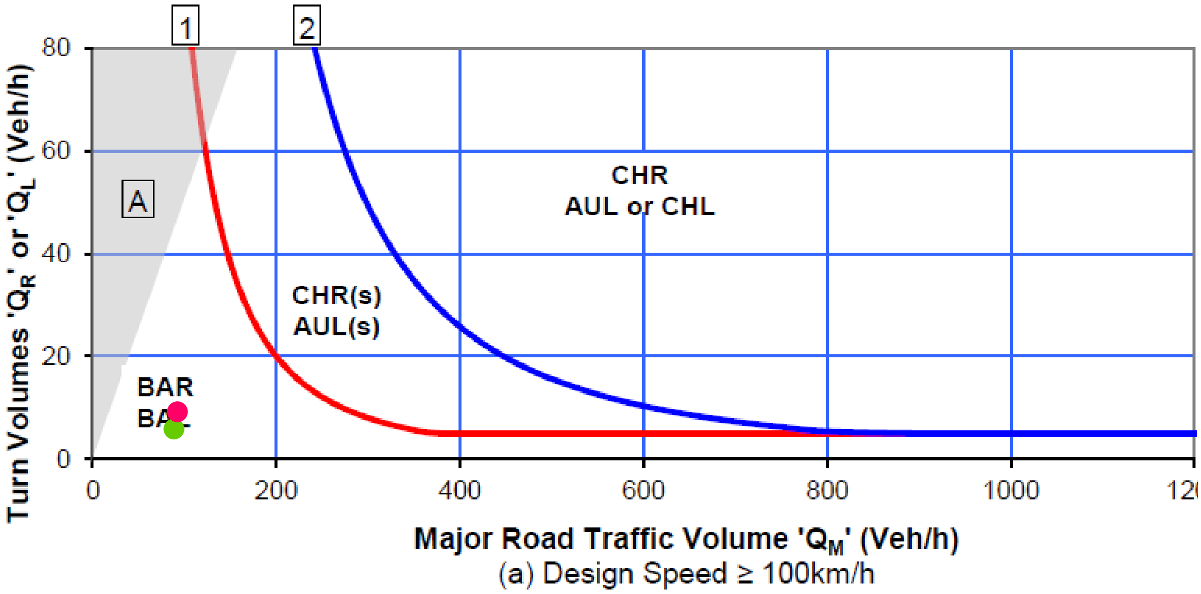


Figure 9 Austroads Figure 2.25: Warrants for turn treatments on major roads at unsignalised intersection

Information from the above-mentioned traffic survey and traffic generated from the proposed development indicates the relevant inputs to the Figure 6 (above) are:

AM

Q_m =101

Q_R =11

PM

Q_m = 104

Q_R =14)

Based on traffic volumes at the intersection d and the future allowed traffic generation from the subject development that this intersection does not require to be upgraded to a BAR/ BAL and a normal T Junction (without widening) is all that is necessary.

Summary

The traffic impacts from the combined development have been assessed and the key findings are as follows:

- The available sight distance is adequate for the speed environment;
- Current traffic count takes into account the existing developments within the area;
- The 3% growth rate takes into account any increase in development in the surrounding area;
- Total traffic generation remains low and does not impact the performance of the intersection both at present and in a 10-year planning horizon;
- Level of service remains level A for all modes tested; and
- The current instruction operates well within the requirements of a rural BAR and such does not need to be upgraded to a complying rural BAR type intersection Based on the findings of this report,

Pavey Consulting Services is of the opinion there are no traffic engineering related matters that should preclude approval of this Application.

APPENDIX A EXISTING TRAFFIC COUNT

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Abercrombie Rd and Sewells Creek Rd, C

GPS -33.714158, 149.811454

Date:	Wed 10/04/24	*North:*	Sewells Creek Rd	Survey Period	AM:	7:00 AM-12:00 PM
Weather:	Fine	*East:*	Abercrombie Rd		PM:	12:00 PM-5:00 PM
Suburban:	Oberon	*South:*	N/A	Traffic Peak	AM:	7:15 AM-8:15 AM
Customer:	N/A	*West:*	Abercrombie Rd		PM:	3:15 PM-4:15 PM

All Vehicles

Time		th Approach Sewells Creek			ast Approach Abercrombie			est Approach Abercrombie			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
7:00	7:15	0	0	2	0	2	8	0	4	0	121	
7:15	7:30	0	0	6	0	4	17	0	6	1	134	Peak
7:30	7:45	0	0	7	0	0	12	0	14	2	122	
7:45	8:00	0	1	5	0	4	13	0	12	1	125	
8:00	8:15	0	0	3	0	3	9	0	12	2	127	
8:15	8:30	0	0	3	0	2	6	0	10	1	126	
8:30	8:45	0	0	12	0	4	6	0	16	0	129	
8:45	9:00	0	0	1	1	8	17	0	11	0	123	
9:00	9:15	0	0	2	0	9	9	0	7	1	119	
9:15	9:30	0	0	2	0	6	8	0	9	0	128	
9:30	9:45	0	1	7	0	11	9	0	4	0	131	
9:45	10:00	0	2	4	1	5	7	0	14	1	122	
10:00	10:15	0	1	4	0	4	15	0	13	0	116	
10:15	10:30	0	3	2	0	6	4	0	12	1	105	
10:30	10:45	0	2	2	0	2	3	0	13	1	104	
10:45	11:00	0	0	2	0	4	13	0	9	0	98	
11:00	11:15	0	0	0	0	5	10	0	11	0	91	
11:15	11:30	0	0	4	0	2	12	0	9	0	82	
11:30	11:45	0	0	3	0	3	8	0	3	0	74	
11:45	12:00	0	0	3	0	1	7	0	9	1	75	
12:00	12:15	0	0	3	0	4	4	0	6	0	76	
12:15	12:30	0	0	3	0	4	4	0	7	1	74	
12:30	12:45	0	0	3	0	3	3	0	9	0	72	
12:45	13:00	0	0	2	0	2	9	0	8	1	74	
13:00	13:15	0	0	2	0	2	5	0	6	0	72	
13:15	13:30	0	0	4	0	2	4	0	7	0	87	
13:30	13:45	0	0	2	0	3	9	0	6	0	97	
13:45	14:00	0	0	7	0	1	8	0	3	1	102	
14:00	14:15	0	0	6	0	5	8	0	11	0	112	
14:15	14:30	0	0	8	0	2	8	0	9	0	105	
14:30	14:45	0	0	8	0	0	8	0	8	1	108	
14:45	15:00	0	0	7	0	0	7	0	16	0	130	
15:00	15:15	0	0	3	1	0	7	0	12	0	130	
15:15	15:30	0	0	1	0	1	4	0	23	1	141	Peak
15:30	15:45	0	0	13	0	3	12	0	17	2	138	
15:45	16:00	0	1	1	0	4	11	0	11	2	117	
16:00	16:15	0	0	7	0	6	8	0	13	0	117	
16:15	16:30	0	1	6	0	5	8	0	7	0		
16:30	16:45	0	1	5	0	3	11	0	6	0		
16:45	17:00	0	1	5	0	3	12	0	8	1		

Peak Time		th Approach Sewells Creek			ast Approach Abercrombie			est Approach Abercrombie			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
7:15	8:15	0	1	21	0	11	51	0	44	6	134
15:15	16:15	0	1	22	0	14	35	0	64	5	141

Light Vehicles

Time		rth Approach Sewells Creek			ast Approach Abercrombie			est Approach Abercrombie		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
7:00	7:15	0	0	2	0	1	7	0	4	0
7:15	7:30	0	0	4	0	2	10	0	6	1
7:30	7:45	0	0	5	0	0	7	0	12	2
7:45	8:00	0	1	5	0	4	10	0	11	0
8:00	8:15	0	0	3	0	3	9	0	11	1
8:15	8:30	0	0	2	0	2	5	0	9	1
8:30	8:45	0	0	9	0	3	3	0	12	0
8:45	9:00	0	0	1	1	7	10	0	11	0
9:00	9:15	0	0	1	0	8	9	0	5	1
9:15	9:30	0	0	2	0	5	6	0	7	0
9:30	9:45	0	1	5	0	9	9	0	2	0
9:45	10:00	0	2	2	1	4	6	0	11	0
10:00	10:15	0	1	4	0	3	13	0	10	0
10:15	10:30	0	3	0	0	6	4	0	10	1
10:30	10:45	0	1	2	0	2	3	0	12	1
10:45	11:00	0	0	2	0	3	8	0	6	0
11:00	11:15	0	0	0	0	3	8	0	8	0
11:15	11:30	0	0	4	0	2	11	0	9	0
11:30	11:45	0	0	2	0	2	5	0	3	0
11:45	12:00	0	0	2	0	0	7	0	9	1
12:00	12:15	0	0	2	0	3	4	0	3	0
12:15	12:30	0	0	2	0	3	4	0	5	1
12:30	12:45	0	0	3	0	2	3	0	9	0
12:45	13:00	0	0	2	0	2	6	0	7	1
13:00	13:15	0	0	1	0	2	4	0	5	0
13:15	13:30	0	0	4	0	2	3	0	6	0
13:30	13:45	0	0	2	0	1	8	0	5	0
13:45	14:00	0	0	4	0	1	8	0	2	1
14:00	14:15	0	0	5	0	4	8	0	8	0
14:15	14:30	0	0	6	0	2	8	0	7	0
14:30	14:45	0	0	8	0	0	8	0	8	1
14:45	15:00	0	0	7	0	0	6	0	13	0
15:00	15:15	0	0	3	1	0	7	0	11	0
15:15	15:30	0	0	1	0	1	4	0	18	1
15:30	15:45	0	0	13	0	2	8	0	15	2
15:45	16:00	0	1	1	0	2	11	0	8	2
16:00	16:15	0	0	6	0	5	7	0	9	0
16:15	16:30	0	1	3	0	4	8	0	5	0
16:30	16:45	0	1	5	0	3	10	0	6	0
16:45	17:00	0	1	5	0	3	11	0	5	1

Heavy Vehicles

Time		th Approach Sewells Creek			st Approach Abercrombie			est Approach Abercrombie		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
7:00	7:15	0	0	0	0	1	1	0	0	0
7:15	7:30	0	0	2	0	2	7	0	0	0
7:30	7:45	0	0	2	0	0	5	0	2	0
7:45	8:00	0	0	0	0	0	3	0	1	1
8:00	8:15	0	0	0	0	0	0	0	1	1
8:15	8:30	0	0	1	0	0	1	0	1	0
		0	**0**	**5**	**0**	**2**	**16**	**0**	**5**	**2**
8:30	8:45	0	0	3	0	1	3	0	4	0
8:45	9:00	0	0	0	0	1	7	0	0	0
9:00	9:15	0	0	1	0	1	0	0	2	0
9:15	9:30	0	0	0	0	1	2	0	2	0
9:30	9:45	0	0	2	0	2	0	0	2	0
9:45	10:00	0	0	2	0	1	1	0	3	1
10:00	10:15	0	0	0	0	1	2	0	3	0
10:15	10:30	0	0	2	0	0	0	0	2	0
10:30	10:45	0	1	0	0	0	0	0	1	0
10:45	11:00	0	0	0	0	1	5	0	3	0
11:00	11:15	0	0	0	0	2	2	0	3	0
11:15	11:30	0	0	0	0	0	1	0	0	0
11:30	11:45	0	0	1	0	1	3	0	0	0
11:45	12:00	0	0	1	0	1	0	0	0	0
12:00	12:15	0	0	1	0	1	0	0	3	0
12:15	12:30	0	0	1	0	1	0	0	2	0
12:30	12:45	0	0	0	0	1	0	0	0	0
12:45	13:00	0	0	0	0	0	3	0	1	0
13:00	13:15	0	0	1	0	0	1	0	1	0
13:15	13:30	0	0	0	0	0	1	0	1	0
13:30	13:45	0	0	0	0	2	1	0	1	0
13:45	14:00	0	0	3	0	0	0	0	1	0
14:00	14:15	0	0	1	0	1	0	0	3	0
14:15	14:30	0	0	2	0	0	0	0	2	0
14:30	14:45	0	0	0	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	1	0	3	0
15:00	15:15	0	0	0	0	0	0	0	1	0
15:15	15:30	0	0	0	0	0	0	0	5	0
15:30	15:45	0	0	0	0	1	4	0	2	0
15:45	16:00	0	0	0	0	2	0	0	3	0
16:00	16:15	0	0	1	0	1	1	0	4	0
16:15	16:30	0	0	3	0	1	0	0	2	0
		0	0	4	0	5	5	0	16	0
16:30	16:45	0	0	0	0	0	1	0	0	0
16:45	17:00	0	0	0	0	0	1	0	3	0

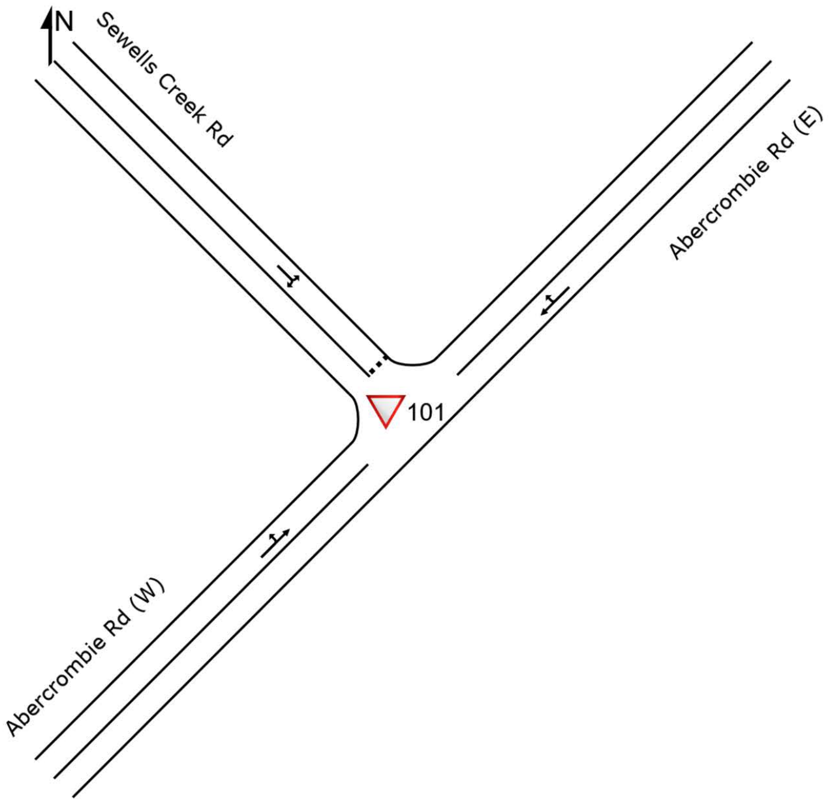
APPENDIX B SIDRA ANALYSIS

SITE LAYOUT

▽ Site: 101 [Abercrombie Rd & Sewells Creek Rd_BY2024_AM (Site Folder: General)]

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com
Organisation: METIS CONSULTANTS | Licence: NETWORK / 1PC | Created: Sunday, 12 May 2024 9:13:29 PM
Project: C:\OneMetis Dropbox\1030 Metis\MC24\MC2404 Abercrombie Rd & Sewells Creek Rd SIDRA Intersection Analysis\C3_Mods \MC2404_AbercrombieRd-SewellsCkRd.sip9

MOVEMENT SUMMARY

Site: 101 [Abercrombie Rd & Sewells Creek Rd_BY2024_AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
NorthEast: Abercrombie Rd (E)																
5	T1	All MCs	60	28.1	60	28.1	0.045	0.1	LOS A	0.1	0.7	0.08	0.13	0.08	58.6
6	R2	All MCs	14	15.4	14	15.4	0.045	5.9	LOS A	0.1	0.7	0.08	0.13	0.08	55.1
Approach			74	25.7	74	25.7	0.045	1.2	NA	0.1	0.7	0.08	0.13	0.08	57.9
NorthWest: Sewells Creek Rd																
7	L2	All MCs	25	20.8	25	20.8	0.019	6.0	LOS A	0.1	0.6	0.17	0.53	0.17	51.5
9	R2	All MCs	1	0.0	1	0.0	0.019	6.0	LOS A	0.1	0.6	0.17	0.53	0.17	52.1
Approach			26	20.0	26	20.0	0.019	6.0	LOS A	0.1	0.6	0.17	0.53	0.17	51.6
SouthWest: Abercrombie Rd (W)																
10	L2	All MCs	7	28.6	7	28.6	0.045	5.9	LOS A	0.0	0.0	0.00	0.06	0.00	55.6
11	T1	All MCs	68	24.6	68	24.6	0.045	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	59.5
Approach			76	25.0	76	25.0	0.045	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.1
All Vehicles			176	24.6	176	24.6	0.045	1.6	NA	0.1	0.7	0.06	0.16	0.06	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▽ Site: 101 [Abercrombie Rd & Sewells Creek Rd_BY2024_PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
NorthEast: Abercrombie Rd (E)															
5	T1	All MCs	45	11.6	45	11.6	0.040	0.2	LOS A	0.1	1.0	0.13	0.21	0.13	58.1
6	R2	All MCs	20	26.3	20	26.3	0.040	6.1	LOS A	0.1	1.0	0.13	0.21	0.13	54.1
Approach			65	16.1	65	16.1	0.040	2.0	NA	0.1	1.0	0.13	0.21	0.13	56.8
NorthWest: Sewells Creek Rd															
7	L2	All MCs	29	14.3	29	14.3	0.023	6.0	LOS A	0.1	0.7	0.18	0.54	0.18	51.8
9	R2	All MCs	2	0.0	2	0.0	0.023	6.0	LOS A	0.1	0.7	0.18	0.54	0.18	52.1
Approach			32	13.3	32	13.3	0.023	6.0	LOS A	0.1	0.7	0.18	0.54	0.18	51.8
SouthWest: Abercrombie Rd (W)															
10	L2	All MCs	5	0.0	5	0.0	0.047	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	57.1
11	T1	All MCs	75	22.5	75	22.5	0.047	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach			80	21.1	80	21.1	0.047	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.4
All Vehicles			177	17.9	177	17.9	0.047	2.0	NA	0.1	1.0	0.08	0.19	0.08	56.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Organisation: METIS CONSULTANTS | Licence: NETWORK / 1PC | Processed: Sunday, 12 May 2024 9:11:59 PM
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MOVEMENT SUMMARY

Site: 101 [Abercrombie Rd & Sewells Creek Rd_BY2024 +Dev_AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
NorthEast: Abercrombie Rd (E)																
5	T1	All MCs	60	28.1	60	28.1	0.053	0.1	LOS A	0.1	1.3	0.11	0.18	0.11	58.4
6	R2	All MCs	20	42.1	20	42.1	0.053	6.3	LOS A	0.1	1.3	0.11	0.18	0.11	53.7
Approach			80	31.6	80	31.6	0.053	1.7	NA	0.1	1.3	0.11	0.18	0.11	57.2
NorthWest: Sewells Creek Rd																
7	L2	All MCs	33	38.7	33	38.7	0.027	6.3	LOS A	0.1	1.0	0.18	0.53	0.18	50.8
9	R2	All MCs	1	0.0	1	0.0	0.027	6.0	LOS A	0.1	1.0	0.18	0.53	0.18	52.1
Approach			34	37.5	34	37.5	0.027	6.3	LOS A	0.1	1.0	0.18	0.53	0.18	50.8
SouthWest: Abercrombie Rd (W)																
10	L2	All MCs	8	37.5	8	37.5	0.046	6.0	LOS A	0.0	0.0	0.00	0.06	0.00	55.2
11	T1	All MCs	68	24.6	68	24.6	0.046	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	59.5
Approach			77	26.0	77	26.0	0.046	0.7	NA	0.0	0.0	0.00	0.06	0.00	59.0
All Vehicles			191	30.4	191	30.4	0.053	2.1	NA	0.1	1.3	0.08	0.20	0.08	56.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▽ Site: 101 [Abercrombie Rd & Sewells Creek Rd_BY2024 +Dev_PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Abercrombie Rd (E)															
5	T1	All MCs	45	11.6	45	11.6	0.047	0.2	LOS A	0.2	1.5	0.16	0.25	0.16	57.9
6	R2	All MCs	26	44.0	26	44.0	0.047	6.4	LOS A	0.2	1.5	0.16	0.25	0.16	53.2
Approach			72	23.5	72	23.5	0.047	2.5	NA	0.2	1.5	0.16	0.25	0.16	56.1
NorthWest: Sewells Creek Rd															
7	L2	All MCs	37	31.4	37	31.4	0.030	6.2	LOS A	0.1	1.0	0.18	0.54	0.18	51.1
9	R2	All MCs	2	0.0	2	0.0	0.030	6.0	LOS A	0.1	1.0	0.18	0.54	0.18	52.1
Approach			39	29.7	39	29.7	0.030	6.2	LOS A	0.1	1.0	0.18	0.54	0.18	51.1
SouthWest: Abercrombie Rd (W)															
10	L2	All MCs	6	16.7	6	16.7	0.048	5.7	LOS A	0.0	0.0	0.00	0.05	0.00	56.3
11	T1	All MCs	75	22.5	75	22.5	0.048	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	59.5
Approach			81	22.1	81	22.1	0.048	0.5	NA	0.0	0.0	0.00	0.05	0.00	59.3
All Vehicles			192	24.2	192	24.2	0.048	2.4	NA	0.2	1.5	0.10	0.22	0.10	56.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Abercrombie Rd & Sewells Creek Rd_FY2034 +Dev_AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
NorthEast: Abercrombie Rd (E)															
5	T1	All MCs	78	28.4	78	28.4	0.059	0.1	LOS A	0.1	1.0	0.09	0.14	0.09	58.5
6	R2	All MCs	18	17.6	18	17.6	0.059	6.1	LOS A	0.1	1.0	0.09	0.14	0.09	54.9
Approach			96	26.4	96	26.4	0.059	1.2	NA	0.1	1.0	0.09	0.14	0.09	57.8
NorthWest: Sewells Creek Rd															
7	L2	All MCs	34	21.9	34	21.9	0.026	6.2	LOS A	0.1	0.8	0.20	0.54	0.20	51.4
9	R2	All MCs	1	0.0	1	0.0	0.026	6.2	LOS A	0.1	0.8	0.20	0.54	0.20	52.0
Approach			35	21.2	35	21.2	0.026	6.2	LOS A	0.1	0.8	0.20	0.54	0.20	51.4
SouthWest: Abercrombie Rd (W)															
10	L2	All MCs	11	30.0	11	30.0	0.060	5.9	LOS A	0.0	0.0	0.00	0.06	0.00	55.5
11	T1	All MCs	89	24.7	89	24.7	0.060	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	59.4
Approach			100	25.3	100	25.3	0.060	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.0
All Vehicles			231	25.1	231	25.1	0.060	1.7	NA	0.1	1.0	0.07	0.17	0.07	57.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▽ Site: 101 [Abercrombie Rd & Sewells Creek Rd_FY2034 +Dev_PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Abercrombie Rd & Sewells Creek Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
NorthEast: Abercrombie Rd (E)															
5	T1	All MCs	59	12.5	59	12.5	0.053	0.2	LOS A	0.2	1.4	0.16	0.23	0.16	58.0
6	R2	All MCs	26	28.0	26	28.0	0.053	6.3	LOS A	0.2	1.4	0.16	0.23	0.16	54.0
Approach			85	17.3	85	17.3	0.053	2.1	NA	0.2	1.4	0.16	0.23	0.16	56.7
NorthWest: Sewells Creek Rd															
7	L2	All MCs	38	13.9	38	13.9	0.030	6.1	LOS A	0.1	0.9	0.21	0.54	0.21	51.7
9	R2	All MCs	3	0.0	3	0.0	0.030	6.1	LOS A	0.1	0.9	0.21	0.54	0.21	52.0
Approach			41	12.8	41	12.8	0.030	6.1	LOS A	0.1	0.9	0.21	0.54	0.21	51.7
SouthWest: Abercrombie Rd (W)															
10	L2	All MCs	7	0.0	7	0.0	0.062	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	57.0
11	T1	All MCs	98	22.6	98	22.6	0.062	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach			105	21.0	105	21.0	0.062	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.3
All Vehicles			232	18.2	232	18.2	0.062	2.0	NA	0.2	1.4	0.09	0.20	0.09	56.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Organisation: METIS CONSULTANTS | Licence: NETWORK / 1PC | Processed: Tuesday, 14 May 2024 1:21:40 PM
Project: C:\OneMetis Dropbox\1030 Metis\MC24\MC2404 Abercrombie Rd & Sewells Creek Rd SIDRA Intersection Analysis\C3_Mods \MC2404_AbercrombieRd-SewellsCkRd.sip9

APPENDIX 3

Annual Return

A. Statement of Compliance - Licence Details

ALL Licence holders must check that the Licence details in Section A are correct.

If there are changes to any of these details, **you must advise Environment Protection Authority (EPA) and apply as soon as possible for a variation to your Licence or for a Licence transfer.**

Licence variation and transfer application forms are available on the EPA website at: http://www.epa.nsw.gov.au/licensing-and-regulation/licensing or from regional offices of the EPA, or by contacting by telephone 02 9995 5700.

If you are applying to vary or transfer your Licence, you must still complete and submit this Annual Return.

A1. Licence holder

Licence number	: 21098
Licence holder	: OBERON EARTHMOVING PTY LTD
Trading name *(if applicable)*	:
ABN	: 74 165 651 141
ACN	: 165 651 141
Reporting period	: From: 4-2-2023 To: 3-2-2024

A2. Premises to which Licence Applies (if applicable)

Common name (if any)	: Middle Creek Quarries
Premises	: 50 Sewells Creek Road OBERON 2787 NSW

A3. Activities to which Licence Applies

Composting

Extractive activities

Resource recovery

Waste storage

A4. Other Activities (if applicable)

A5. Fee-Based Activity Classifications

Note that the fee based activity classification is used to calculate the administrative fee.

Fee-based activity	Activity scale	Unit of measure
Composting	> 5,000.00 - 50,000.00	T annual capacity to receive organics
Waste storage - other types of waste	> 0.00	other types of waste stored
Recovery of general waste	> 0.00	general waste recovered
Extractive activities	> 100,000.00 - 500,000.00	T annually extracted or processed

A6. Assessable Pollutants (if applicable)

Note that the identification of assessable pollutants is used to calculate the **load-based fee.**
The following assessable pollutants are identified for the fee-based activity classifications in the licence:

B. Monitoring and Complaints Summary

B1. Number of Pollution Complaints

Pollution Complaint Category	Complaints
Air	0
Water	0
Noise	0
Waste	0
Other	0
Total complaints recorded by the licensee during the reporting period	**0**

B2. Concentration Monitoring Summary

For each concentration monitoring point identified in your licence, details are displayed below. If concentration monitoring is not required by your licence, **no data** will appear below.
If data was provided from an uploaded file, the file name will be displayed below instead of any data.
Note that this does not exclude the need to conduct appropriate concentration monitoring of assessable pollutants as required by load-based licensing (if applicable).

Discharge & Monitoring Point 1

Discharge to waters
Discharge quality monitoring, Sediment basin SB-1 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	0	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

Discharge & Monitoring Point 2

Discharge to waters
Discharge quality monitoring, Sediment basin SB-2 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	0	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

Discharge & Monitoring Point 3

Discharge to waters
Discharge quality monitoring, Sediment basin SB-3 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	0	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

Discharge & Monitoring Point 4

Discharge to waters
Discharge quality monitoring, Sediment basin SB-4 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	0	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

Discharge & Monitoring Point 5

Discharge to waters
Discharge quality monitoring, Sediment basin SB-5 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	0	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

Discharge & Monitoring Point 6

Discharge to waters
Discharge quality monitoring, Sediment basin SB-6 on Figure 4.6 (Surface Water Management) in the document "Environmental Impact Statement (as amended) - Continued Operation, Extension and Commencement of Composting & Waste Management Works at Middle Creek Quarries" (DOC17/588707-02)

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
BOD	milligrams per litre	0	0	0	0	0
Nitrogen (ammonia)	milligrams per litre	0	0	0	00	0
Oil and Grease	milligrams per litre	0	0	0	0	0
pH	pH	0	0	0	0	0
Total organic carbon	milligrams per litre	0	0	0	0	0
Total suspended particles	milligrams per litre	0	0	0	0	0

B3. Volume or Mass Monitoring Summary

For each volume or mass monitoring point identified in your licence, details are displayed below. If volume or mass monitoring is not required by your licence, **no data** will appear below.
If data was provided from an uploaded file, the file name will be displayed below instead of any data.
Note that this does not exclude the need to conduct appropriate volume or mass monitoring of assessable pollutants are required by load-based licensing (if applicable).

C. Statement of Compliance - Licence Conditions

C1. Compliance with Licence Conditions

Were all conditions of the licence complied with (including monitoring and reporting requirements)?	**Yes**

D. Statement of Compliance - Load Based Fee Calculation

If you are not required to monitor assessable pollutants by your licence, **no data** will appear below.

If assessable pollutants have been identified on your licence, the following worksheets for each assessable pollutant will determine your load based fee for the licence fee period to which this Annual Return relates.

Loads of assessable pollutants must be calculated using any of the methods provided in EPA's Load Calculation Protocol for the relevant activity. A Load Calculation Protocol would have been already sent to you with your licence. If you require additional copies, you can download the Protocol from the EPA's website or you can contact us on telephone 02 9995 5700.

You are required to keep all records used to calculate licence fees for four years after the licence fee was paid or became payable, whichever is the later date.

E. Statement of Compliance - Requirement to Prepare PIRMP

Have you prepared a Pollution Incident Response Management Plan (PIRMP) as required under section 153A of the Protection of the Environment Operations (POEO) Act 1997?		**Yes**
Is the PIRMP available at the premises?		**Yes**
Is the PIRMP available in a prominent position on a publicly accessible website?		**Yes**
Address of the web page where the PIRMP can be accessed ▼		
https://www.oberonearthmoving.com.au/middle-creek-quarry		
Has the PIRMP been tested?		**Yes**
The PIRMP was last tested on	**25-9-2023**	
Has the PIRMP been updated?		**No**

Number of times the PIRMP was activated in this reporting period?	0
The PIRMP was activated on	

F. Statement of Compliance - Requirement to Publish Pollution Monitoring Data

Are there any conditions attached to your licence that require pollution monitoring to be undertaken as required under section 66(6) of the Protection of the Environment Operations (POEO) Act 1997?	**Yes**
Do you operate a website?	**Yes**
Is the pollution monitoring data published on your website in accordance with the EPA's written requirements for publishing pollution monitoring data?	**Yes**
Address of the web page where the pollution monitoring data can be accessed ▼	
https://www.oberonearthmoving.com.au/middle-creek-quarry	

G. Statement of Compliance - Environment Management System and Practices

Do you have an ISO 14001 certified Environmental Management System (EMS) OR any other system that EPA considers is equivalent to the accountability, procedures, documentation and record keeping requirements of an ISO 14001 certified EMS?	**No**
Have you conducted an assessment of your activities and operations to identify the aspects that have a potential to cause environmental impacts and implemented operational controls to address these aspects?	**Yes**
Have you established and implemented an operational maintenance program, including preventative maintenance?	**Yes**
Do you keep records of regular inspections and maintenance of plant and equipment?	**Yes**
Do you conduct regular (at least yearly) environmental audits at the premises that are conducted by a competent and independent person?	**Yes**
Have you undertaken an independent environmental audit covering documented environmental practices, procedures and systems in place during the annual return period?	**Yes**
Have you established and implemented an environmental improvement or management plan?	**Yes**
Do you train staff in environmental issues that may arise from your activities and operations at the premises and keep records of this?	**Yes**

H. Signature and Certification

This Annual Return may only be signed by person(s) with legal authority to sign it as set out in following categories: an Individual, a Company, a Public authority or a Local council.

It is an offence under section 66 of the Protection of the Environment Operations Act 1997 to supply any information in this form that is false or misleading in a material respect, or to certify a statement that is false or misleading in a material respect. There is a maximum penalty of $250,000 for a corporation and $120,000 for an individual.

I/We
- declare that the information in the Monitoring and Complaints Summary in Section B of this Annual Return application is correct and not false or misleading in a material respect, and
- certify that the information in the Statement and Compliance in sections A, C, D, E, F, G and H and any other pages attached to Section C is correct and not false or misleading in a material respect.

Signed by: Director

Name	Zac Rowlandson
Position	Director
Email Address	zac@oberonearthmoving.com.au
Phone Number	0411729732

Signature	
Name	
Position	
Date	/ /

Declaration

I declare that the information in the Monitoring and Complaints Summary in section B of this Annual Return is correct and not false or misleading in a material respect, and

I certify that the information in the Statement of Compliance in section A,C,D,E,F and G and any pages attached to Section C is correct and not false or misleading in a material respect.

APPENDIX 4

Community Submissions

Community Submission Number One

RECEIVED
2 7 OCT 2023
BY: ....

[redacted]

The General Manager
Oberon Shire Council
Oberon Street
OBERON NSW 2787

Dear Sir.

Re: Amendment To DA 10.2016.38.1

We would like to lodge an objection to the proposed alteration on the following grounds :-

- The harmful effects of increased dust emanating from the site. There is currently a large amount of dust coming from the site. This has increased over the time the quarry has been in operation and will undoubtedly increase as the quarry expands. Efforts to reduce the amount of dust being generated (if any) have clearly failed. Silicosis caused by inhalation of dust is increasingly being recognised as a major health risk especially among younger members of the population, of which there are increasing numbers in the Bracken Estate and immediate surrounds.
- The effects of increased noise pollution on the amenity of the surrounding areas.
- Damage and associated repair costs of increased truck movements on roads clearly not constructed to cope with the weight and volume of traffic to which they are currently being subjected and which would be exacerbated by the approval of this proposal.
- The amenity of a semi-rural setting is continually being eroded by the impact of the existing quarry. This variation and any further variations can only have a greater impact.

Thank you for the opportunity to comment on this proposal

Yours faithfully

[redacted]

[redacted]

Community Submission Number Two

[redacted]

From: [redacted]
Sent: Thursday, 26 October 2023 7:49 PM
To: Council
Subject: DA 10.2016.38.2 Extractive Industry submission
Attachments: Modification DA 10.2016.38.1 Extractive Industry Submission.docx

Good evening

Please see attached submission regarding current application to modify development approval - 50 Sewells Creek Rd, OBERON.

Be advised that I provide this submission in a strictly personal capacity and it has is no way been influenced by my position within, or knowledge relating to, Oberon Council.

It should also be noted that the owner / Director of Oberon Earthmoving is also the CEO of Bettergrow Oberon, a composting and Fertiliser Company that is also a subsidiary of Borg Manufacturing. This must raise the question if there a connection between the Middle Creek Quarry D.A modification application and the current expansion of the Bettergrow plant, and if the intentions for the Middle Creek Quarry site are transparent?

Regards,

[redacted]

Community Submission Number Three

Oberon Council
Attention Gary Wallace

RE: Modification DA 10.2016.38.1 – Extractive Industry Submission

As landowners located within close proximity to the Middle Creek Quarries site, we hold a number of concerns in relation to this modification application.

The Modification seeks to:

- Increase extraction rate by 33% Ref. SEE 3.1
- Increase import of green waste by 80%
- Increase import of concrete waste for crushing
- Increase production rate by 26%
- Increase truck movements from 100 to 180 daily Mon-Fri and from 60- 90 Saturday
- Decrease import of drilling mud by 75%
- Add a washing circuit to the production site
- Construction of a new pad to relocate composting operations and stockpiling site

The initial development application (DA 10.2016.38.1) was for consideration of the operation of an extractive industry focusing on gravel extraction, with the ability to receive and store small amounts of bio-waste. There seems to be an indication within the current application that there will be a significant change in the operations of the facility, focusing more on waste storage and potential composting. These changes indicate an adjustment in the site use and thus change in associated impacts. I question how this application can be considered as a modification application, when such significant changes are being proposed?
It is also of concern that the majority of reports and supporting documentation supplied by Middle Creek Quarries were created prior to 2016. There have been extensive changes in the surrounding land use and environment over the last 6 years and it is difficult to believe these reports would still hold relevance and accurately reflect the current impacts, given the amount of change that has occurred.

Increase extraction rate by 33% & Increase import of concrete waste for crushing

- Crystalline Silica is a dust produced during the concrete crushing and extraction processes. These Silica particles become airborne and are very easily transported via wind, for which Oberon is renowned. Silica has been identified as an extremely hazardous substance and when these dust particles are inhaled, pose a severe health risk. The Modification SEE states that water spray is the preferred control measure, however, this only has an efficiency rating of 70%. Due to the Bracken Glen Estate subdivision, there have been 15 new dwellings (primarily inhabited by young families) built within a 3.5km proximity to the site, with a 13 lot section recently finalised, which adds 13 potential new homes within a short distance from the Quarry.
- Those living in close proximity to the Quarry risk long term exposure issues and whilst there are proposed plans in place to contain the dust, it is highly likely (given the 70% efficacy figure quoted) that there will still be, at a minimum, around 30% of dust released into the surrounding atmosphere. Are there requirements in place for receptors within close residential areas to monitor the ongoing pollution concerns of residents?

Increase in Truck Movements

- An increase in truck movements each weekday from 100-180 is of concern. The traffic data used was compiled in 2015 and relies on historical figures and predictions. A more current report on traffic volumes should be required prior to any consideration.

Noise Impact

- It is noted in the Noise Impact Assessment that there were no receivers placed within the Bracken Glen Estate vicinity. This estate has the highest density of housing within the closest proximity to the Quarry. The current operations undertaken at the Quarry site are audible from Bracken Glen Estate. The proposed increase in operations will unquestionably increase the noise impact on surrounding landholders, including those located within Bracken Glen Estate.

Composting and Fertiliser Production

- It is stated in the Community Information Sheet that the future intent is to import green waste including food, organic and garden waste, biosolids and manure for composting and sale. The proposed relocation and development of an area to establish a composting space and windrows which will allow for the importing and anaerobic processing of organic green waste, drilling mud and other materials also raises concerns, in particular, the lack of reporting on practices to be employed to control associated odours and pollution.

We respectfully request our concerns be addressed by Oberon Council and forwarded to the WRPP for consideration.

Kind Regards

[redacted]

Community Submission Number Four

[redacted]

From: [redacted]
Sent: Friday, 27 October 2023 2:40 PM
To: Council
Subject: DA 10.2016.38.2 Extractive Industry Submission

You don't often get email from rjbilyana@gmail.com. Learn why this is important

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

We wish to lodge our objection to the above submission.

The fear of contamination to the district, both known and unknown is paramount.

Recent dust emissions from the existing Quarry suggest non-compliance or mis-management of mitigation responsibilities, or both.

If granted, it will seriously affect our health, lifestyle,
property sales and our general welfare and liveability in the Oberon township and area.
The addition of many heavy vehicles on inadequate roads will also impact our lifestyle and safety.

Signed,

[redacted]

[redacted]

Virus-free.www.avg.com

Community Submission Number Five

[redacted]

Thursday 26th October, 2023

To The General Manager - Oberon Council,

<u>OBJECTION</u> TO APPLICATION NO: 10.2016.38.2 - Extractive Industry Submission

As long term local residents who also work in the Local Oberon Council area, we would like to notify Oberon Council of our **<u>Objection</u>** to the above application by Oberon Earthmoving Pty Ltd to Modify an Existing Development Application at 50 Sewells Creek Road, Oberon (Middle Creek Quarry).
This being due to the following concerns:

<u>Traffic Impact</u>

The Impact from the proposed increased number of *Heavy Vehicle Movements* would be significant to our home and neighbors. The proposed amounts of 180 truck movements on Weekdays/90 on Saturdays will have a large impact on existing traffic travelling around the area and the noise that they will produce may not be within acceptable residential levels to the homes within the area. The proposed route for travel is already coping with large amounts of numerous heavy vehicles from different industries. These being involved with timber production, earthmoving and livestock. Before any approval is considered we propose a more accurate and recent investigation be carried out into traffic movements in this area as the information provided in the Supplementary Traffic Assessment (Listed as 1.3 Reference Documents) is outdated and was performed in 2017. Some resource material within this document also dates back to 2005 (Table 4.11 – Traffic Impact Assessment). In the time passed there has been noticeably increased traffic due to town/industry expansion and predictions may be different to reports.
It would also be of benefit for more detailed research to be carried out on areas such as:

- If Heavy Vehicles are travelling from other areas where are they able to wait for admission into the Quarry if they arrive before business hours? We live off

Abercrombie Road and have noted Quarry trucks waiting in groups out the front of our residence, clearly waiting for entry to Middle Creek Quarry. This is noisy and disruptive, especially in early morning hours.

- What extra precautions would be taken to make sure loads of hazardous material are being secured to prevent 'fall off' onto the roads and surrounding environment of travel. Just covering a load will not prevent fine dust and debris from escaping the load. Some of the proposed materials for transportation are hazardous in nature to humans, animals and the environment.

Air Quality

The continued operations and increased volumes of production of materials at Middle Creek Quarry will produce increased levels of Silica dust. This dust is toxic to humans and will be carried around the area by wind. The Cancer Council of Australia have further information regarding Silica Dust and the effects on human health on their website and it suggests there are no safe levels of exposure to humans at all. It could be argued that if any receptors have detected any levels of Silica in the air that the Quarry should not be operating at all. Those living in close proximity to the Quarry risk long term exposure issues due on their health and wellbeing. Whilst there are proposed plans in place to contain the dust there is likely to be still stray particles. Since Middle Creek Quarry was established there has been a new Large Lot Residential Estate (Bracken Estate) established within close proximity to this area. Some of these lots are within 2.5kms (Distanced sourced on SIX Maps) from the proposed expansion site. There have been a number of new homes built in this estate and they have the potential to be directly impacted by Middle Creek Quarry's operations. As we live in close proximity to Bracken Estate, in our opinion, it would be of benefit to have permanent receptors within this area to monitor the ongoing pollution concerns for the many residents.

We would like to further note the proximity of Middle Creek Quarry to Oberon Township and surrounding homes. We consider this not a suitable placement for such an expansion of this size and business type being surrounded by residential homes and rural grazing property.

Approval of this application would also set the precedent for even larger future expansion of the operation with which in our opinion would negatively impact the whole Oberon Local Government Area. (See 3.8 Alternatives Considered – Umwelt report)

Yours Sincerely,

[redacted]

Community Submission Number Six

Attention Oberon Council

Extractive Industry Submission

Modification DA 10.2016.38.1 Middle C reek Quarries

The above DA was approved by the Western Regional Planning Panel (WRPP) in 2018 and allows for the extraction of 150,000 TPA of gravel, the importation of 25,000 TPA of green waste (mulch), 75000 TPA VENM/ENM and up to 60,000 TPA of drilling mud for the production of compost.

I note the revamped community information pamphlet on Public Exhibition on Oberon Council Website states “that no mulch or clean fill has been imported to the quarry to date”. Is this a correct statement?

I note that all reports and documents supporting the Modification Application were sourced in 2015/16 or earlier. Much has changed since then.

The Modification seeks to

- Increase extraction rate by 33% Ref. SEE 3.1
- Increase import of green waste by 80%
- Increase import of concrete waste for crushing
- Increase production rate by 26%
- Increase truck movements from 100 to 180 daily Mon-Fri and from 60- 90 Saturday
- Decrease import of drilling mud by 75%
- Add a washing circuit to the production site
- Construction of a new pad to relocate composting operations and stockpiling site

I would like the following considered by Oberon Council and the WRPP

It is my view that the development is not substantially the same as that approved under development consent DA 10.2016.38.1 which was approved by the WRPP on 21 March 2018. Initially the proposal was for the operation of an extractive industry with the potential to receive small amounts of waste. The development has now changed with an emphasis more on composting and resource recovery, with the applicant considering the future potential of composting waste. The reasoning behind this statement is that the impacts associated with the importation of new sources of waste accepted for composting (extended to include green waste from additional sources such as commercial and horticultural landscaping projects) by 80% changes the overall use and associated impacts of the site. There is no justification, other than a letter from a junior Council staff member stating the application "may" be substantially the same. The applicant should justify why this application should be considered a modification in this instance.

Composting and Fertiliser Production

- The modification application includes the proposed relocation and development of an area to establish a composting space and windrows which will allow for the importing and anaerobic processing of organic green waste, drilling mud and other materials. It is stated in both the Community Information Sheet and the SEE currently on public exhibition (Ref:

- Agency Consultation and Responses) , that it is the future intent of the applicant to import highly odorous organic food waste, bio solids and manure for incorporation into the process. The relocation and establishment of a new composting area under this modification would open the way for a future DA or modification to allow this. It has been identified in the SEE document (Sect3.8) that the addition of organic food wastes etc. to the composting process would require additional buildings and infrastructure to deal with potential odour, air and water pollution etc. So, although we have no definite plan on the table for the further development of the quarry, if this modification application is approved future expansion plans appear clear when reading the lodged documents. This would be a huge concern for the Oberon Community.

Visual Amenity

- An assessment of visual impact has not been included in the modification application – this report would enable a fair assessment of impacts upon visual amenity (views both too and from the development). This should be considered.

Noise Impact

- The application will undoubtabley have increased noise impact on adjoining land use, however the assessment does not appropriately consider these impacts on the adjacent residential land use. The noise report, for example, does not consider the newly constructed subdivision (Bracken Glen Estate) along Abercrombie Road as potential sensitive receivers.

Increase extraction rate by 33%/Increase import of concrete for crushing

- Dust containing Crystalline Silica is produced as a result of crushing and extraction processes. Silica particles are produced as a result of this process, are airborne and therefore subject to wind impact. Oberon is renowned for its windy atmosphere. Silica has been identified as dangerous to human health. The Modification SEE (Jacobs Report) relies on data obtained from Buttai Gravel NSW to for its emission control measures. I note that Page 51 Table 5.4 states water spray is a preferred control measure I also note this has a 70% efficiency rating. Due to major subdivision, there are an ever increasing number of dwellings within the proximity of the quarry. 70% efficiency is too low and should be reassessed specific to the quarry site and not rely on historical data from elsewhere. Human Health impact is very important.

Increase in Truck Movements

- An increase of 80% in truck movements per weekday from 100-180 is of concern. The traffic data used was compiled in 2015 or earlier and relies on historical data and predictions. There has been substantial Industrial development in Oberon since 2015 especially around the Timber Industry impacting Abercrombie Road in particular. Residential Estates have also been developed. Mayfield Garden on Mayfield Rd can be accessed via Sewells Creek Road , this world renowned garden is generating more tourism traffic each year. Tourism is an important part of Oberon's growth. A more current report on traffic volumes should be considered. Middle Creek Quarry supplies gravel to both Forestry and Oberon Council, the delivery of which impacts many local roads. The extent of the current impact and the impact in the future, should this modification be approved, is not clear in the SEE.

Note - We understand that the owner of Oberon Earthmoving is also the CEO of Bettergrow Oberon, a composting and Fertiliser Company which is a subsidiary of Borg Manufacturing. The DA for the Bettergrow development was approved by the WRPP on December 20 2019 (10.2019.43.1) with a modification approved on August 31 2022 (10.2021.49.1) is there a connection between the Middle Creek Quarry modification application and the expansion of the Bettergrow plant currently under construction?

Note – from the diagrams included in the SEE there appears that work has been undertaken (road sealing) within an area mapped as having High Biodiversity Value. Any works undertaken within an area so mapped should trigger a Biodiversity Development Assessment Report (BDAR). Whilst a Biodiversity Report has been provided, it has not addressed this particular issue.

I respectfully request my concerns be addressed by Oberon Council and forwarded to the WRPP for consideration

[redacted]

Community Submission Number Seven

[redacted]

27 October 2023

Oberon Council
PO Box 84
OBERON NSW 2787

Submission - Extractive Industry Modification DA 10.2016.38.1 Middle Creek Quarries

I write in relation to the Modification Application lodged by Middle Creek Quarries which seeks to increase the extraction rate of the current operation by 33%, increase the import of green waste by 80%, increase the import of concrete waste for crushing and increase the production rate by 26%. As a result of the increased production requested by the modification the application also states that traffic movements will increase from 100 to 180 daily Monday to Friday and 60 to 90 on Saturdays.

Our property is [redacted] and our home is located within close proximity to the operations. I would like to note the following concerns and request they be considered by Oberon Council and the WRPP in assessing the modification application.

Odour - Composting and Fertiliser Production

The modification application states that an area for composting and windrows will be relocated and developed to managed imported organic waste, drilling mud and other materials. The future intent of the applicant to import highly odorous organic food waste, bio solids and manure for incorporation into the process is of high concern. The relocation and establishment of a new composting area under this modification would open the way for a future DA or modification to allow this. Any composting process would require infrastructure to ensure potential odour, air and water pollution etc. is appropriately managed. In addition any importing of organic waste allows for potential odour emissions which will travel within 200 metres of our home and be housed in close proximity to our property.

Noise Impact

The application will have increased noise impact on our property which is located directly opposite the quarry site.

The application states that noise generating activities principally relate to the following operational activities:

- Vegetation clearing and topsoil and subsoil stripping
- Ripping, drilling and blast extraction of raw materials
- Load and haul of materials for processing through crushing and screening or emplacement of overburden
- Stockpiling and transport of final products
- Miscellaneous equipment use within the Quarry

An increase in the quarry operations, and in particular the proposed increase traffic movements will substantially increase the current noise levels from the operations. The noise from trucks entering and existing the operation site is already disturbing to our amenity and this increase will have substantial impact to us as a close neighbour.

Dust and Silica Particles

Dust containing Crystalline Silica is produced as a result of crushing and extraction processes. Silica particles produced become airborne and therefore pose a health risk. Oberon often experiences windy conditions and the prevailing winds often carry dust from the existing extraction site across neighbouring properties for a significant distance. Silica is known to be dangerous to human health. Water spray is a noted as the preferred control measure however is not very effective and the impact on human health is of major concern.

Increase in Truck Movements

An increase of 80% in truck movements per weekday from 100-180 is of great concern. Since the commencement of the quarry operations visitation to Mayfield Garden has substantially increased. There has also been a notable increase from our observations in general traffic using both Abercrombie Road and Sewells Creek Road. The substantial increase in traffic movements has already created many near misses on the Sewells Creek Road, particularly near the Abercrombie Road intersection where sight distance along Sewells Creek Road is minimal. An updated traffic assessment and review of the current road conditions to determine if they would be suitable to meet safety requirements along this route to the quarry would be required should the modification application be approved.

I hope you will consider the issue raised which we believe will have potential health and lifestyle impacts on us as a neighbouring property to the development.

Kind Regards

[redacted]

Community Submission Number Eight

[redacted]

Planning and Development Director,

Oberon Council,

137-139 Oberon Street,

Oberon NSW 2787.

27 October 2023

Dear Sirs,

<u>Re: Oberon Earthmoving Pty Ltd - Middle Creek Quarries Modification</u>

We write in response to the above modification proposal and to lodge our objection to its approval in the strongest terms.

We do not accept that this is a modification of the existing development consent. It is in fact a new development, as is evidenced by the substantial change in scope and scale.

Amongst our many concerns is the impact of an 86% increase in truck movements, the installation of a processing plant and the sourcing of water, including groundwater. The introduction of importing, crushing and processing of demolition waste (concrete and plasterboard) is also a substantial change and seems to drive the large (and unreasonable) increase in truck movements. The crushing of concrete will also have acoustic impacts that have not properly been considered. Even if the overall acoustic impact in terms of acoustic levels does not exceed the Industrial Noise Policy or what is provided in the Acoustic Management Plan that applies to the site (which we do not accept), this does not account for the constancy of higher levels of noise that will occur.

There has already been an impact on our use and quiet enjoyment of our rural property as noise from Middle Creek Quarry and truck traffic has increased tangibly over recent years notwithstanding the COVID19 Pandemic.

As you are aware, the development consent the subject of the modification application was only granted after lengthy and expensive litigation. It was ultimately resolved by consent orders because of the conditions that were accepted by Oberon Earthmoving. We considered that the imposition of additional truck traffic on a rural road had been resolved. The large number of truck movements was a serious issue of contention in those proceedings. Paragraph 9 of the decision in *Pegela Pty Ltd v Oberon Earthmoving Pty Limited; Walter Graham Turnbull v Oberon Council* [2018] NSWLEC 1624 makes it plain that the limitation on truck movements was one of the reasons why the consent orders were entered into and the consent granted by the Court.

Section 4.56(1A) of the *Environmental Planning and Assessment Act 1979* requires the consent authority to consider the reasons given for the grant of the consent that is sought to be modified. An almost doubling of the truck movements is not only qualitatively and quantitatively different to what was approved such that the modification proposes development that is not substantially the same, the limitation on truck movements currently in place was essential to the grant of consent and should not be allowed to increase.

It is very disappointing that we are once again in this position of having to defend the rural nature of our home and our community. As residents and rate payers of almost 30 years, are we to be continuously subjected to the further imposts of ever expanding ambitions for this land, with all its consequent related legal proceedings?

As stated, we strongly oppose this application and have regretfully, again, instructed our lawyers and will make further submissions in due course. Any further correspondence should be directed to [redacted]

[redacted]

APPENDIX 5

Monthly Dust Deposition Monitoring Results

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson
REPORT ON:	Oberon Earth Moving February 2022 Dust Results
REPORT NO:	2400-7241-02
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	J.Sharp
REPORTED BY:	T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

NATA
WORLD RECOGNISED ACCREDITATION

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

ACIRL Pty Ltd
ABN 41 000 513 888
Part of the ALS Laboratory Group
Unit 3, 16 Donald Street
LITHGOW NSW 2790
Phone +61 2 6350 7400 Fax +61 2 6352 3583 www.alsglobal.com
A Campbell Brothers Limited Company

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-02
Month	Jan-22
Date Replaced	30/12/2022
Date Collected	31/01/2022

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	4.5	3.1	1.4
#2	0.4	0.2	0.2
#3	0.7	0.4	0.3
#4	1.2	0.7	0.5

No.of days exposed -333

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-02

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Slightly cloudy, insects, bird droppings, organic matter, fine black dust, coarse black dust.
#2	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#3	Clear, bird droppings, organic matter, fine brown dust, coarse brown dust.
#4	Clear, insects, bird droppings, organic matter, fine brown dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-02

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
March 2022 Dust Results

REPORT NO: 2400-7241-03

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J.Sharp

REPORTED BY: A. Hernandez

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

NATA
WORLD RECOGNISED ACCREDITATION

Accreditation #	15784
Site #	11436

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LITHGOW NSW 2790
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ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-03
Month	Feb-22
Date Replaced	31/01/2022
Date Collected	28/02/2022

DUST DEPOSITION RESULTS

(g/m².month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.4	<0.1	0.4
#2	1.8	1.1	0.7
#3	0.4	0.2	0.2
#4	0.6	0.3	0.3

No.of days exposed 28

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-03

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, bird droppings, organic matter, fine brown dust, coarse brown dust.
#2	Clear, insects, bird droppings, organic matter, fine green dust, coarse brown dust.
#3	Clear, insects, bird droppings, organic matter, fine brown dust, coarse brown dust.
#4	Clear, insects, organic matter, fine grey dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-03

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
April 2022 Dust Results

REPORT NO: 2400-7241-04

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J.Sharp & L.Pyne

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation #	15784
Site #	11436

Accredited for compliance with ISO/IEC 17025.

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LITHGOW NSW 2790
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ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-04
Month	Mar-22
Date Replaced	28/02/2022
Date Collected	31/03/2022

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	1.0	0.7	0.3
#2	0.5	0.4	0.1
#3	0.6	0.5	0.1
#4	1.0	0.8	0.2

No.of days exposed 31

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-04

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, bird droppings, organic matter, fine brown dust, coarse brown dust.
#2	Clear, insects, organic matter, fine grey dust, coarse black dust.
#3	Clear, insects, organic matter, fine grey dust, coarse black/brown dust.
#4	Clear, insects, organic matter, fine grey dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-04

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
May 2022 Dust Results

REPORT NO: 2400-7241-05

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J.Sharp

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

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Part of the ALS Laboratory Group
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LITHGOW NSW 2790
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ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-05
Month	Apr-22
Date Replaced	31/03/2022
Date Collected	28/04/2022

DUST DEPOSITION RESULTS

(g/m².month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	1.3	0.7	0.6
#2	1.3	0.7	0.6
#3	0.1	<0.1	0.1
#4	0.7	0.4	0.3

No.of days exposed 28

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-05

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#2	Clear, organic matter, fine brown dust, coarse brown dust.
#3	Clear, insects, organic matter, fine grey dust, coarse black dust.
#4	Clear, insects, bird droppings, organic matter, fine brown dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-05

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
June 2022 Dust Results

REPORT NO: 2400-7241-06

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J.Sharp

REPORTED BY: A. Hernandez

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

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LITHGOW NSW 2790
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ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-06
Month	May-22
Date Replaced	28/04/2022
Date Collected	30/05/2022

DUST DEPOSITION RESULTS

(g/m².month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	NS	NS	NS
#2	0.3	0.1	0.2
#3	0.3	0.2	0.1
#4	0.4	0.2	0.2

NS: not sampled due to dangerous conditions

No.of days exposed 32

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-06

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Not sampled due to dangerous conditions
#2	Clear, insects,organic matter, fine brown dust, coarse brown dust.
#3	Clear, insects, organic matter, fine grey dust, coarse black dust.
#4	Clear, insects, organic matter, fine brown dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-06

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson
REPORT ON:	Oberon Earth Moving July 2022 Dust Results
REPORT NO:	2400-7241-07
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	J.Sharp & L.Pyne
REPORTED BY:	A. Hernandez

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

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ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-07
Month	Jun-22
Date Replaced	30/05/2022
Date Collected	30/06/2022

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.3	0.2	0.1
#2	0.6	0.3	0.3
#3	2.9	1.7	1.2
#4	2.3	1.3	1.0

No.of days exposed 31

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-07

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine grey dust, coarse brown dust.
#2	Clear, insects, organic matter, fine brown dust, coarse green dust.
#3	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#4	Clear, insects, organic matter, fine brown dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-07

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
August 2022 Dust Results

REPORT NO: 2400-7241-08

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: L.Pyne

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

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ABN 41 000 513 888
Part of the ALS Laboratory Group
Unit 3, 16 Donald Street
LITHGOW NSW 2790
Phone +61 2 6350 7400 Fax +61 2 6352 3583 www.alsglobal.com
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ALS

ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-08
Month	Jul-22
Date Replaced	30/06/2022
Date Collected	28/07/2022

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.4	0.3	0.1
#2	0.5	0.3	0.2
#3	2.3	1.2	1.1
#4	1.1	0.6	0.5

No.of days exposed 28

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-08

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine grey dust, coarse black dust.
#2	Clear, organic matter, fine grey dust, coarse black dust.
#3	Slightly cloudy, organic matter, fine red dust, coarse brown dust.
#4	Clear, insects, organic matter, fine grey dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-08

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson
REPORT ON:	Oberon Earth Moving September 2022 Dust Results
REPORT NO:	2400-7241-09
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	J.Sharp & L.Pyne
REPORTED BY:	T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025.

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ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-09
Month	Sep-22
Date Replaced	29/08/2022
Date Collected	29/09/2022

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.1	0.1	<0.1
#2	0.3	0.2	0.1
#3	2.1	1.4	0.7
#4	1.7	1.4	0.3

No.of days exposed 31

NS No sample due to funnel and bottle being broken

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS

ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-09

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine grey dust, coarse black dust.
#2	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#3	Slightly cloudy, insects, organic matter, fine yellow/brown dust, coarse black dust.
#4	Clear, insects, organic matter, fine green dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-09

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
October 2022 Dust Results

REPORT NO: 2400-7241-10

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: B. Collins & L.Pyne

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

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ABN 41 000 513 888
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Unit 3, 16 Donald Street
LITHGOW NSW 2790
Phone +61 2 6350 7400 Fax +61 2 6352 3583 www.alsglobal.com
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ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-10
Month	Oct-22
Date Replaced	29/09/2022
Date Collected	28/10/2022

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.6	0.5	0.1
#2	1.4	1.3	0.1
#3	1.4	0.6	0.8
#4	0.9	0.8	0.1

No.of days exposed 29

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS

ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-10

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine grey/brown dust, coarse black dust.
#2	Clear, insects, organic matter, fine grey dust, coarse brown dust.
#3	Clear, insects, organic matter, fine grey dust, coarse brown dust.
#4	Clear, insects, organic matter, fine grey/brown dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-10

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
November 2022 Dust Results

REPORT NO: 2400-7241-11

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: C.Roach & J.Sharp

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

NATA
WORLD RECOGNISED ACCREDITATION

Accreditation # 15784
Site # 11436

Accredited for compliance with ISO/IEC 17025.

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ACIRL Pty Ltd
ABN 41 000 513 888
Part of the ALS Laboratory Group
Unit 3, 16 Donald Street
LITHGOW NSW 2790
Phone +61 2 6350 7400 Fax +61 2 6352 3583 www.alsglobal.com
A Campbell Brothers Limited Company

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-11
Month	Nov-22
Date Replaced	28/10/2022
Date Collected	28/11/2022

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.9	0.7	0.2
#2	1.2	1.0	0.2
#3	1.1	0.8	0.3
#4	1.8	1.4	0.4

No.of days exposed 31

** Incombustible Matter
Analysed in accordance with AS3580.10.1

Oberon Earth Moving

Report No 2400-7241-11

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Slightly cloudy, organic matter, fine grey dust, coarse grey dust.
#2	Clear, insects, bird droppings, organic matter, fine brown dust, coarse brown dust.
#3	Clear, insects, bird droppings, organic matter, fine brown dust, coarse brown dust.
#4	Clear, bird droppings, organic matter, fine brown dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-11

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS AIRBORNE DUST
ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson

REPORT ON: Oberon Earth Moving
December 2022 Dust Results

REPORT NO: 2400-7241-12

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: L.Pyne

REPORTED BY: T.MacPhee

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

NATA WORLD RECOGNISED ACCREDITATION

Accreditation # 15784
Site # 11436

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ACIRL Pty Ltd
ABN 41 000 513 888
Part of the ALS Laboratory Group
Unit 3, 16 Donald Street
LITHGOW NSW 2790
Phone +61 2 6350 7400 Fax +61 2 6352 3583 www.alsglobal.com
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ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No	2400-7241-12
Month	Dec-22
Date Replaced	28/11/2022
Date Collected	29/12/2022

DUST DEPOSITION RESULTS

(g/m².month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.4	0.3	0.1
#2	0.5	0.4	0.1
#3	0.6	0.3	0.3
#4	0.9	0.7	0.2

No.of days exposed 31

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS
ANALYSIS AND TESTING REPORT

Oberon Earth Moving

Report No 2400-7241-12

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine brown dust, coarse black dust.
#2	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#3	Clear, insects, organic matter, fine brown dust, coarse brown dust.
#4	Clear, insects, organic matter, fine brown dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7241-12

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	3580.10.1	X

In accordance with "Methods for sampling and analysis of ambient air.
Method 10.1: Determination of particulate matter- Deposited matter-Gravimetric method"
Standards Australia, 2003

ACIRL Pty Ltd
ABN 66 003 451 876
Unit 3, 16 Donald Street
Lithgow, NSW, 2790, Australia
Tel: +61 2 6350 7400
Fax: +61 2 6352 3583

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson 1/30 O'Connell Rd, Oberon NSW 2787
REPORT ON:	Oberon EarthMoving January 2023 Dust Results
REPORT NO:	2400-7311-01
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	J. Sharp & C. Jenkins
REPORTED BY:	T.MacPhee
DATE:	22/02/2023

These reported results only relate to the items sampled and tested

Sampling and Analysis performed by: ACIRL Lithgow NSW NATA Accreditation No. 15784, Site No. 11436 in accordance with **AS** Standards listed on Page 7.

Accredited for compliance with ISO 17025 - Testing
Accreditation Number 15784

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

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ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-01
Month	Jan-23
Date Replaced	29/12/2022
Date Collected	30/01/2023

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.1	0.1	<0.1
#2	0.2	<0.1	0.2
#3	0.3	0.2	0.1
#4	0.1	0.1	<0.1

No.of days exposed 32

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-01
Month	Jan-23
Date Replaced	Dec-22
Date Collected	Jan-23

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, organic matter, fine black dust, coarse black dust
#2	Clear, insects, organic matter, fine brown dust, coarse brown dust
#3	Cloudy, insects, organic matter, fine green/brown dust, coarse brown dust
#4	Clear, insects, organic matter, fine brown dust, coarse black dust

Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7311-01

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	AS/ NZS 3580.10.1	X

Samples were analysed in accordance with the following Australian Standards or equivalent:

Australian Standards	**Description**
AS/NZS 3580.10.1	Determination of particulate matter- Deposited matter-Gravimetric method

ACIRL Pty Ltd
ABN 66 003 451 876
Unit 3, 16 Donald Street
Lithgow, NSW, 2790, Australia
Tel: +61 2 6350 7400
Fax: +61 2 6352 3583

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson
1/30 O'Connell Rd, Oberon NSW 2787

REPORT ON: Oberon EarthMoving
March 2023 Dust Results

REPORT NO: 2400-7311-03 Amended 01

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J. Sharp

REPORTED BY: T.MacPhee

DATE: 30/05/2023

These reported results only relate to the items sampled and tested

Sampling and Analysis performed by: ACIRL Lithgow NSW NATA Accreditation No. 15784, Site No. 11436 in accordance with **AS** Standards listed on Page 4.

NATA Accredited for compliance with ISO 17025 - Testing
Accreditation Number 15784

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

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ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

Amendment History

Amend No	Date	Descripion of Amendment	Editor	Approved By
01	30/05/2023	Sampling dates incorrect, amended	AH	AH

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-03 Amended 01
Month	Mar-23
Date Replaced	28/02/2023
Date Collected	29/03/2023

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.1	0.1	<0.1
#2	0.1	0.1	<0.1
#3	<0.1	<0.1	<0.1
#4	<0.1	<0.1	<0.1

No.of days exposed 29

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-03 Amended 01
Month	Mar-23
Date Replaced	Feb-23
Date Collected	Mar-23

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, fine brown dust, coarse black dust.
#2	Clear, insects, organic matter, fine green dust, coarse green dust.
#3	Clear, insects, fine grey dust, coarse green dust.
#4	Clear, insects, fine grey dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7311-03 Amended 01

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	AS/ NZS 3580.10.1	X

Samples were analysed in accordance with the following Australian Standards or equivalent:

Australian Standards	**Description**
AS/NZS 3580.10.1	Determination of particulate matter-Deposited matter-Gravimetric method

ACIRL Pty Ltd
ABN 66 003 451 876
Unit 3, 16 Donald Street
Lithgow, NSW, 2790, Australia
Tel: +61 2 6350 7400
Fax: +61 2 6352 3583

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

REPORT TO: Zac Rowlandson
1/30 O'Connell Rd, Oberon NSW 2787

REPORT ON: Oberon EarthMoving
March 2023 Dust Results

REPORT NO: 2400-7311-03

PERIOD OF EXPOSURE: Typically 30 days +/- 2 days

SAMPLED BY: J. Sharp

REPORTED BY: T.MacPhee

DATE: 6/04/2023

These reported results only relate to the items sampled and tested

Sampling and Analysis performed by: ACIRL Lithgow NSW NATA Accreditation No. 15784, Site No. 11436 in accordance with **AS** Standards listed on Page 4.

NATA Accredited for compliance with ISO 17025 - Testing
Accreditation Number 15784

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

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ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-03
Month	Feb-23
Date Replaced	30/01/2023
Date Collected	28/02/2023

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.1	0.1	<0.1
#2	0.1	0.1	<0.1
#3	<0.1	<0.1	<0.1
#4	<0.1	<0.1	<0.1

No.of days exposed 29

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-03
Month	Feb-23
Date Replaced	Jan-23
Date Collected	Feb-23

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, insects, fine brown dust, coarse black dust.
#2	Clear, insects, organic matter, fine green dust, coarse green dust.
#3	Clear, insects, fine grey dust, coarse green dust.
#4	Clear, insects, fine grey dust, coarse brown dust.

Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7311-03

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	AS/ NZS 3580.10.1	X

Samples were analysed in accordance with the following Australian Standards or equivalent:

Australian Standards	**Description**
AS/NZS 3580.10.1	Determination of particulate matter- Deposited matter-Gravimetric method

ACIRL Pty Ltd
ABN 66 003 451 876
Unit 3, 16 Donald Street
Lithgow, NSW, 2790, Australia
Tel: +61 2 6350 7400
Fax: +61 2 6352 3583

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson 1/30 O'Connell Rd, Oberon NSW 2787
REPORT ON:	Oberon EarthMoving April 2023 Dust Results
REPORT NO:	2400-7311-04
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	J. Sharp & C.Bulkeley
REPORTED BY:	T.MacPhee
DATE:	4/05/2023

These reported results only relate to the items sampled and tested

Sampling and Analysis performed by: ACIRL Lithgow NSW NATA Accreditation No. 15784, Site No. 11436 in accordance with **AS** Standards listed on Page 4.

Accredited for compliance with ISO 17025 - Testing
Accreditation Number 15784

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

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ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-04
Month	Apr-23
Date Replaced	29/03/2023
Date Collected	27/04/2023

DUST DEPOSITION RESULTS

(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.9	0.7	0.2
#2	0.8	0.7	0.1
#3	0.8	0.6	0.2
#4	0.9	0.8	0.1

No.of days exposed 29

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No 2400-7311-04
Month Apr-23

Date Replaced Mar-23
Date Collected Apr-23

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, fine brown dust, coarse black dust.
#2	Clear, fine green dust, coarse grey dust.
#3	Clear, fine grey dust, coarse grey dust.
#4	Clear, fine grey dust, coarse grey dust.

Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7311-04

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	AS/ NZS 3580.10.1	X

Samples were analysed in accordance with the following Australian Standards or equivalent:

Australian Standards	**Description**
AS/NZS 3580.10.1	Determination of particulate matter-Deposited matter-Gravimetric method

ACIRL Pty Ltd
ABN 66 003 451 876
Unit 3, 16 Donald Street
Lithgow, NSW, 2790, Australia
Tel: +61 2 6350 7400
Fax: +61 2 6352 3583

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST ANALYSIS AND TESTING REPORT

REPORT TO:	Zac Rowlandson 1/30 O'Connell Rd, Oberon NSW 2787
REPORT ON:	Oberon EarthMoving May 2023 Dust Results
REPORT NO:	2400-7311-05
PERIOD OF EXPOSURE:	Typically 30 days +/- 2 days
SAMPLED BY:	L. Pyne
REPORTED BY:	T.MacPhee
DATE:	7/06/2023

These reported results only relate to the items sampled and tested

Sampling and Analysis performed by: ACIRL Lithgow NSW NATA Accreditation No. 15784, Site No. 11436 in accordance with **AS** Standards listed on Page 4.

Accredited for compliance with ISO 17025 - Testing
Accreditation Number 15784

Adriana Hernandez
Environmental Project/Quality Officer– Lithgow NSW

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ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-05
Month	May-23
Date Replaced	27/04/2023
Date Collected	29/05/2023

DUST DEPOSITION RESULTS
(g/m^2.month)

GAUGE NO.	INSOLUBLE SOLIDS	COMBUSTIBLE MATTER	**ASH
#1	0.2	<0.1	0.2
#2	0.5	0.3	0.2
#3	NS	NS	NS
#4	0.5	0.3	0.2

No.of days exposed 32

NS: No sample, unable to access site

** Incombustible Matter
Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST
ANALYSIS AND TESTING REPORT

Report No	2400-7311-05
Month	May-23
Date Replaced	Apr-23
Date Collected	May-23

DUST GAUGE OBSERVATIONS

Gauge	Analysis Observations
#1	Clear, organic matter, fine brown black, coarse brown dust.
#2	Clear, organic matter, fine brown dust, coarse black dust.
#3	No sample, unable to access site.
#4	Clear, organic matter, fine brown dust, coarse black dust.

Analysed in accordance with AS3580.10.1

ALS Coal Division
OBERON EARTHMOVING AIRBORNE DUST

METHODS OF ANALYSIS

Tests for results issued in this report have been carried out at the following NATA accredited laboratories in accordance with the methods as detailed below:-

Report No: 2400-7311-05

DUST

TEST	METHOD	LABORATORY
		ACIRL Lithgow NATA Accreditation #11436
Dust (Deposited matter gravimetric method)	AS/ NZS 3580.10.1	X

Samples were analysed in accordance with the following Australian Standards or equivalent:

Australian Standards	**Description**
AS/NZS 3580.10.1	Determination of particulate matter-Deposited matter-Gravimetric method

APPENDIX 6

Air Quality Impact Assessment

Middle Creek Quarries

Air Quality Impact Assessment

F0 | V0

18 November 2022

Oberon Earthmoving Pty Ltd

Middle Creek Quarries

Project No:	IA226200
Document Title:	Air Quality Impact Assessment
Document No.:	F0
Revision:	V0
Date:	18 November 2022
Client Name:	Oberon Earthmoving Pty Ltd
Project Manager:	Luke Spencer
Author:	Luke Spencer
File Name:	Middle Queek Quarries AQ report Final

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 4, 12 Stewart Avenue
Newcastle West NSW 2302 Australia
PO Box 2147 Dangar NSW 2309 Australia
T +61 2 4979 2600
F +61 2 4979 2666
www.jacobs.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
D0vA	31/10/2022	Working draft for client review	LS			
D0vB	16/11/2022	Draft for internal TR	LS	BC		
F0v0	18/11/2022	Final following internal and client review	LS	BC	BC	BC

Contents

Executive Summary

Background

Oberon Earthmoving Pty Ltd (Oberon Earthmoving) is seeking an approval to modify operations at Middle Creek Quarries on Lot 2 DP 1112479, 50 Sewells Creek Road, Oberon. The extraction and transport of up to 150,000 tonnes per annum (tpa) of material presently takes place at the Quarry in accordance with development consent DA 10. 2016.38.1. The proposed modification involves increasing the maximum extraction rate at the site up to 315,000 tpa and associated increases in production, and storage and haulage.

This report provides an assessment of the potential air quality and greenhouse gas impacts of the proposal. In summary, the air quality assessment involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling the potential impact of the Project on local air quality. The modelling was carried out in accordance with the assessment procedures prescribed by the EPA.

The key air quality issue was identified as dust during operations. This was the focus of the assessment, along with impacts from diesel exhaust emissions, NO_2 emissions from blasting, impacts from associated road transport activities and the effects of crystalline silica.

Key features of the existing environment

As part of the assessment, key features of the existing environment were identified including surrounding sensitive receptors, local meteorology and background air quality. Aerial imagery was used to identify the location of surrounding receptors. Meteorological and ambient air quality data collected at monitors operated by DPE and BoM (Meteorology only) in the surrounding area were reviewed to characterise existing local conditions. The following conclusions were made in relation to the existing environment:

- Meteorological conditions do not vary significantly from year to year, and conditions in 2021 were identified as most representative of the long term, local conditions.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal setting.

Assessment of impacts

Air quality emission rates for key dust-generating activities associated with the proposed modification were estimated from local and international guidance. Modelling was then carried out with these emission rate to predict potential changes to local air quality. The assessment determined that air quality impacts associated with the proposal would meet the relevant requirements of the EPA's Approved Methods. Specifically, it was predicted that:

- Modified Operational dust emissions due are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on modelling which showed compliance with the EPA assessment criteria.
- No exceedances of the EPA's NO_2 criteria from diesel exhaust emissions or from blasting.
- Emissions from truck diesel exhausts travelling on public roads are not expected to result in any adverse air quality impacts based on modelling which showed that maximum kerbside concentrations would not exceed EPA criteria.
- Monitoring from a similar site and results from modelling suggest that the proposal is not expected to cause, adverse air quality impacts with respect to crystalline silica.

Conclusion and recommended safeguards

While this assessment has shown the proposal is not expected to cause any adverse air quality impacts, a range of mitigation and management measures are recommended. These include the continuation of existing measures outlined in the 'Air Quality Management Plan, Middle Creek Quarries' (AQMP) (Umwelt, 2019), as well as additional measures regarding blasting and diesel exhaust emissions.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts for the Middle Creek Quarry Modification proposal in accordance with the scope of services set out in the contract between Jacobs and Oberon Earthmoving Pty Ltd (Oberon Earthmoving), as well as Umwelt (Australia) Pty Ltd (Umwelt). That scope of services, as described in this report, was developed with Oberon Earthmoving and Umwelt.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Oberon Earthmoving and Umwelt and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Oberon Earthmoving and Umwelt (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Oberon Earthmoving and Umwelt, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and Oberon Earthmoving and Umwelt. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

Oberon Earthmoving Pty Ltd (Oberon Earthmoving) seeks to modify the operations at Middle Creek Quarry (the Quarry). The Quarry is located on Lot 2 DP 1112479 at 50 Sewells Creek Road, approximately 4 km west of Oberon, within the Oberon Shire Council local government area (LGA) (see Figure 1.1). The Quarry is classed as a Designated Development and operates under development consent DA 10.2016.38.1, permitting the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and Virgin and Excavated Natural Material (VENM and ENM). Under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the modification of the development consent includes the following:

- Extended resource recovery activities including:
  - Sand washing; and
  - Concrete for crushing.
- Construction of additional stockpiling areas; and
- Increased number of truck movements.

The development is also classified as Regional Development under the *State Environmental Planning Policy (State and Regional Development) 2011*. As a result, the development application will be determined by the independent Western Region Planning Panel (WRPP).

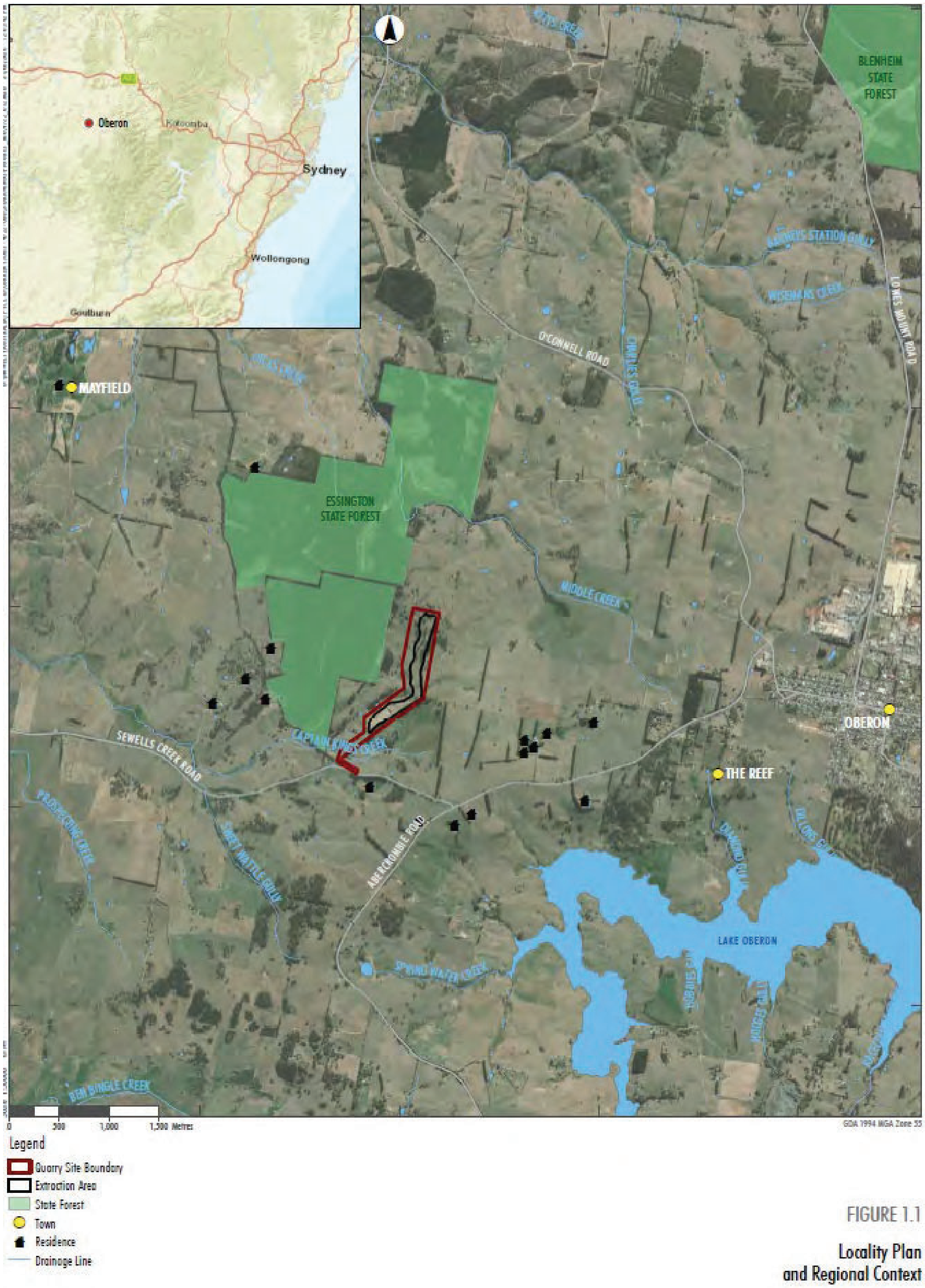


Figure 1.1. Quarry setting (Umwelt, 2022)

Oberon Earthmoving has engaged Umwelt (Australia) Pty Limited (Umwelt) to complete an application to modify DA 10.2016.38.1 for these works. Umwelt has engaged Jacobs Group (Australia) Pty Ltd (Jacobs) to undertake an Air Quality Impact Assessment (AQIA) to support the modification application. The AQIA has been prepared to address the following requirements issued for a similar recent quarry development.

Table 1.1. AQIA Assessment objectives.

Assessment objective
Air – including an assessment of the likely air quality impacts of the development in accordance with the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW'. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage.

In meeting these requirements, the objectives of this assessment were to:

- Describe the proposal modification, proposed activities and potential air quality issues (Section 2);
- Establish suitable air quality assessment criteria (Section 0);
- Describe the existing environment including surrounding receivers, terrain, meteorology and ambient air quality conditions (Section 4);
- Explain the methods used to predict potential air quality impacts, including the estimated emissions to air associated with the proposal modification (Section 5);
- Present and discuss predicted potential impacts (Section 6); and
- Recommend mitigation and management measures (Section 7).

2. Proposal details

2.1 Modification overview

The extraction and transport of up to 150,000 tonnes per annum (tpa) of material presently takes place at the Quarry in accordance with development consent DA 10. 2016.38.1. The proposal involves increasing the maximum extraction rate at the site up to 315,000 tpa and associated increases in production, and storage and haulage. Key details of the proposal, including how operations would change from existing activities are listed in **Table 2.1**.

Table 2.1. Key details of existing and proposed operations

Parameter	Existing approved operations under DA 10. 2016.38.1	Proposed operations
Site location	Lot 2 DP 1112479	No change
Resource Recovery	Importation of VENM, ENM, Treated Drilling Muds for land application or processing and sale	As per existing, as well as the importation of waste concrete for crushing and sale (up to 35,000 tpa)
Production rate	Up to 250,000 tpa	Up to 315,000 tpa (increase of 26%)
Disturbance area	Extraction Area (including all processing and stockpiling operation): 15 ha Erosion and Sediment Control features: <0.25 ha Site Access Road: <1 ha	Extraction Area (including select processing and stockpiling operation): 15 ha Erosion and Sediment Control features: <0.25 ha Site Access Road: <1 ha Out of Pit Processing and Stockpile Area: 1 ha Additional Water Management Features: to be confirmed
Extraction area	As identified in **Figure 2.1**	No change
Extraction design	• Operational Face Height: ▪ <15 m: friable rock. ▪ <20 m: harder rock. • Operational Bench Width: 20 m to 100 m (longitudinal i.e. north-south). • Terminal Bench Width: 3 m to 5 m (approximate).	No change
Extraction methods	Drill and blast	No change
Overburden Management	Sale as select fill Void backfill (rehabilitation)	Construction of an additional stockpile and processing area
Composting	Aerobic windrow composting of mulch within the completed extraction area	No change to process. Relocation to Out of Pit Processing and Stockpile Area
Processing operations	Campaign crushing and screening	Addition of a washing circuit
Truck movements	Maximum of 100 truck movements per day (Monday to Friday) Maximum 60 truck movements per day (Saturday)	Maximum of 180 truck movements per day (Monday to Friday) Maximum 90 truck movements per day (Saturday)
Hours of operation	Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 2.00 pm No work on Sundays or Public Holidays	No change
Rehabilitation activities	Retained void with stable final slopes	No change to residual voids Out of Pit Processing and Stockpile Area to be profiled to blend with surrounding slopes

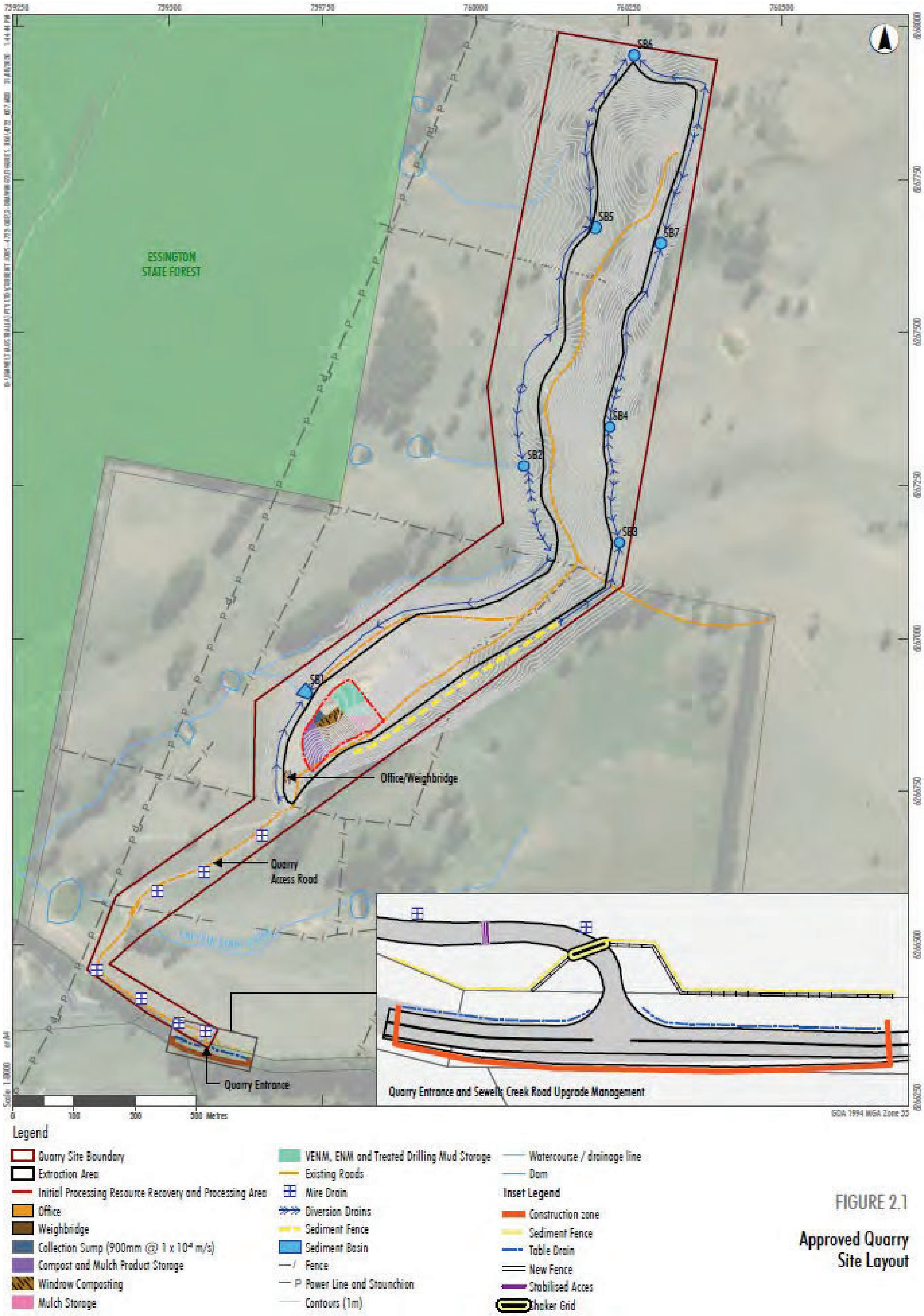


Figure 2.1. Approved quarry site layout (Umwelt, 2022)

2.2 Key air quality-related matters

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Changes in potential dust impacts at nearby residential receivers due to modified operations at the quarry presents the key air quality-related risk.

Dust is often referred to as particulate matter and in the forms of:

- Total Suspended Particles (TSP);
- Deposited dust;
- Particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}); and
- Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

Plant and equipment exhausts also have the potential to generate emissions that include carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter, and to a lesser extent sulphur dioxide (SO_2). Post-blast fume has the potential to generate NO_x emissions which, in turn, can oxidise to the more harmful and odorous nitrogen dioxide (NO_2). Rock crushing also has the potential to cause emissions of crystalline silica.

The area around the Project site contains various emission sources that will influence the local air quality. Consequently, the potential cumulative impacts are an important issue to address.

The key issues for construction will be:

- Emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and deposited dust) including those from machinery exhausts.

The key issues for operation will be:

- Emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and deposited dust);
- Post-blast fume (NO_2);
- Diesel exhaust (PM_{10}, $PM_{2.5}$ and NO_2); and
- Crystalline silica due to the crushing of rock.

These issues are the focus of this assessment.

Composting is already an approved activity at the site. As listed in Table 2.1 there is no proposed changes to composting operations except the relocation of the activity to an out of pit processing and stockpile area. This change is minimal (movement of around 100 to 200 metres to the north of the existing processing and storage location). Noting that this aspect remains largely unchanged, expected impacts from composting are similarly expected to remain largely unchanged. As such, these effects (barring dust generated from wind erosion of the new out of pit processing and storage area) have not been considered as part of this assessment and should continue being managed as outlined in the 'Air Quality Management Plan, Middle Creek Quarries' (AQMP) (Umwelt, 2019).

3. Policy setting and assessment criteria

3.1 Overview

There are several statutes and guidelines that apply to the regulation of emissions to air from developments in NSW including:

- *NSW Protection of the Environment Operations Act 1997* (POEO Act NSW);
- *NSW Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO Clean Air Regulation);
- 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW', (NSW Environment Protection Authority [EPA], 2022);
- 'NSW Voluntary Land Acquisition and Mitigation Policy', (NSW Government, 2018); and
- 'Approved Methods for Sampling and Analysis of Air Pollutants in NSW', (NSW Department of Environment and Conservation [DEC], 2005).

Requirements relevant to the proposal from each of these documents are outlined below.

3.1.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act NSW) is the primary piece of legislation for the regulation of potential pollution impacts associated with Scheduled operations or activities in NSW. Scheduled activities are those defined in Schedule 1 of the POEO Act. The site is and will remain a Scheduled activity, operating in accordance with the requirements of Environment Protection Licence (EPL) No.21098. EPL 21098 includes the following conditions listed below in **Table 3.1** regarding the management of air quality-related issues at the site.

Table 3.1. EPL21098 air quality requirements

EPL Condition	Requirement
L6.5	Blasting operations at the premises may only take place between 10am-4pm Monday to Friday
L7 Potentially offensive odour	L7.1 No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the *Protection of the Environment Operations Act 1997*
O3 Dust	O3.1 Activities occurring at the premises must be carried out in a manner that will minimise emissions of dust from the premises. O3.2 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises. O3.3 Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading. O3.4 All dust control equipment must be operable at all times with exception of shutdowns required for maintenance.

These requirements will remain applicable for the site.

3.1.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The NSW *Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO Clean Air Regulation) contains provisions for the regulation of emissions to air from wood heaters, open burning, motor vehicles, fuels and industry. The proposal does involve any activities listed Schedule 3 of the POEO Clean Air Regulation. As such the applicability of the POEO Clean Air Regulation to the proposal is expected to be limited.

3.1.3 Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and NSW Voluntary Land Acquisition and Mitigation Policy

Air quality is typically quantified by the concentrations of substances in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of one or more substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the substances most relevant to the Project have been identified, from Section 2.2, as particulate matter in its various forms.

The EPA has developed criteria for a range of air quality indicators including particulate matter that are used for the assessment of specific projects. These criteria are outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2022), hereafter referred to as the Approved Methods. Most of the EPA criteria referred to in this report have been drawn from national standards for air quality set by the National Environment Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 1998).

The Project has been assessed in terms of its ability to comply with the air quality criteria set by the EPA as part of the Approved Methods. These criteria are outlined in Table 3.2 and apply to existing and potentially sensitive receptors, where the Approved Methods defines a sensitive receptor as *"a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area"*. This definition has also been interpreted as places of near-continuous occupation.

Table 3.2. EPA air quality assessment criteria

Substance	Averaging time	Criterion	Source
Particulate matter (PM_{10})	24-hour	50 µg/m^3	EPA (2022) / DoE (2016)
	Annual	25 µg/m^3	EPA (2022) / DoE (2016)
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	EPA (2022) / DoE (2016)
	Annual	8 µg/m^3	EPA (2022) / DoE (2016)
Particulate matter (TSP)	Annual	90 µg/m^3	EPA (2022) / NHMRC (1996)
Deposited dust	Annual (maximum increase)	2 g/m^2/month	EPA (2022) / NERDDC (1998)
	Annual (maximum total)	4 g/m^2/month	EPA (2022) / NERDDC (1998)
Nitrogen dioxide (NO_2)	1-hour	164 µg/m^3	EPA (2022) / DoE (2021)
	Annual	31 µg/m^3	EPA (2022) / DoE (2021)
Carbon monoxide (CO)	1-hour	30 mg/m^3	EPA (2022) / DoE (2016)
	8-hour	10 mg/m^3	EPA (2022) / DoE (2016)

On 25 February 2016, an amendment to the Ambient Air Quality NEPM entered into force and introduced the new national air quality standards for PM_{10} and $PM_{2.5}$, as noted above. The EPA subsequently revised its PM_0 and $PM_{2.5}$ assessment criteria as part of an update to the Approved Methods. These revised criteria are reflected in Table 3.2 and took effect from 20 January 2017 onwards. There is currently no State legislation regarding the aim to move to more stringent $PM_{2.5}$ criteria by 2025. Table 3.1 also reflects the April 2021 update to the NEPM, where the standards for ozone (O_3), sulfur dioxide (SO_2) and NO_2 were updated in-line with the latest scientific research around health impacts.

The 'NSW Voluntary Land Acquisition and Mitigation Policy', (NSW Government, 2018) (VLAMP) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. The VLAMP brings the air quality criteria in line with the NEPM standards and EPA assessment criteria. Noting that the proposal is not currently and is expected to remain below the triggers for State Significant Development as outlined in Schedule 1, Clause 7 (Extractive Industries) of the *State Environmental Planning Policy (Planning Systems) 2021*, the VLAMP and its provisions are not expected to be applicable for the site. As such, the VLAMP hasn't been considered further in the assessment.

3.1.4 Approved Methods for Sampling and Analysis of Air Pollutants in NSW

The Approved Methods for Sampling and Analysis of Air Pollutants in NSW, (DEC, 2005) provides guidance for the monitoring and analysis of air pollutants in NSW. This standard applies to the air quality monitors used to establish local background air quality conditions (see Section 4.4).

4. Existing environment

4.1 Surrounding receivers

Identified nearby sensitive receivers in the air quality study area around the site are displayed below in Figure 4.1.

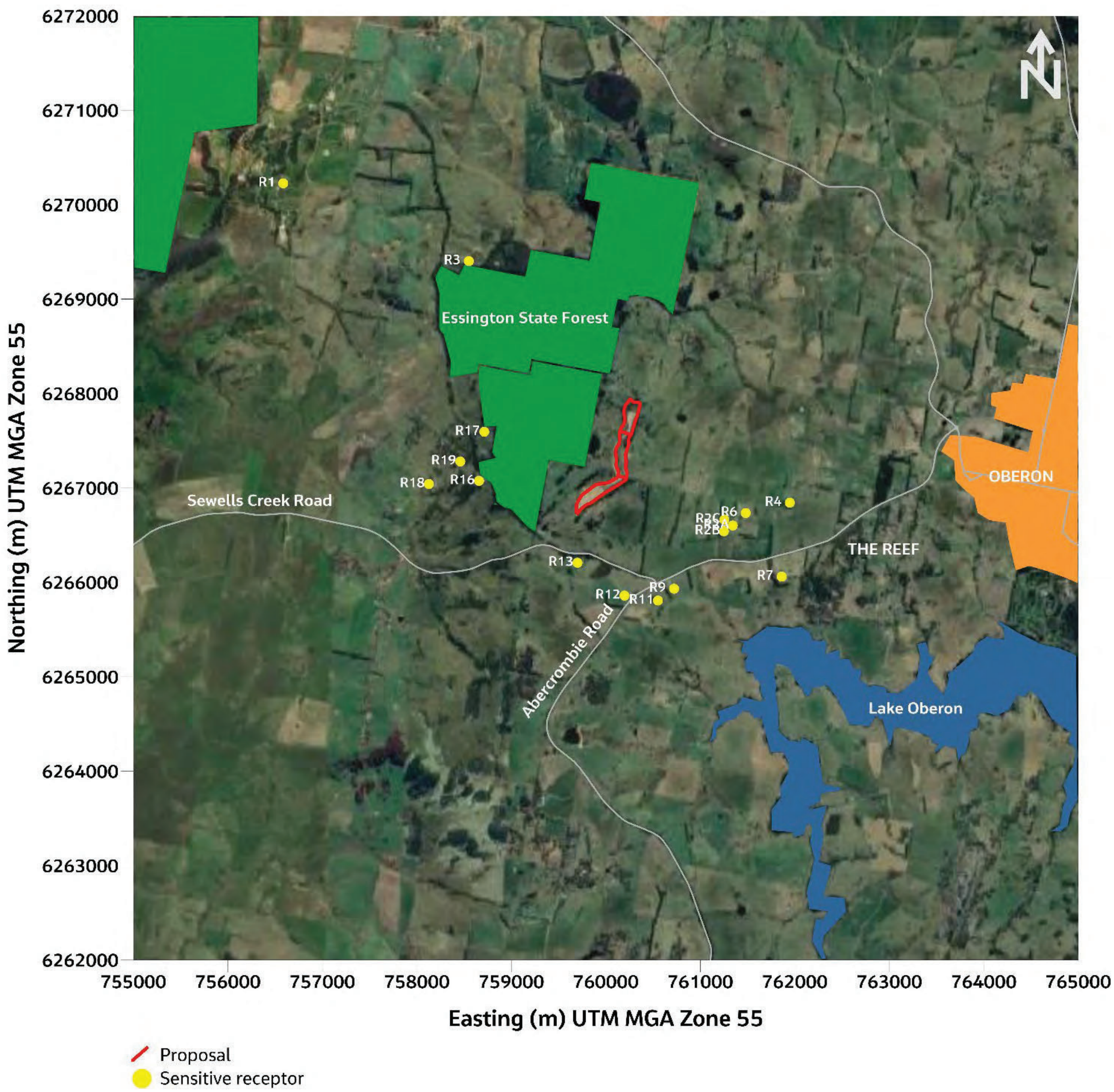


Figure 4.1. Surrounding sensitive receptors

Details of these locations are listed in Table 4.1 below. The receiver identification numbers listed are consistent with those used in the overall modification application .

Table 4.1. Surrounding residential receivers

Receiver ID	Approximate co -ordinates UTM MGA 55		Approximate elevation (m)	Approximate distance from the site (km)	Approximate orientation from the site	Affiliated with site or permanently disused?
	Easting (m)	Northing (m)				
R1	756586	6270224	1011	4.1	Northwest	No
R2A	761345	6266600	1125	1.2	East southeast	No
R2B	761248	6266538	1131	1.2	East southeast	No
R2C	761255	6266664	1123	1.1	East southeast	No
R3	758547	6269398	1040	2.2	Northwest	No
R4	761947	6266839	112 4	1.7	East	No
R6	761479	6266733	1119	1.3	East	No
R7	761860	6266057	1144	1.9	Southeast	No
R9	760720	6265932	1155	1.2	South southeast	No
R11	760552	6265804	1147	1.1	South southeast	No
R12	760196	6265857	1152	0.8	South southeast	No
R13	759699	6266209	112 6	0.2	South	No
R16	758658	6267073	110 3	1.1	West	No
R17	758711	6267593	1080	1.2	West	No
R18	758124	6267042	1051	1.6	West	No
R19	758456	6267277	1066	1.3	West	No

As listed the nearest sensitive receiver (R13) is located around 200 metres from the quarry site boundary. R13 is located along Sewells Creek Road near the site entrance (i.e. the sealed main quarry road) but is around 500 metres from the materials handlin g areas.

4.2 Terrain

A three-dimensional schematic of terrain features around the proposal is shown below in **Figure 4.2**.

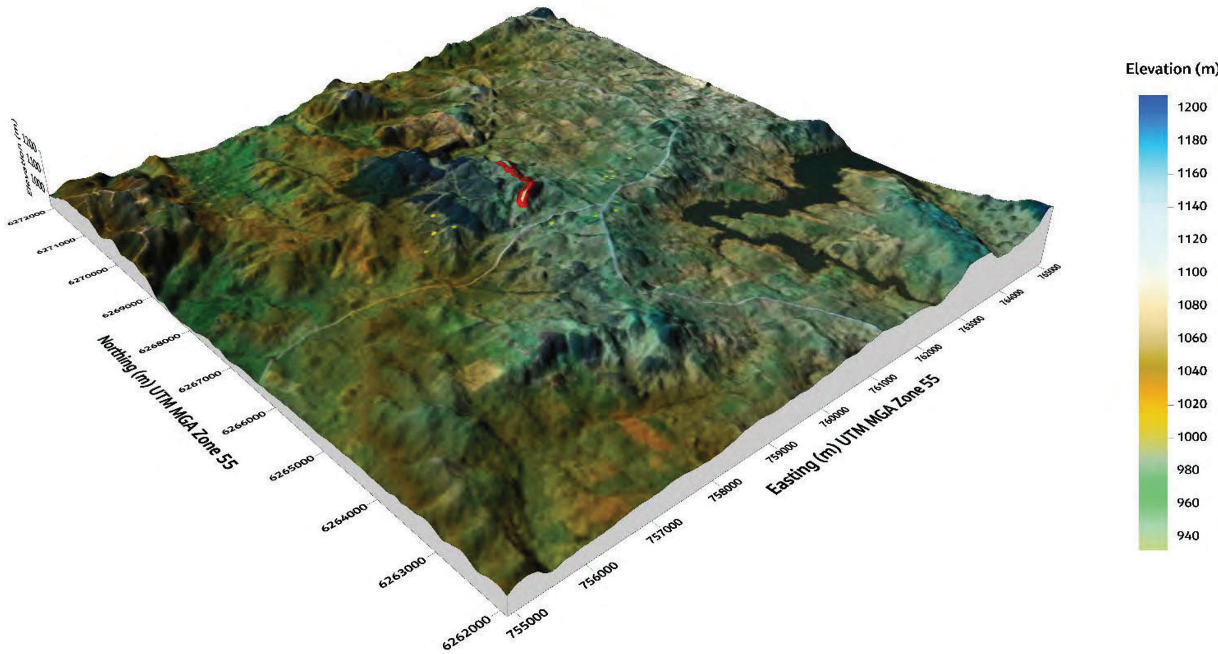


Figure 4.2. Three-dimensional schematic of proposal setting

As displayed, elevations within the air quality study area range from around 940 to 1200 metres above sea level. Elevations at the site range are around 1,150 metres above sea level. As listed above in **Table 4.1**, most identified nearby receivers are at locations with approximately the same elevation as the proposal site. Receivers R1, R3, R18 and R19 are all at elevations around 100 metres or more below the site.

4.3 Meteorology

Meteorological conditions are important for determining the transport of emissions, and the potential influences on air quality. In addition, meteorological data are often used with concurrent air quality data to determine potential contributions from sources of interest. This section provides an analysis of meteorological data collected near the Project and identifies the datasets that may be representative of the long term, local conditions.

The EPA prescribes the minimum requirements for meteorological data that are to be used for air quality assessments. These requirements are outlined in the Approved Methods and include minimum data capture rates, siting and operation, and data preparation. Two types of meteorological stations are described by the EPA:

- "Site specific"; and
- "Site representative".

Data from site-specific meteorological stations are preferred for air quality assessments however site representative data is also acceptable provided that analysis indicate that the data adequately describes the expected meteorological conditions at the site of interest.

There are no known meteorological stations around the site, however the Bureau of Meteorology (BoM) and NSW Department of Planning and Environment (DPE) operate automatic weather stations throughout NSW. As listed below in **Table 4.2**, the nearest stations to the site are both in Bathurst. Both are 35 kilometres distance from the site and are unlikely to collect data that accurately represent conditions around the site, primarily due to terrain effects. Meteorological modelling has therefore been used to derive local conditions.

Table 4.2. Details of representative meteorological station

Station	Operated by	Approximate co-ordinates UTM MGA 55		Elevation (m)	Approx. distance (km) from the site	Approx. direction from the site
		Easting (m)	Northing (m)			
Bathurst Airport (Station no. 063291)	BoM	746802	6299899	745	35	North northwest
Bathurst SewageTreatment Plant (STP)	DPE	739441	6301208	651	39	Northwest

Consistent with the NSW EPA's Approved Methods, meteorological data from the five most recent calendar years (2017, 2018, 2019, 2020 and 2021) were analysed to identify overall and year-to-year trends, and to identify a representative year for use in the dispersion modelling. This review is presented below in **Table 4.3**.

Table 4.3. Meteorological review

Parameter	BoM Bathurst Airport						DPE Bathurst					
	2017	2018	2019	2020	2021	5 year average	2017	2018	2019	2020	2021	5 year average
Data completeness (%)	99.9	99.9	100	100	100	**99.9**	99.7	99.9	99.6	99.6	96.0	**99.0**
Mean wind speed (m/s)	3.4	3.4	3.4	3.4	3.2	**3.3**	1.7	1.6	1.6	1.8	1.8	**1.7**
99th percentile wind speed (m/s)	9.7	9.8	10.1	9.3	9.0	**9.6**	6.4	6.9	6	7.0	6.6	**6.6**
Percentage of calms (%)	5.8	7.4	7.0	6.3	8.8	**7.1**	25.4	26.7	27.4	24.5	21.4	**25.1**
Percentage of winds >6 m/s (%)	13.2	13.0	13.9	12.5	10.8	**12.7**	1.4	1.9	1.0	2.4	1.8	**1.7**
Wind direction distribution (%)												
North	7	7	6	9	8	**7**	7	8	7	8	8	**8**
Northeast	17	18	17	19	19	**18**	12	12	13	14	13	**13**
East	15	15	13	15	12	**14**	10	8	8	10	10	**9**
Southeast	11	12	11	11	12	**11**	15	17	14	14	15	**15**
South	12	11	11	9	10	**11**	9	11	10	8	9	**9**
Southwest	15	15	17	15	16	**16**	10	11	13	10	11	**11**
West	13	13	15	13	12	**13**	11	12	14	13	12	**12**
Northwest	11	10	10	10	10	**10**	26	21	21	23	23	**23**
Wind speed distribution (%)												
0 to 0.5 m/s	6	7	7	6	9	**7**	26	27	27	25	22	**25**
0.5 to 2 m/s	24	24	24	23	24	**24**	41	41	41	40	42	**41**
2 to 4 m/s	35	35	36	36	35	**35**	24	23	23	24	25	**24**
4 to 6 m/s	21	21	19	22	21	**21**	8	7	8	9	9	**8**
6 to 8 m/s	10	10	9	10	8	**9**	1	2	1	2	2	**2**
8 to 10 m/s	3	3	4	2	2	**3**	0	0	0	0	0	**0**
> 10 m/s	1	1	1	1	0	**1**	0	0	0	0	0	**0**

Parameter	BoM Bathurst Airport						DPE Bathurst					
	2017	2018	2019	2020	2021	5 year average	2017	2018	2019	2020	2021	5 year average
		Within 1% of 2016 to 2020 5-year average										
		Within 1 to 2% of 2016 to 2020 5-year average										

As displayed in **Table 4.3**, over the years reviewed, the mean wind speed ranged from 3.2 to 3.4 m/s at BoM's Bathurst Airport station and from 1.6 to 1.8 m/s at DPE's station located at Bathurst STP. The 99th percentile wind speeds (i.e. wind speeds only exceeded one percent of the time) were also consistent, ranging between 9 and 10.1 m/s BoM's Bathurst Airport station and from 6 to 7 m/s at the DPE station. The percentage occurrence of calm conditions (i.e. when wind speeds were recorded less than 0.5 m/s) ranged between 5.8 and 8.8 %, and 21.4 and 27.4 % at the BoM and DPE Bathurst stations respectively.

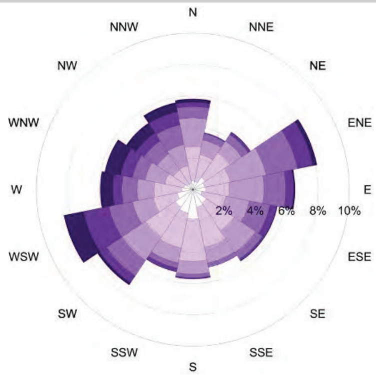
There are notable differences in the wind speeds observed from both stations, with the average and 99th percentile speeds recorded at the DPE Bathurst station being considerably lower than at BoM's Bathurst Airport station. The frequency of winds greater than 6 m/s are also much lower, with the frequency of calm conditions recorded as being around 18% higher. These results are not expected given that the stations are only located 7 kilometres apart.

AS/NZS 3580.1.1:2016 provides guidance of avoiding the siting of meteorological stations within '10 x height of the obstruction' metres of the monitor to avoid associated obstructions and interferences. Aerial imagery reveals the presence of several structures within 50-60 metres (10 x 5-6 metre building height), suggesting that the results recorded at the DPE station may be obstructed. This is supported by the results from other stations located throughout central NSW where recorded meteorology are more consistent with the observations at BoM's Bathurst Airport station. Further, the Bathurst Airport Station is located at a more comparable elevation (745 metres) compared to the site (see **Section 4.2** above) than the DPE station (651 metres). Considering these factors, data from BoM's Bathurst Airport station have been considered for the identification of a suitable metrological year for the assessment.

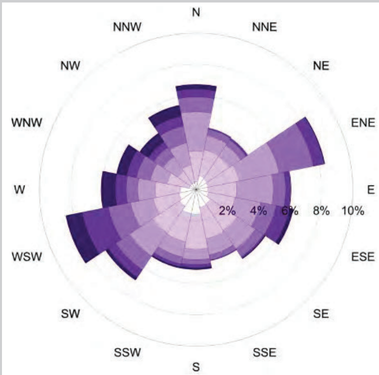
Annual meteorological datasets used for the purpose of dispersion modelling in NSW are required to be contain records that are at least 90% complete. As listed in **Table 4.3**, the 90% data capture target was achieved at BoM's Bathurst Airport station for all five years reviewed. Annual and seasonal wind roses displayed below in **Figure 4.3** were developed for further analysis to identify a representative year for modelling.

2017	2018	2019	2020	2021

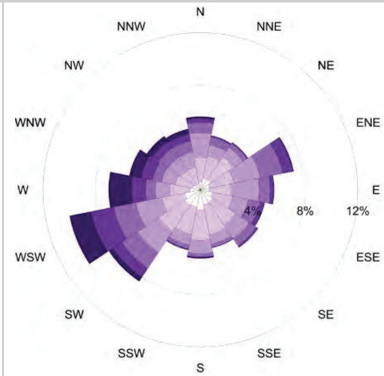
Annual



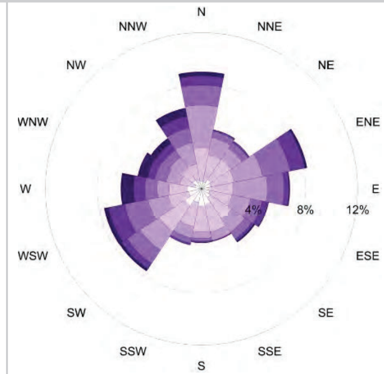
Calms:5.8%



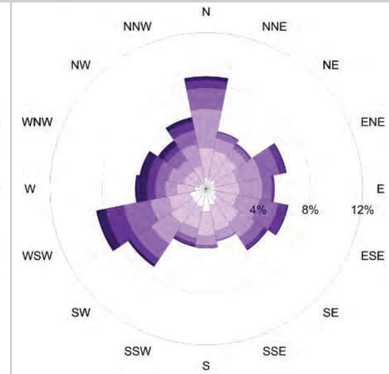
Calms:7.4%



Calms:7.0%

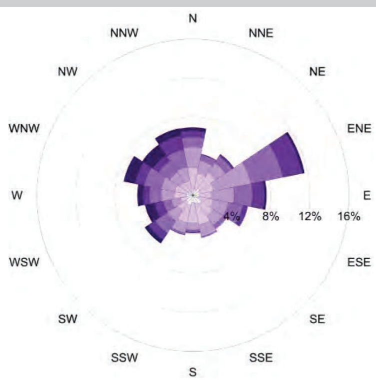


Calms:6.3%

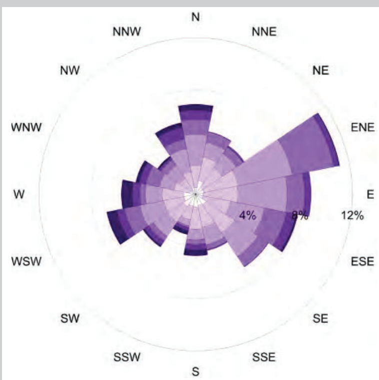


Calms:8.8%

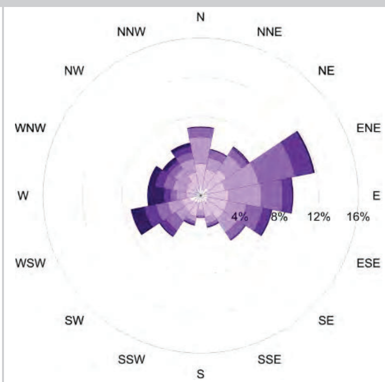
Summer



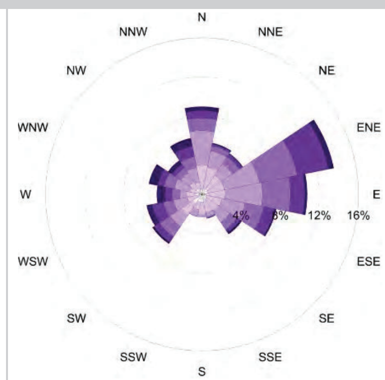
Calms:5.0%



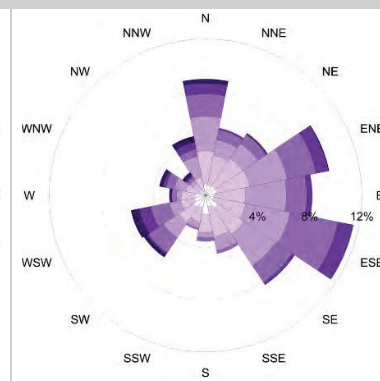
Calms:5.4%



Calms:6.2%

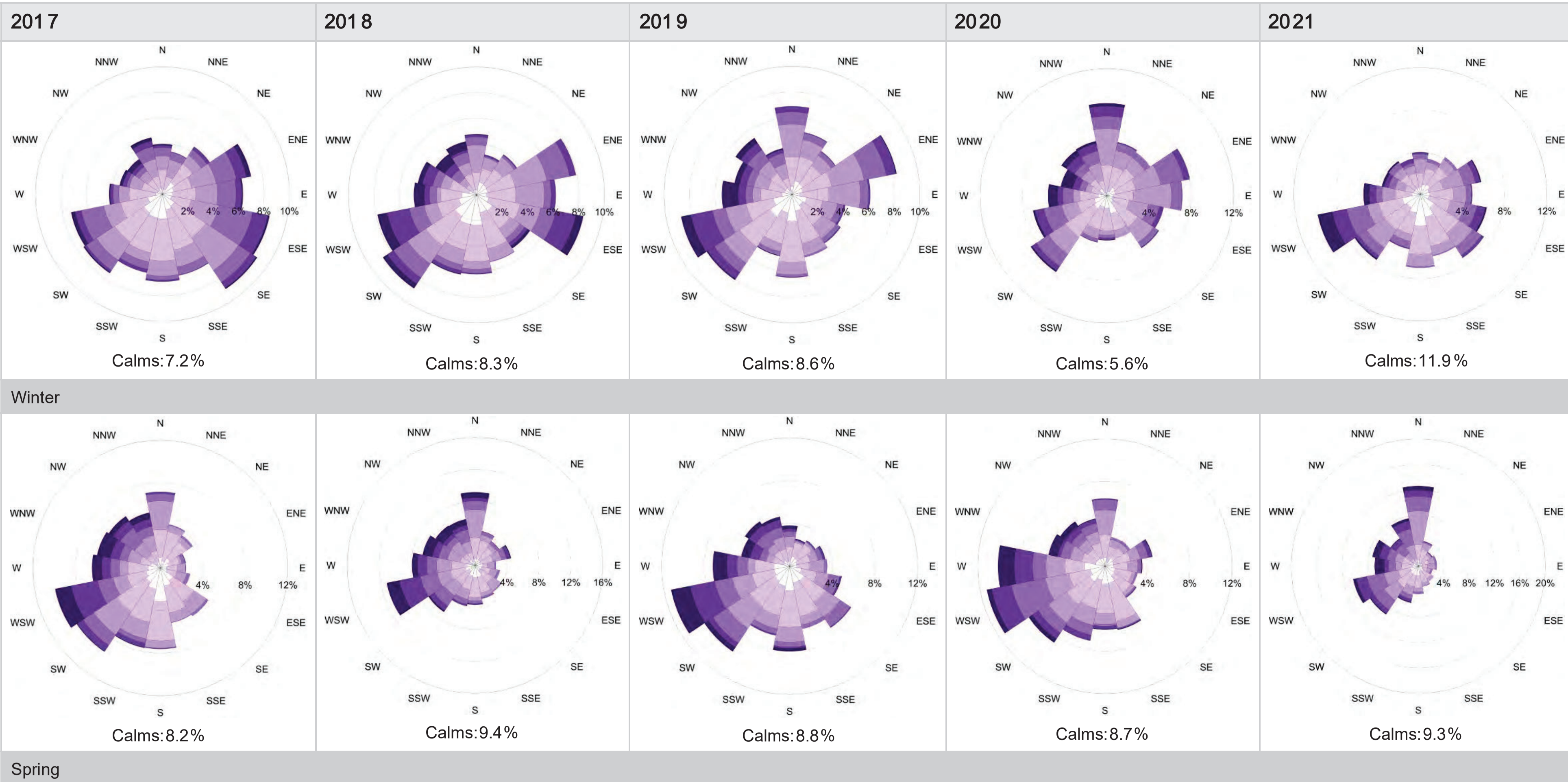


Calms:4.3%



Calms:6.9%

Autumn


2017
2018
2019
2020
2021
Calms: 7.2%
Calms: 8.3%
Calms: 8.6%
Calms: 5.6%
Calms: 11.9%
Winter
Calms: 8.2%
Calms: 9.4%
Calms: 8.8%
Calms: 8.7%
Calms: 9.3%
Spring

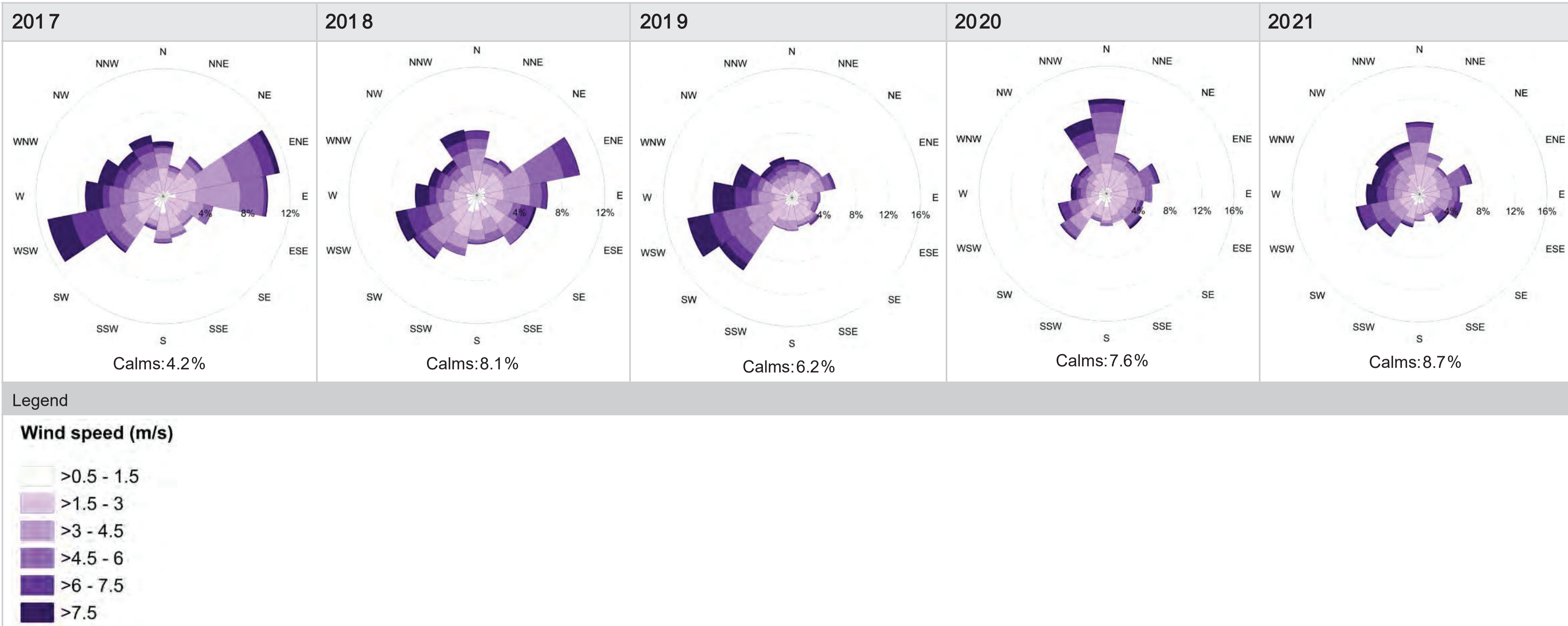


Figure 4.3. Annual and seasonal wind roses forBoM Bathurst, 2017 to 2021

As displayed in **Figure 4.3**, annual and seasonal wind roses were consistent across all five years with the following trends observed:

- Annual: Winds blowing from the west-southwest and east-northeast most common, with winds from the north and east-southeast also occurring often;
- Summer: Similar trends to those observed annually, with winds blowing from the east-northeast most common
- Autumn: Similar trends to those observed annually, with winds blowing from the southeast also common
- Winter: Winds blowing from the north and west-southwest occurring most often.
- Spring: Similar trends to those observed annually.

Considering the consistency of observations, none of the five years were excluded as being an unsuitable representative meteorological year. Background air quality trends outlined below in **Section 4.4** were therefore also reviewed to identify a suitable representative year for the purpose of the assessment.

4.4 Background air quality

4.4.1 Overview

To provide a comprehensive assessment of impacts against the relevant air quality criteria (see **Section 0**), it is necessary to have information or estimates of the existing air quality conditions. Although there is no air quality monitoring undertaken at or directly around the site, there a number of regional monitoring stations operated by DPE which can be used to provide an indication of the air quality conditions in similar, rural environments. Details of these monitoring locations are listed in **Table 4.4** below.

Table 4.4. Summary of relevant air quality monitoring stations

Station location	Operated by	Type	Approximate distance (km) and direction from the proposal	Type	Pollutant(s) of interest monitored
Bathurst	DPE	Regional air quality monitoring station	40 km to the northwest	TEOM, BAM	PM_{10}, $PM_{2.5}$
Orange	DPE	Regional air quality monitoring station	82 km to the northwest	TEOM, BAM	PM_{10}, $PM_{2.5}$
Beresfield	DPE	Regional air quality monitoring station	200 km to the northeast	Chemiluminescence $NO/NO_2/NO_X$ Analyzer	NO_x
Albion Park	DPE	Regional air quality monitoring station	130 km to the southeast		NO_x
Goulburn	DPE	Regional air quality monitoring station	115 km to the south		NO_x

TEOM= Tapered element oscillating microbalance and BAM = Beta attenuation monitor

As listed in **Table 4.4**, the nearest regional air quality monitoring stations operated by DPE are at Bathurst and Orange. The Orange monitoring station was only commissioned in January 2019. PM_{10} and $PM_{2.5}$ data were considered from these two stations. The assessment of plant exhaust emissions and blast fume also requires an understanding of background NO_2 concentrations, which is not monitored at Bathurst or Orange. Measured NO_2 data were considered from Beresfield, Albion Park, Wagga Wagga and Goulburn in order to establish suitable background levels for these components of the assessment.

The quality or level of completeness is an important factor in determining whether data are suitable for the purpose of representing background air quality conditions in the environmental around a proposal. Generally, a data capture rate of 90% or more is considered acceptable, taking into account periods of servicing, calibration and maintenance. **Table 4.5** summarises the rate of data capture at both of the monitors.

Table 4.5. PM_{10} and $PM_{2.5}$ data capture rates (per cent)

Year	DPE Bathurst	DPE Orange
PM_{10}		
2017	97%	ND
2018	98%	ND
2019	99%	93%
2020	98%	97%
2021	96%	99%
$PM_{2.5}$		
2017	94%	ND
2018	95%	ND
2019	95%	93%
2020	98%	97%
2021	99%	99%

'ND' = No data, station not yet commissioned; '-' = not measured at station; 'N/A' = not applicable to the assessment; and below 90% quality objective

PM_{10} and $PM_{2.5}$ capture rates higher than 90 per cent were met at both DPE Bathurst and Orange stations for all years that they operated (5 and 3 years respectively). This indicates the suitability of the data sets collected over the last five years.

Capture rates of NO_2 data for DPE Beresfield, Albion Park and Goulburn stations in 2017, 2018, 2019, 2020 and 2021 are listed below in **Table 4.6**.

Table 4.6. NO_2 data capture rates (per cent)

Year	DPE Beresfield	DPE Albion Park	DPE Goulburn
NO_2			
2017	92%	93%	ND
2018	92%	93%	ND
2019	84%	91%	ND
2020	86%	83%	89%
2021	85%	58%	89%

'ND' = No data, station not yet commissioned; '-' = not measured at station; 'N/A' = not applicable to the assessment; and below 90% quality objective

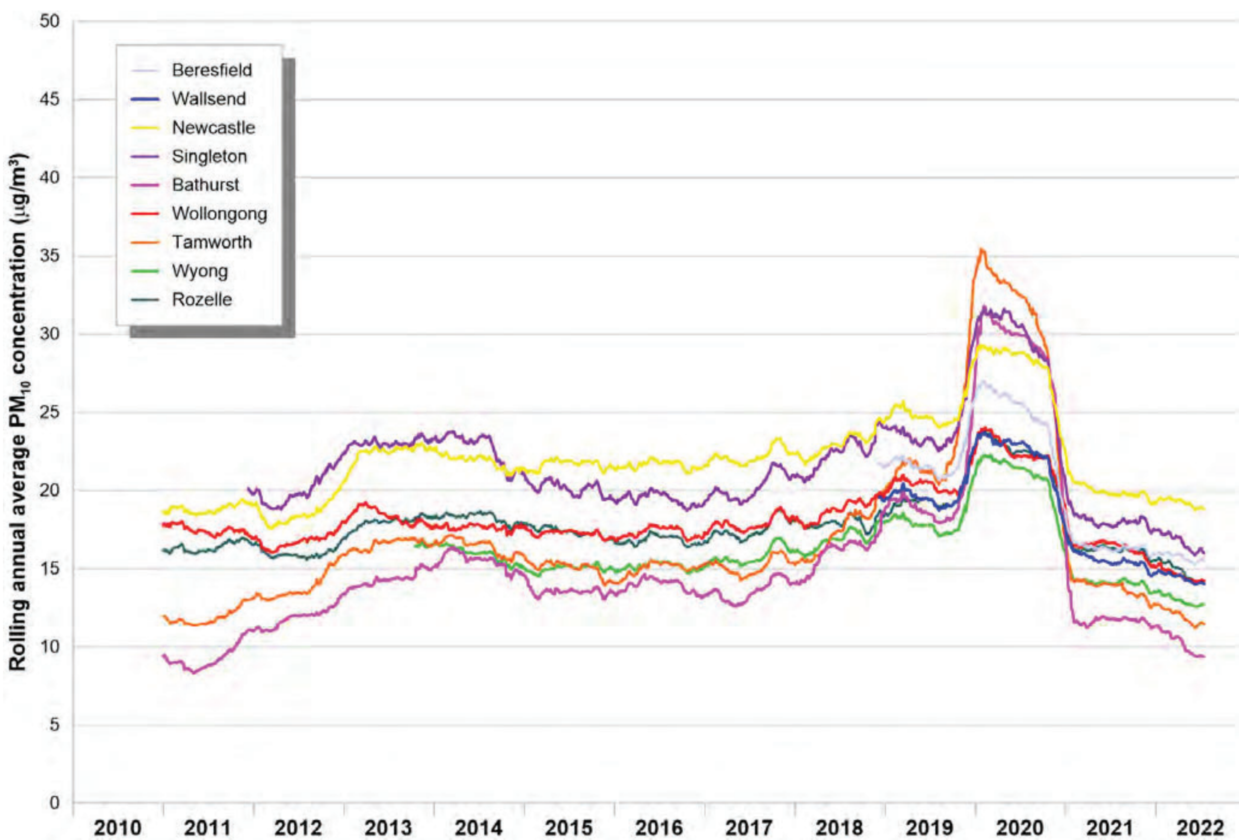
As displayed, there were several years where hourly NO_2 capture rates were less than 90%.

4.4.2 Extraordinary events

Air quality in many parts of NSW, including the Central Tablelands, was adversely influenced by drought conditions between 2017 and early 2020 with lower-than-average rainfall. A deterioration in air quality conditions in recent years was not unique to the Central Tablelands and extraordinary events, beyond normal conditions, have been identified as part of annual reviews of monitoring data.

In their ‘Annual Air Quality Statement 2018’ the DPE concluded that particle levels increased across NSW due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH, 2019). The DPE subsequently concluded, from their “Annual Air Quality Statement 2019”, that air quality in NSW was greatly affected by the continuing intense drought conditions and unprecedented extensive bushfires during 2019. In addition, the continued “intense drought has led to an increase in widespread dust events throughout the year” (DPIE, 2020).

The influence of drought conditions on air quality is evident in the DPE’s monitoring data. **Figure 4.4** shows the rolling annual average PM_{10} concentrations from data collected at various rural and urban air quality monitoring sites since 2011. These data clearly show an increase in PM_{10} concentrations at all rural and urban locations from 2017 onwards, reflecting the onset of drought conditions, and increased bushfire activity in 2019 and into early 2020.



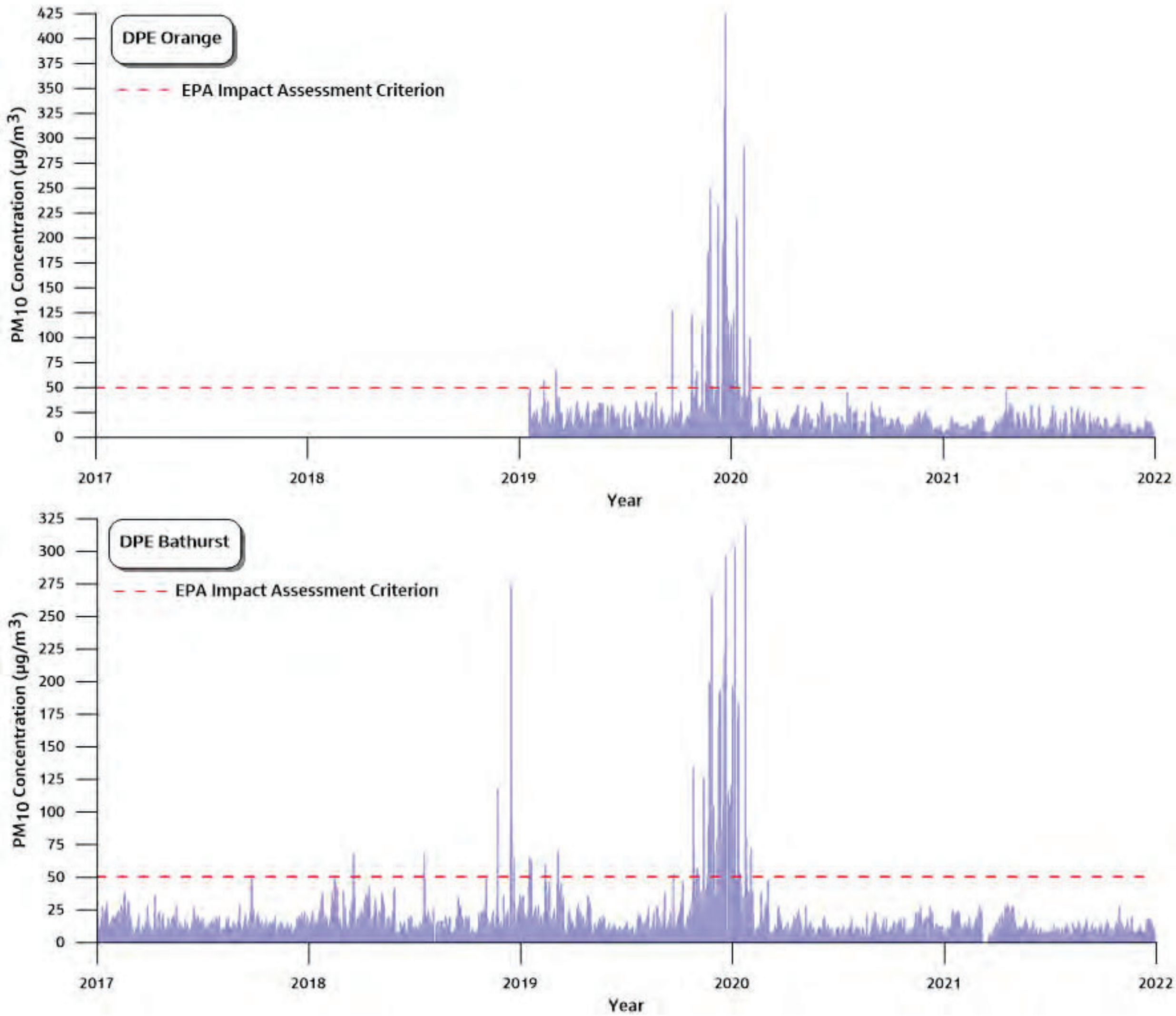
Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.4. Annual average PM_{10} concentrations from various NSW air quality monitoring sites

The use of years with elevated air quality levels, largely driven by extraordinary events or extreme climatic conditions (or both) are avoided in modelling studies primarily because they do not address the definition of representative. In addition, extraordinary events cannot be reliably simulated in air dispersion models as it is not possible to identify all possible factors that led to these events, for example, the factors that influence the time, location and intensity of bushfires. This context has been considered in the analysis below.

4.4.3 Particulate matter as PM_{10}

Continuous PM10 measurements are collected at DPE's Orange and Bathurst stations. Time-series of daily (that is, 24-hour average) measurements from 2017 to 2021 is displayed below in **Figure 4.5**. The NSW EPA's daily impact assessment criterion of 50 µg/m3 is also displayed.



Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.5. Measured 24-hour average PM_{10} concentrations at DPE Bathurst and Orange, 2017 to 2021

As shown in **Figure 4.5**, from 2017 to 2021 there were several instances where daily PM_{10} concentrations exceeded 50 µg/m^3. **Table 4.7** summarises these results.

Table 4.7. Summary of PM_{10} measurement statistics at DPE Bathurst and Orange, 2017 to 2021

Year	DPE Bathurst	DPE Orange	Criterion
Maximum 24-hour average in µg/m^3			
2017	49.9	ND	50
2018	274.1	ND	
2019	296.6	423.7	

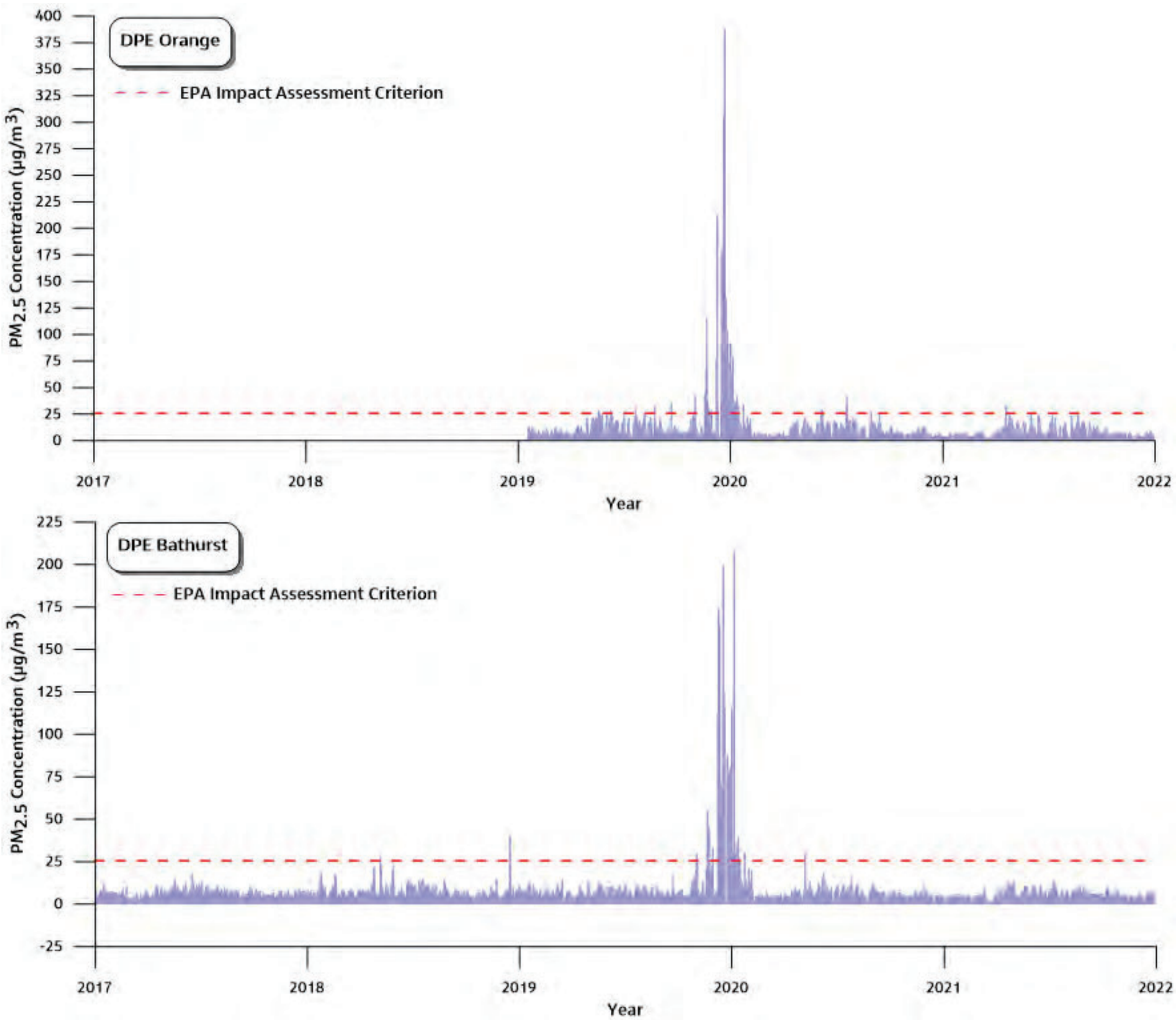
Year	DPE Bathurst	DPE Orange	Criterion
2020	320.4	291.8	
2021	29.2	46.3	
Number of days above 24-hour average criteria (50 µg/m^3)			
2017	0	ND	-
2018	8	ND	
2019	40	35	
2020	14	12	
2021	0	0	
Annual average in µg/m^3			
2017	14.1	ND	30
2018	18.8	ND	
2019	27.4	28.3	25 (applicable from 20 Jan 2017 onwards)
2020	17	17.9	
2021	11.3	11.4	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

As evident in **Table 4.7** there was a higher frequency of exceedances in 2019 compared with other years. A high number of these exceedances occurred in the fourth quarter, corresponding to an unprecedented fire season, causing a significant deterioration in air quality throughout Central and Eastern Australia. This is reflected in the higher annual average PM_{10} concentration at Bathurst (27 µg/m^3) compared with previous years.

4.4.4 Particulate matter as $PM_{2.5}$

PM2.5 is also monitored at the DPE's Orange and Bathurst stations. Like for PM10, only limited years of data were available, particularly from the Orange station. **Figure 4.6** shows a time-series of daily measurements collected from 2017 to 2021, with the 25 µg/m3 NSW EPA daily impact assessment criterion also displayed.



Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Figure 4.6. Measured 24-hour average $PM_{2.5}$ concentrations at DPE Bathurst and Orange, 2017 to 2021

As for PM_{10}, there were several days where $PM_{2.5}$ concentrations exceeded the NSW EPA's 25µg/m^3 impact assessment criterion. **Table 4.8** summarises these results.

Table 4.8. Summary of $PM_{2.5}$ measurement statistics at DPE Bathurst and Orange, 2017 to 2021

Year	DPE Bathurst	DPE Orange	Criterion
Maximum 24-hour average in µg/m^3			
2017	17.5	ND	-
2018	40.5	ND	

Year	DPE Bathurst	DPE Orange	Criterion
2019	199.5	387.4	25 (applicable from 20 Jan 2017 onwards)
2020	207.3	92.3	
2021	13.8	32.3	
Number of days above 24-hour average criteria (25 µg/m^3)			
2017	0	ND	-
2018	2	ND	
2019	24	31	
2020	13	15	
2021	0	3	
Annual average in µg/m^3			
2017	6.1	ND	-
2018	7	ND	
2019	11.3	15.8	8 (applicable from 20 Jan 2017 onwards)
2020	7.6	9.1	
2021	5.1	6.6	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

As for PM_{10}, **Table 4.8** shows how maximum daily $PM_{2.5}$ concentrations were recorded several times higher (up to 387 µg/m^3) than the EPA's impact assessment criterion (25 µg/m^3) during the 2019/20 Australian bushfires. Annual $PM_{2.5}$ concentrations exceeded 8 µg/m^3 at both stations in 2019, and also in 2020 at Orange.

4.4.5 Total suspended particulates (TSP)

Air quality criteria for TSP are usually set to protect against nuisance amenity impacts. No known monitoring of TSP is conducted near the Project. The NSW Minerals Council estimated that, for rural environments in NSW, the average PM_{10} concentrations are typically 40 per cent of the TSP concentrations (Minerals Council, 2000). **Table 4.9** shows the estimated TSP concentrations at the DPE monitoring locations based on this PM_{10} to TSP relationship. Concentrations are estimated to be much lower than the EPA assessment criterion. Even lower concentrations would be expected near the Project.

Table 4.9. Estimated TSP concentrations

Year	DPE Bathurst	DPE Orange	Criterion
Annual average in µg/m^3			
2017	35.3	ND	90
2018	47	ND	
2019	68.5	70.8	
2020	42.5	44.8	
2021	28.3	28.5	

4.4.6 Deposited dust

As outlined in the AQMP (Umwelt, 2019), deposited dust monitoring was completed at four locations around the site. The location of the four gauges are displayed below in **Figure 4.7**.

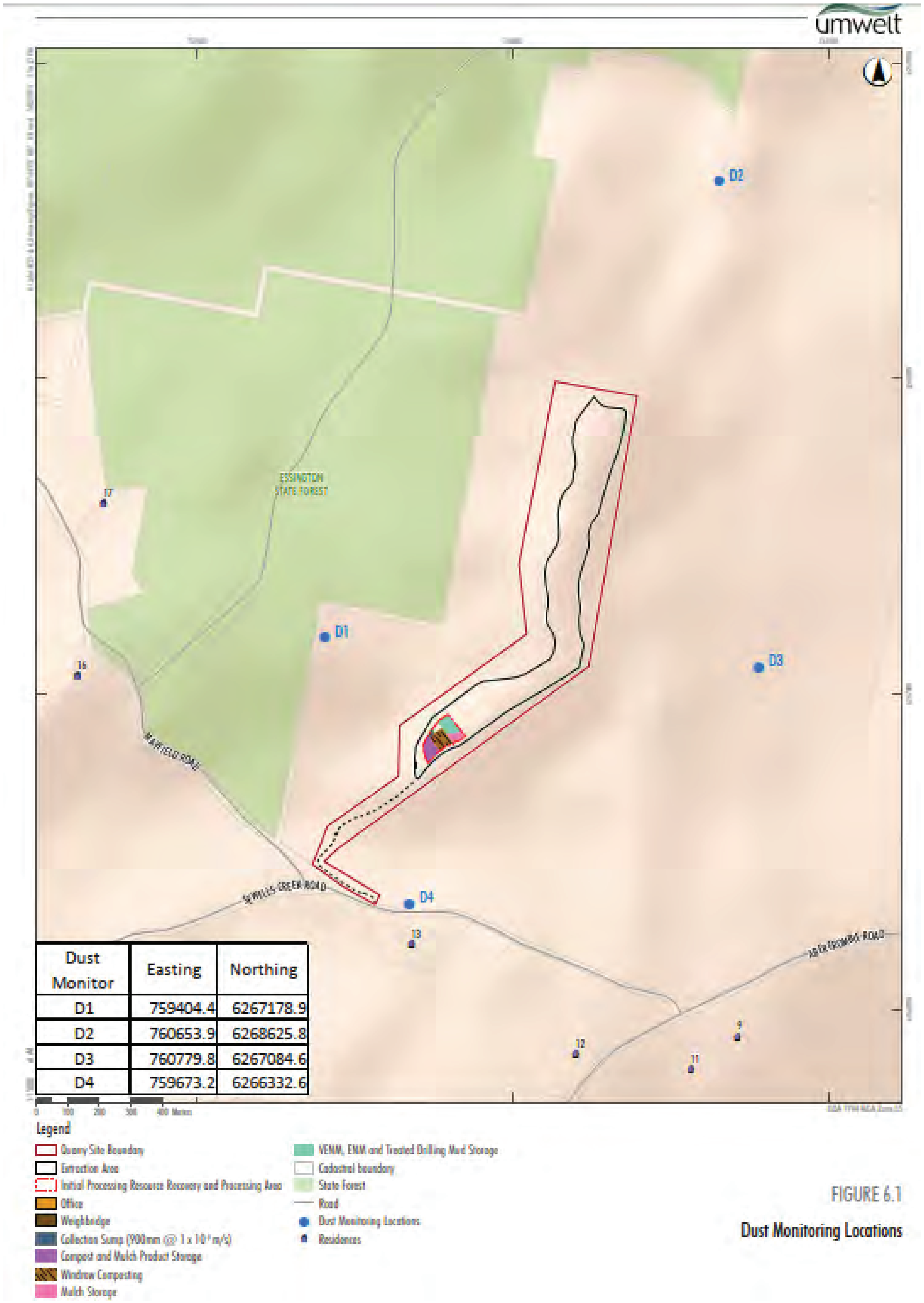


Figure 4.7. Site deposited dust monitoring locations (Source: Umwelt, 2019)

Results from these monitors for 2021 are summarised below in **Table 4.10**. As listed, the highest annual average measured was 0.9 g/m^2/month at gauge D4. These results indicate that in 2021, local deposited dust levels remained below the EPA's 4 g/m^2/month impact assessment criterion.

Table 4.10. Measured local deposited dust levels around the site (Source: Oberon Earthmoving, 2022)

Period	Reported insoluble solids (g/m^2/month)				EPA impact assessment criterion (g/m^2/month)
	D1	D2	D3	D4	
January 2021	0.1	0.2	0.4	0.5	4
February 2021	0.4	0.2	0.5	1.2	
March 2021	0.7	0.7	0.6	0.7	
April 2021	0.6	0.3	0.4	0.9	
May 2021	0.2	<0.1	0.2	0.4	
June 2021	1.0	0.5	0.3	1.3	
July 2021	0.5	0.9	ND	ND	
August 2021	0.6	ND	ND	0.8	
September 2021	1.1	1.0	0.3	1.0	
October 2021	1.5	0.8	0.6	0.7	
November 2021	0.8	ND	0.1	1.0	
December 2021	1.6	1.6	0.1	1.7	
2021	**0.8**	**0.6**	**0.4**	**0.9**	

4.4.7 Nitrogen dioxide

The assessment of plant exhaust emissions and blast fume also requires an understanding of background NO_2 concentrations. Table 4.11 provides a summary of the measured NO_2 concentrations from DPE's Beresfield, Albion Park and Goulburn stations from 2017 to 2021. These data show that the maximum NO_2 concentrations have not exceeded the EPA's 1-hour average assessment criterion of 164 µg/m^3 with the exception of Goulburn in 2020. Annual averages have not exceeded the EPA's annual average assessment criterion of 31 µg/m^3.

Table 4.11. Summary of representative NO_2 measurements

Year	DPE Beresfield	DPE Albion Park	DPE Goulburn	Criterion
Maximum 1-hour average in µg/m^3				
2017	82	78	ND	164
2018	82	80	ND	
2019	115	84	ND	
2020	72	80	**203**	
2021	70	66	60	
Annual average in µg/m^3				
2017	18	8	ND	31
2018	18	8	ND	
2019	16	8	ND	
2020	14	6	6	
2021	12	4	6	

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Nitrogen dioxide is a component of NO_x. Emissions of NO_x from combustion related sources will include both nitric oxide (NO) and NO_2. In general, at the point of emission, NO will comprise the greatest proportion of the total NO_x emission. Typically, this is 90% by volume of the NO_x. The remaining 10% will comprise mostly NO_2.

Ultimately however, much of the NO emitted into the atmosphere is oxidised to NO_2. The rate at which this oxidisation takes place depends on prevailing atmospheric conditions including temperature, humidity and the presence of other substances in the atmosphere such as ozone. It can vary from a few minutes to many hours. The rate of conversion is important because from the point of emission to the point of maximum ground-level concentration there will be an interval of time during which some oxidation will take place. If the dispersion is sufficient to have diluted the plume to the point where the concentration is very low, then the level of oxidation is unimportant. However, if the oxidation is rapid and the dispersion is slow then high concentrations of NO_2 can occur.

The NO_x monitoring data from the DPE Beresfield, Albion Park and Goulburn monitors in 2021 show that percentage of NO_2 in the NO_x is inversely proportional to the total NO_x concentration, and when NO_x concentrations are high, the percentage of NO_2 in the NO_x is typically of the order of 20% or less. This is demonstrated by **Figure 4.8** which shows that, for high NO_x concentrations, the NO_2 to NO_x ratio reduces to less than 20%.

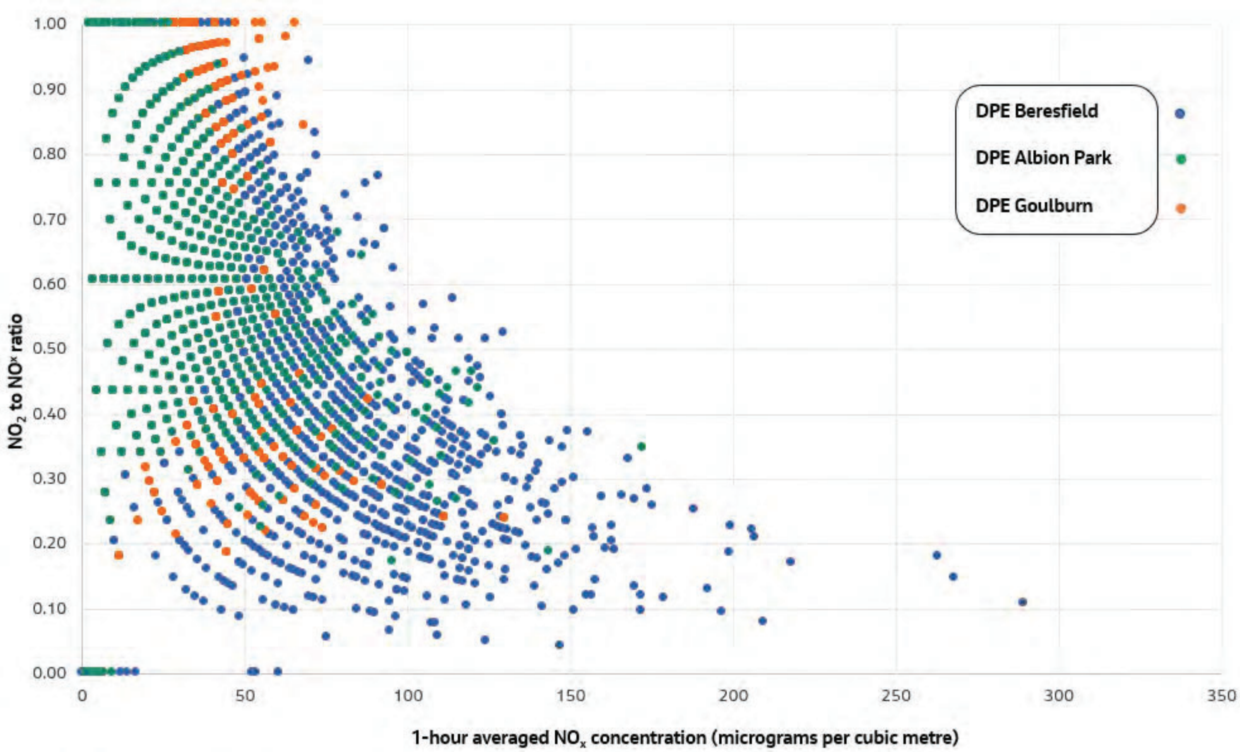


Figure 4.8. Measured NO_2 to NO_x ratios from hourly average data collected at DPE Beresfield, Albion Park and Goulburn in 2021

Source: https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

4.5 Selection of a representative assessment year and establishment of background air quality conditions

The review of the existing environment led to the following observations:

- Meteorological conditions do not vary significantly from year to year and conditions in 2021 can be considered as representative of the long-term conditions near the site.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal location.

- Concentrations of key air quality indicators would be expected to be lower near the proposal than in areas of higher population densities (i.e., where the monitoring data considered for the assessment were collected).

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to proposal contributions for the assessment of potential cumulative impacts. Table 4.12 shows the assumed background levels that apply at sensitive receptors. These levels have been added to proposal contributions to determine the potential cumulative impacts, as per the Approved Methods.

Table 4.12. Adopted background air quality conditions

Pollutant	Averaging time	Adopted value	Justification	EPA impact assessment criterion
Particulate matter as PM_{10}	24-hour	Variable by day, noting the maximum daily concentration observed being 29.2 µg/m^3	Measured PM_{10} concentrations from DPE Bathurst in the representative year, 2021	50 µg/m^3
	Annual	11.3 µg/m^3		25 µg/m^3
Particulate matter as $PM_{2.5}$	24-hour	Variable by day, noting the maximum daily concentration observed being 13.8 µg/m^3	Measured $PM_{2.5}$ concentrations from DPE Bathurst in the representative year, 2021	25 µg/m^3
	Annual	5.1 µg/m^3		8 µg/m^3
Particulate matter, TSP	Annual	28.3 µg/m^3	Estimated annual average concentration for Bathurst in the representative year, 2021	90 µg/m^3
Deposited dust	Annual	0.9 g/m^2/ month	Highest deposited dust level measured across all four deposited dust gauges surrounding the site in 2021	4 g/m^2/ month
Nitrogen dioxide (NO_2)	1-hour	70 µg/m^3	Highest NO_2 concentration from DPE Beresfield, Albion Park and Goulburn in the representative year, 2021	164 µg/m^3
	Annual	12 µg/m^3		31 µg/m^3

5. Assessment methodology

5.1 Operational dust

Potential dust impacts associated with the proposed modification have been quantified by air dispersion modelling. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporal and spatial varying flow fields due to influences of the local complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions. The CALPUFF model has been selected. This model is specifically listed in the Approved Methods and has been used to predict ground-level particulate matter concentrations and deposition levels due to the Proposal and other sources. Concentrations and deposition levels have been simulated for every hour of the representative year and results at local communities and sensitive receptors have then been compared to the relevant air quality assessment criteria. Figure 5.1 shows an overview of the model inputs and how they interact. Each are described in further detail, including details of how CALPUFF was configured below.

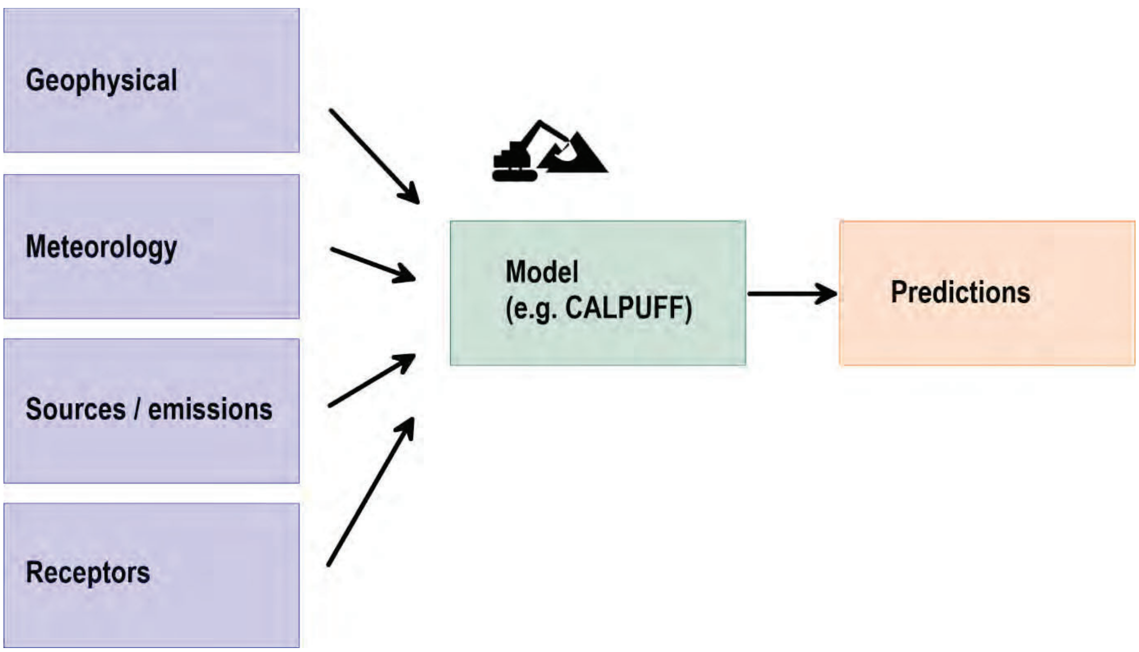


Figure 5.1. Overview of model inputs

5.1.1 Geophysical

The geophysical inputs of the model are the terrain and land -use information applied. These are displayed below in Figure 5.2. Elevations across the modelling domain were determined using 1 second (30 metre) digital elevation data from the Shuttle Research Topography Mission (SRTM). Land uses were digitised from aerial imagery and classified in-line with the land use types specified in 'CALPUFF Modeling System Version 6 User Instructions', (TRC, 2011).

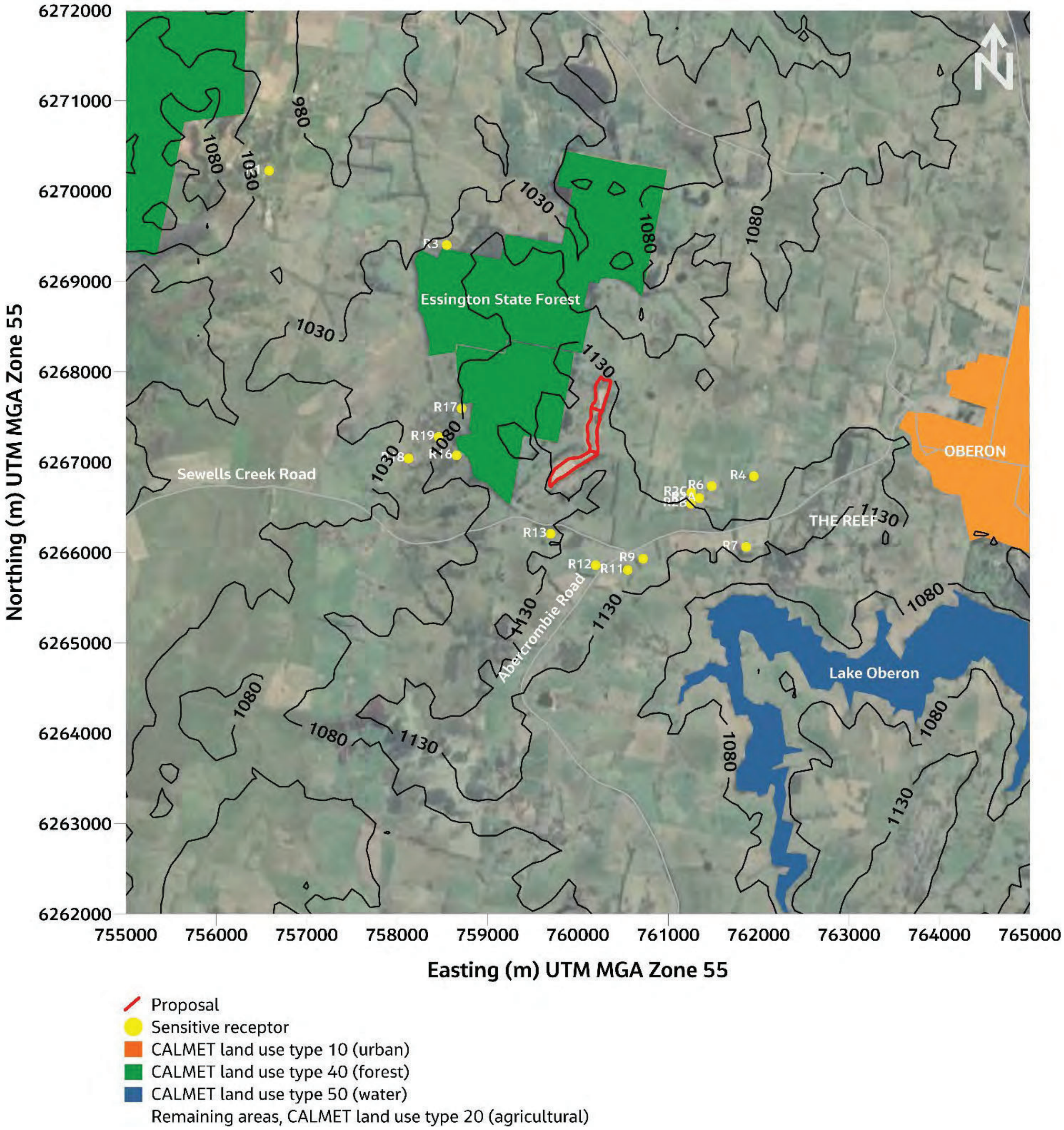


Figure 5.2. Terrain and land use inputs

5.1.2 Meteorology

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

Meteorological data collected in 2021 from the BoM Bathurst Airport surface station and upper air data generated by TAPM at this location were used to initialise the CALMET model. The meteorological modelling followed the guidance of TRC (2011) and adopted the "observations" mode. Key setup details for TAPM and CALMET are listed in **Table 5.1** and **Table 5.2** respectively.

Table 5.1. TAPM setup details

Aspect	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2021, with one "spin-up" day.
Centre of analysis	33°42' S, 149°48.5' E
Terrain data source	Shuttle Research Topography Mission (SRTM), 90 m resolution
Land use data source	Default
Meteorological data assimilation	BoM Bathurst Airport Station Radius of influence = 5 km. Number of vertical levels for assimilation = 4 Quality factor = 1

Table 5.2. CALMET setup details

Aspect	Value(s)
Model version	6.334
Run mode	"observations" mode
Terrain data source(s)	NASA SRTM 1 second 30 metre resolution dataset
Land-use data source(s)	Digitized from aerial imagery and classified as displayed above in **Figure 5.2**.
Meteorological grid domain	10.3 km x 10.3 km x 2km (vertically)
Meteorological grid resolution	0.1 km
Meteorological grid dimensions	103 x 103 x 9
Meteorological grid origin	754850 m E, 6261850 m S. MGA Zone 55
Surface meteorological inputs	BoM Bathurst Airport Station for observations of wind speed and wind direction. TAPM for temperature, relative humidity, air pressure, ceiling height and cloud cover.
Upper air meteorological inputs	Upper air data file for the location of BoM Bathurst Airport Station derived by TAPM Biased towards surface observations (-1, -0.8, -0.6, -0.4, -0.2, 0, 0, 0, 0)
Simulation length	8760 hours (1 Jan 2021 to 31 Dec 2021)
R1, R2	0.5, 1.0
RMAX1, RMAX2	5, 20
TERRAD	4

Using this approach, the meteorological conditions displayed in **Figure 5.3** were predicted at the approximate location of the proposal.

Figure 5.3. Site meteorology

As Figure 5.3 shows, winds blowing from the north, west southwest and southwest were predicted to occur most often annually at the site. The simulation may over-estimate the frequency of winds blowing from the north, although this is not considered to represent an issue noting that the nearest sensitive receptors are located to the south of the site (i.e., conservatively in the direction of these winds from the site). The winds blowing from the west, west southwest and southwest are well represented in the dataset, which are also expected to be a significant feature at the site given its location in the Central Tablelands to the west of the Blue Mountains. The frequency of calm conditions (9.8%) consistent with what was observed at BoM's Bathurst Airport station in 2021. This is important, noting that low wind speeds contribute to poor dispersion which can result in elevated near-field concentrations.

5.1.3 Sources and emissions

Dust (particulate matter) will be the most significant emission to air during proposal and estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing details of the proposal and identifying the location and intensity of dust-generating activities. Operational parameters have been combined with emissions factors:

- Emission Estimation Technique Manual for Mining (NPI, 2012); and
- AP 42 (US EPA 1985 and updates).

Dust emissions inventories were developed for three stages of operations:

- **Stage 1:** Stage 1 involves the continued blasting and extraction of materials from Cell 1 as displayed below in Figure 5.4. Imported materials would also be managed in the central portion of Cell 1, with crushing and screening of excavated materials and waste concrete products and product storage also taking place in this general location. The new storage area for composting materials would also be in-use.
- **Stage 2:** Blasting and extraction of materials moves to Cell 2 (see Figure 5.4 below). A mobile unit would be established at Cell 2 to crush and screen excavated materials directly within the cell. Waste concrete materials would continue to be crushed and screened at the same location as for Stage 1 using the fixed units. Imported materials would continue being managed in the central portion of Cell 1, and use of the new storage area for composting materials would continue.
- **Stage 3:** Blasting and extraction of materials moves to Cell 3 (see Figure 5.4 below). A mobile unit would be established at Cell 3 to crush and screen excavated materials directly within the cell. Waste concrete materials would continue to be crushed and screened at the same location as for Stage 1 using the fixed units. Imported materials would continue being managed in the central portion of Cell 1, and use of the new storage area for composting materials would continue. Rehabilitation of Cell 2 would be underway, noting that Cell 1 is unlikely to be rehabilitated until completion.

The location of each source as represented in the dispersion model is displayed below in Figure 5.4. The specific locations where each source/activity was set for each of the three assessment stages above is listed in Table 5.3, with the specific TSP, PM_{10} and $PM_{2.5}$ emission rates (kilograms per year) applied as detailed in Table 5.4. Further details of how each emission rate was determined is provided in Appendix A, with the basis for the control effectiveness applied outlined in Table 5.5.

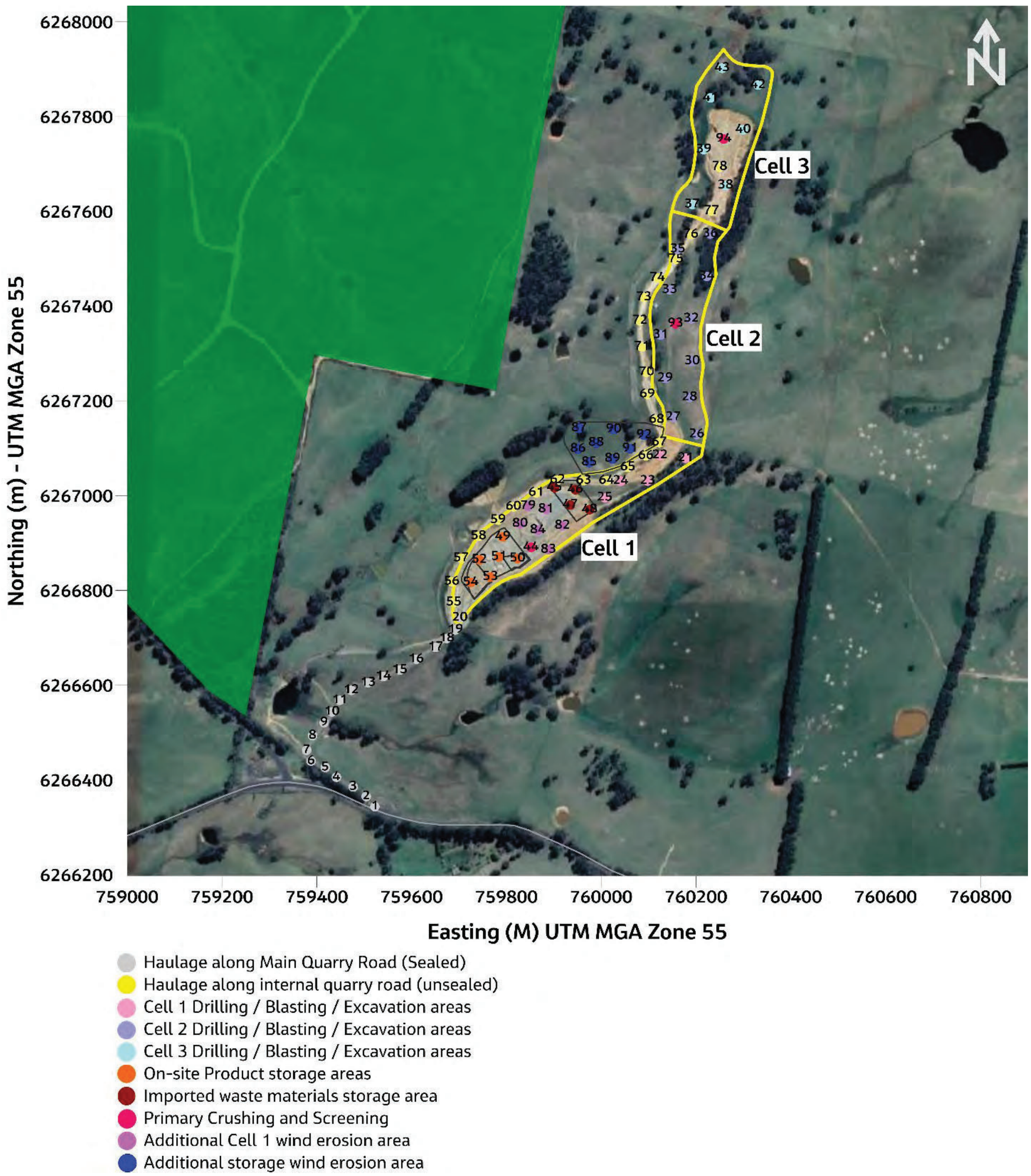


Figure 5.4. Operational dust assessment source locations

Table 5.3. Source locations

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
On-site won materials			
Drilling	21 to 25	26 to 36	37 to 43
Blasting	21 to 25	26 to 36	37 to 43
Dozers on raw materials	21 to 25	26 to 36	37 to 43

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
Excavators loading raw materials to trucks	21 to 25	26 to 36	37 to 43
Hauling raw materials from pit to processing units	21 to 25, 59 to 67 and 80	26 to 36	37 to 43
Unloading raw materials to processing units	44	93	94
Primary crushing	44	93	94
Screening	44	93	94
Front end loader loading product to trucks	44	93	94
Hauling product to storage stockpiles	49 to 54	31, 57 to 71 and 49 to 54	57 to 78
Unloading product to storage stockpiles	49 to 54	49 to 54	49 to 54
Wind erosion from stored product in stockpiles	49 to 54	49 to 54	49 to 54
Loading product for export	49 to 54	49 to 54	49 to 54
Off-site export of product via sealed quarry access road	1 to 20	1 to 20	1 to 20
Off-site export of product via internal unsealed internal road	55 to 59	55 to 59	55 to 59
Wind erosion from remaining Cell 1 areas	21 to 25 and 79 to 83	21 to 25 and 79 to 83	21 to 25 and 79 to 83
Wind erosion from Cell 2	N/A	26 to 36	26 to 36
Wind erosion from Cell 3	N/A	N/A	37 to 43
Management of imported resource recovery materials			
Import of organic woody waste (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20
Import of organic woody waste (haulage along unsealed internal roads)	55 to 67 and 85 to 92	55 to 67 and 85 to 92	55 to 67 and 85 to 92
Import of VENM, ENM and treated drilling mud (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	55 to 63 and 45 to 48	55 to 63 and 45 to 48	55 to 63 and 45 to 48
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	45 to 48	45 to 48	45 to 48
Import of waste concrete (haulage along sealed quarry access road)	1 to 20	1 to 20	1 to 20

Source/activity	Locations where activities were modelled		
	Stage 1	Stage 2	Stage 3
Import of waste concrete (haulage along unsealed internal roads)	55 to 59 and 80	55 to 59 and 80	55 to 59 and 80
Primary crushingof waste concrete	44	44	44
Screening of waste concrete	44	44	44
Loading of waste concrete product to trucks for storage	44	44	44
Hauling waste concrete product to storage stockpiles	79 to 84	79 to 84	79 to 84
Unloading waste concrete product to storage stockpiles	79 to 84	79 to 84	79 to 84
Wind erosion from stored waste products (exduding organic woody waste)	45 to 48	45 to 48	45 to 48
Wind erosion from composting area	85 to 92	85 to 92	85 to 92

Table 5.4. Estimated annual dust emissions, operations (kg/year)

Source/activity	Estimated annual emissions (kg/y ear)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
On-site won materials									
Drilling	9	5	0	9	5	0	9	5	0
Blasting	70	36	3	70	36	3	70	36	3
Dozers on raw materials	5,236	1,135	550	5,236	1,135	550	5,236	1,135	550
Excavators loading raw materials to trucks	566	268	28	566	268	28	566	268	28
Hauling raw materials from pit to processing units	6,846	1,947	97	3,423	973	49	2,567	730	36
Unloading raw materials to processing units	28	10	1	28	10	1	28	10	1
Primary crushing	2,000	800	100	2,000	800	100	2,000	800	100
Screening	2,500	860	125	2,500	860	125	2,500	860	125
Front end loader loading product to trucks	28	10	1	28	10	1	28	10	1
Hauling product to storage stockpiles	1,284	365	18	13,691	3,893	195	20,537	5,840	292
Unloading product to storage stockpiles	5	2	0	5	2	0	5	2	0

Source/activity	Estimated annual emissions (kg/y ear)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Wind erosionfrom stored product in stockpiles	550	275	28	511	255	26	550	275	28
Loading product for export	28	10	1	28	10	1	28	10	1
Off-site export of product via sealed quarry access road	3,289	631	131	3,289	631	131	3,289	631	131
Off-site export of product via internal unsealed internal road	2,322	660	33	2,322	660	33	2,322	660	33
Wind erosion from remaining Cell 1 areas	7,796	3,898	390	7,796	3,898	390	7,796	3,898	390
Wind erosion from Cell 2	N/A	N/A	N/A	8,234	4,117	412	5,764	2,882	288
Wind erosion from Cell 3	N/A	N/A	N/A	N/A	N/A	N/A	7,534	3,767	377
Management of imported resource recovery materials									
Import of organic woody waste (haulage along sealed quarry accessroad)	411	79	16	411	79	16	411	79	16
Import of organic woody waste (haulage along unsealed internal roads)	1,209	344	17	1,209	344	17	1,209	344	17
Import of VENM, ENM and treated drilling mud (haulage along sealed quarry accessroad)	1,809	347	72	1,809	347	72	1,809	347	72
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4,789	1,362	68	4,789	1,362	68	4,789	1,362	68
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	1,320	473	66	1,320	473	66	1,320	473	66

Source/activity	Estimated annual emissions (kg/year)								
	Stage 1			Stage 2			Stage 3		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Import of waste concrete (haulage along sealed quarry accessroad)	575	110	23	575	110	23	575	110	23
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	847	241	12	847	241	12
Primary crushing of waste concrete	7,000	700	350	7,000	700	350	7,000	700	350
Screening of waste concrete	2,800	2,100	140	2,800	2,100	140	2,800	2,100	140
Loading of waste concrete product to trucks for storage	5	2	0	5	2	0	5	2	0
Hauling waste concrete product to storage stockpiles	449	128	6	449	128	6	449	128	6
Unloading waste concrete product to storage stockpiles	1	0	0	1	0	0	1	0	0
Wind erosion from stored waste products (excluding organic woody waste)	858	429	43	858	429	43	858	429	43
Wind erosion from composting area	2,628	1,314	131	2,628	1,314	131	2,628	1,314	131
Total	**57,258**	**18,540**	**2,455**	**74,438**	**25,193**	**2,992**	**85,530**	**29,448**	**3,333**

In consultation with Umwelt and Oberon Earthmoving, the controls listed in **Table 5.5** were applied in the inventories. Control efficiency values were applied consistent with guidance presented in Table 4 of NPI, 2012.

Table 5.5. Emission control measures

Source/activity	Control measure	Control efficiency (%)	Reference
Drilling	Water sprays	70%	(NPI, 2012), Table 4
Hauling materials	Watering of haulage routes	50%	(NPI, 2012), Table 4
Wind erosion	Water sprays	50%	(NPI, 2012), Table 4
	Water sprays and rehabilitation	65%	(NPI, 2012), Table 4, including multiple concurrent controls equation

5.1.4 Receptors

Predictions were made at 867 discrete receptors (including the 16 nearby sensitive receptors shown in **Figure 4.1**) to allow for contouring of results. The locations of the modelled discrete receptors are shown in **Figure 5.5**. This approach allowed the creation of a higher density of receptors near the proposal site where resulting concentrations and levels are expected to be higher.

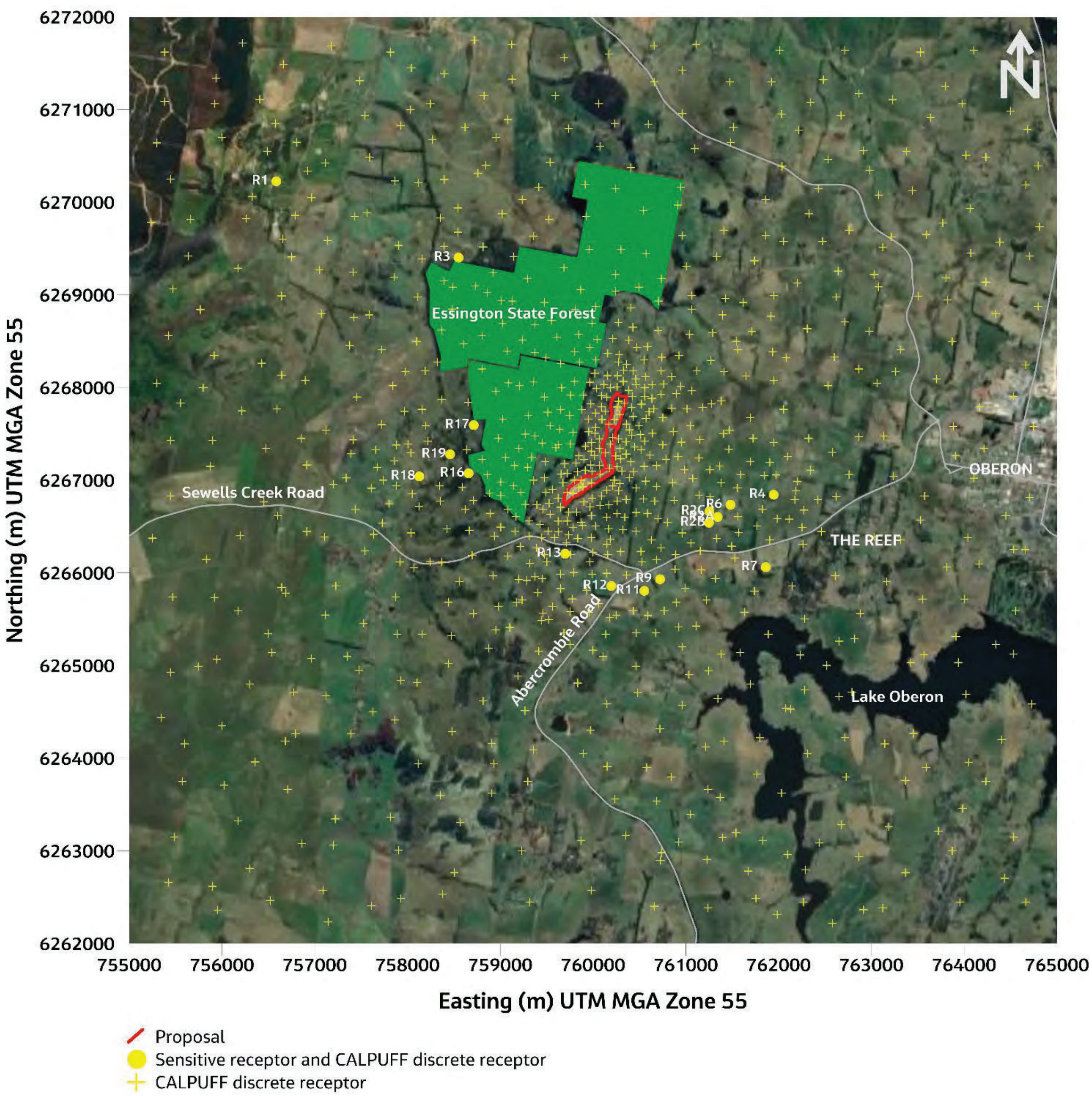


Figure 5.5. Modelled CALPUFF discrete receptors

5.1.5 Dispersion modelling

Ground-level concentration and deposition levels due to the identified emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap, and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long -range transport and near calm conditions. CALPUFF has the ability to model the effect of emissions entrained in the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA, 2016).

The modelling was performed using the geophysical, meteorological, source and receptor inputs described above with the following key settings listed in **Table 5.6** applied.

Table 5.6. CALPUFF setup details

Aspect	Value(s)
Model version	6.334
Computational grid domain	103 x 103 grid points
Chemical transformation	None
Dry deposition	Yes
Wind speed profile	ISC rural
Puff element	Puff
Dispersion option	Turbulence from micrometeorology
Time step	3600 seconds (1 hour)
Terrain adjustment	Partial plume path
Number of volume sources	See **Section 5.1.3** above
Number of discrete receptors	See **Section 5.1.4** above

5.2 Operational blast fume

Blasting activities have the potential to result in fume and particulate matter emissions. Particulate matter emissions from blasting are produced from the modelling discussed in **Section 5.1**. Post-blast fume has also been quantified by modelling.

Post-blast fume can be produced in non-ideal explosive conditions of the ammonium nitrate/fuel oil (ANFO) and is visible as an orange / brown plume. The fumes comprise of NO_x including NO and NO_2 and from the NO_x monitoring in the Lower Hunter (**Section 4.4.7**) the percentage of NO_2 in the NO_x is inversely proportional to the total NO_x concentration. When NO_x concentrations are high, the percentage of NO_2 in the NO_x is typically of the order of 20%.

The methodology for the operational post-blast fume modelling is outlined below:

- Blast modelled as a single volume source in the centre of Cell 2. It is acknowledged that moving the blast location, for example further to the north (i.e., Cell 3) or south (i.e., Cell 1), would lead to a corresponding shift in the contours, potentially changing the predicted extent of impacts. However, as discussed in **Section 6.2** that impacts are predicted to be well within assessment criteria so an alternative assumption on the blast location would not change outcomes.
- Release height of 10 m, effective plume height of 20 m, initial horizontal spread (sigma y) of 25 m and initial vertical spread (sigma z) of 10 m. These are conservative estimates based on the data presented by Attalla et al. (2008). No plume rise due to buoyancy was modelled, which is again a conservative assumption.
- Emissions assumed to occur every hour between 10 am and 3 pm.
- Blasting could be on any day of the week (a conservative assumption as the Proposal does not propose any activities on Sundays).
- NO_x emissions based on data presented in the Queensland Guidance Note for the management of oxides in open cut blasting (DEEDI, 2011). It was conservatively assumed that the initial NO_2 concentration in the

plume would be 17 ppm (34.9 mg/m^3) based on the Rating 3 Fume Category in the Queensland Guidance Note.

- The initial NO_2 concentration in the plume was converted to a total NO_x emission rate based on a detailed measurement program of NO_x in blast plumes in the Hunter Valley made by Attalla et al. (2008) which found that the NO:NO_2 ratio was typically 27:1, giving a NO_x:NO_2 ratio of approximately 18.6 g NO_x/g NO_2.
- Calculated emission of 43 g/s of NO_x per blast and an emission release time of 5 minutes.
- 20% of the NO_x is NO_2 at the points of maximum 1-hour average concentrations and at sensitive receptors.

Model results for post-blast fume have been compared to the applicable EPA air quality assessment criterion for NO_2; that is 164 µg/m^3 as a 1-hour average and taking background levels into account. **Section 6.2** provides the assessment of operational post blast fume.

5.3 Operational diesel exhaust

Emissions from diesel exhausts associated with off-road vehicles and equipment at quarries are often deemed a lower air quality impact risk than dust emissions from material handling activities. This is because of the relatively few emission sources involved, for example when compared to a busy motorway, and the large distances between the sources and sensitive receptors. Nevertheless, a review of the potential impacts has been carried out, including modelling to quantify the potential level of the impacts.

The most significant emissions from diesel exhausts are products of combustion including CO, NO_x, PM_{10} and $PM_{2.5}$. It is the NO_x, or more specifically NO_2, and PM_{10} (including $PM_{2.5}$) which have been assessed. DPE monitoring data have shown that CO concentrations have not exceeded relevant air quality criteria at rural or urban monitoring stations in NSW, indicating that this indicator represents a much lower air quality risk.

The modelling for operational dust (**Section 5.1**) has considered emission factors that represent the contribution from both wheel-generated particulates and the exhaust particulates. These emission factors, including with control factors, are based on measured emissions which included diesel particulates in the form of both PM_{10} and $PM_{2.5}$. The emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (that is, older trucks). Todoroski Air Sciences has also reported (TAS, 2016) that several studies, reported to the EPA, confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission. This information highlights that the potential impacts of diesel exhaust emissions (as PM_{10} and $PM_{2.5}$) are represented in the model results for operational dust (**Section 6.1**).

Table 5.7 provides the explicit estimates of PM_{10} and $PM_{2.5}$ emissions due only to diesel plant and equipment exhausts. Emission factors for “Industrial off-road vehicles and equipment” from the EPA’s 2008 Air Emissions Inventory (EPA, 2012) were used for the calculations and it has been assumed that there will be no reduction to emissions in the future; a conservative approach. These factors relate to diesel exhaust and evaporative emissions.

Table 5.7. Estimated PM_{10} and $PM_{2.5}$ emissions from diesel engines

Parameter	Existing	Proposed
Estimated fuel usage(kL/y) (Source:Oberon Earthmoving)	35	55
PM_{10} calculations		
Diesel exhaust emission factor (kg/kL)	2.84	2.84
Diesel exhaust emissions- all equipment (kg/y)	99	157
$PM_{2.5}$ calculations		
Diesel exhaust emission factor (kg/kL)	2.75	2.75
Diesel exhaust emissions- all equipment (kg/y)	96	152

Emissions of NO_x from diesel exhausts have been estimated using fuel consumption data, provided by Oberon Earthmoving, and an emission factor from the EPA's Air Emissions Inventory for 2008 (EPA, 2012). **Table 5.8** shows the calculations. Again, it has been assumed that there will be no reduction to emissions in the future; a conservative approach.

Table 5.8. Estimated NO_x emissions from diesel engines

Parameter	Existing	Proposed
Estimated fuel usage(kL/y) (Source:Oberon Earthmoving)	35	55
NO_x calculations		
Diesel exhaust emission factor (kg/kL)	40.77	40.77
Diesel exhaust emissions- all equipment (kg/y)	1,427	2,242

The NO_x emission estimates for Stage 2 have been explicitly modelled to provide an indication of the off -site NO_2 concentrations due to diesel exhaust emissions. This was selected being the most representative, centrally located stage. **Section 6.3** provides the assessment of operational diesel exhaust.

5.4 Road transport

As well as emissions generated from processing and operational activities, an assessment of emissions associated with the transportation of quarry products was also completed. Emissions from transportation along internal roads have already considered as outlined above. Roads and Maritime Services air quality screening tool known as TRAQ ("Tool for Roadside Air Quality") was used to assess the effects of diesel emissions from trucks transporting quarry products along public roads. TRAQ adopts emission factors from the EPA's Motor Vehicle Emissions Inventory (MVEI) and uses the CALINE air dispersion model to predict the maximum near roadside air pollutant concentrations based on traffic volume, traffic mix, traffic speed, road type, road grade, and other factors. The model considers conservative, worst-case conditions to determine the potential for impacts. . The key conservative assumptions include worst-case wind angles, stable atmospheric conditions, and low winds that allow for high air pollutant concentrations to occur. A high-level summary of the assessment process is shown in **Figure 5.6**.

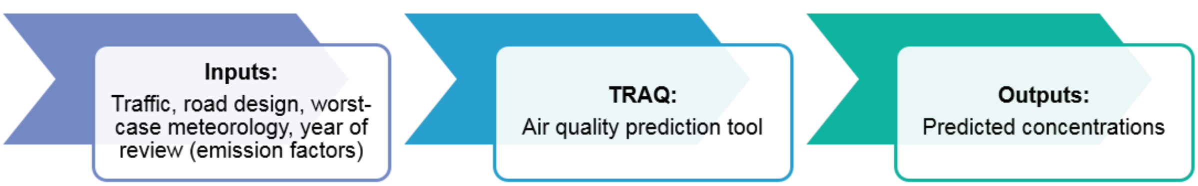


Figure 5.6. Overview of TRAQ assessment process

The key input settings that were applied in the model are listed below in **Table 5.9**.

Table 5.9. TRAQ inputs

Aspect	Value(s)
Model version	TRAQ version 1.3 (2017)
Modelled meteorological conditions	Worst-case meteorological conditions assumed (that is, wind speed of 1 metre per second, Pasquil atmospheric stability Class F (i.e. highly stable), and 15 degrees Celsius).
Assessment location	Worst-case, roadside along Italia Road and the pacific highway
Road geometry	Single lane in either direction (representing conditions on surrounding local roads including Sewells Creek Road, Beaconsfield Road, Mayfield Road and O'Connell Road)
Traffic inputs	Maximum of 180 truck movements per day

Aspect	Value(s)
Vehicle emissions	2021 NSW EPA emission factors were conservatively applied, noting that these generally improve into the future. Emissions included worst-case cold start effects.

Results were assessed by comparing predictions with impact assessment criteria from the EPA's Approved Methods. This aspect of the assessment is presented below in **Section 6**.

5.5 Crystalline silica

Silica (SiO_2) occurs in abundance in nature and comprises minerals composed of silicon and oxygen. It exists in crystalline and amorphous forms which relate to the structural arrangement of the oxygen and silicon atoms. Only the crystalline forms are known to be fibrogenic (that is, dust which causes an increase of scar tissue after deposition in the gas exchange region of the lung) and only the respirable particles, being those which are capable of reaching the gas exchange region of the lungs, are considered in determining health effects of crystalline silica.

Dust from quarrying activities such as crushing may contain silica. The potential impacts have been informed by ambient monitoring carried out by Buttai Gravel at the Martins Creek Quarry (Jacobs, 2020). **Section 6.5** presents the assessment.

6. Assessment of impacts

6.1 Operational dust

6.1.1 Overview

This section presents and discusses the results of the operational dust assessment by classification of particulate matter. The significance of the predictions was assessed by evaluating the cumulative (i.e., background plus change as a result of the proposal) concentrations and levels against the criteria and guidance from the EPA's Approved Methods as well as the VLAMP presented in **Section 3**.

6.1.2 Particulate matter as PM_{10}

Predicted contributions from the proposal and cumulative annually averaged PM_{10} concentrations at the identified surrounding sensitive receptors are shown below in **Table 6.1**. The cumulative concentrations consider an annual PM_{10} background concentration of 11.3 μg/m^3 as established above in **Section 4.5**.

Table 6.1. Predicted results, annually averaged PM_{10}

Receptor	Proposal contribution (μg/m^3)			Cumulative concentration (μg/m^3)			EPA criterion (μg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<11.4	<11.4	<11.4	25
R2A	0.1	0.1	0.2	11.4	11.4	11.5	
R2B	0.1	0.2	0.2	11.4	11.5	11.5	
R2C	0.1	0.2	0.2	11.4	11.5	11.5	
R3	<0.1	<0.1	<0.1	<11.4	<11.4	<11.4	
R4	0.1	0.1	0.1	11.4	11.4	11.4	
R6	0.1	0.1	0.1	11.4	11.4	11.4	
R7	0.1	0.1	0.1	11.4	11.4	11.4	
R9	0.1	0.2	0.2	11.4	11.5	11.5	
R11	0.2	0.2	0.2	11.5	11.5	11.5	
R12	0.3	0.3	0.3	11.6	11.6	11.6	
R13	0.4	0.4	0.4	11.7	11.7	11.7	
R16	0.1	0.1	0.1	11.4	11.4	11.4	
R17	0.1	0.1	0.1	11.4	11.4	11.4	
R18	<0.1	<0.1	0.1	<11.4	<11.4	11.4	
R19	0.1	0.1	0.1	11.4	11.4	11.4	

As **Table 6.1** displays, cumulative annually averaged PM_{10} concentrations were predicted to remain below the EPA's 25 μg/m^3 impact assessment criterion at all surrounding sensitive receptors, during all assessed stages of the proposal. Annually averaged PM_{10} contributions from the proposal are also displayed as ground-level concentration contour plots below in **Figure 6.1** for all three assessment stages considered.

Figure 6.1. Ground-level concentration contours, proposal annually averaged PM_{10} contributions

The maximum 24-hour averaged PM_{10} concentration in 2021 at the DPE's Bathurst station was 29.2 µg/m^3 (see **Section 4.5**). As such the objective of this aspect of the assessment was to determine whether the proposal could result in exceedances of the EPA's 50 µg/m^3 criterion at the surrounding sensitive receptors. The results from the dispersion modelling are listed below in **Table 6.2** (contributions from the proposal are also displayed as ground-level concentration contours below in **Figure 6.2**). The cumulative concentrations conservatively consider the worst-case (i.e., highest 29.2 µg/m^3 2021 DPE Bathurst measured value) rather than applicable time-varying concentration.

Table 6.2. Predicted results, maximum 24-hour averaged PM_{10}

Receptor	proposal contribution (µg/m³)			Cumulative concentration (µg/m³)			EPA criterion (µg/m³)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	0.1	0.1	0.1	29.3	29.3	29.3	50
R2A	0.8	1.2	1.1	30.0	30.4	30.3	
R2B	1.0	1.2	1.2	30.2	30.4	30.4	
R2C	0.9	1.3	1.2	30.1	30.5	30.4	
R3	0.2	0.2	0.2	29.4	29.4	29.4	
R4	0.6	0.7	0.9	29.8	29.9	30.1	
R6	0.7	1.1	1.0	29.9	30.3	30.2	
R7	0.8	1.0	1.0	30.0	30.2	30.2	
R9	1.7	1.6	1.6	30.9	30.8	30.8	
R11	1.4	1.4	1.4	30.6	30.6	30.6	
R12	2.2	2.4	2.4	31.4	31.6	31.6	
R13	4.2	4.7	4.8	33.4	33.9	34.0	
R16	0.5	0.7	0.7	29.7	29.9	29.9	
R17	0.6	0.7	0.7	29.8	29.9	29.9	
R18	0.3	0.4	0.4	29.5	29.6	29.6	
R19	0.4	0.4	0.5	29.6	29.6	29.7	

As shown, even with the conservatively adopted background assumption, maximum 24-hour averaged PM_{10} concentrations were predicted to remain below the 50 µg/m³ impact assessment criterion. This was the case at all identified surrounding sensitive receptors, and for all three assessment stages considered.

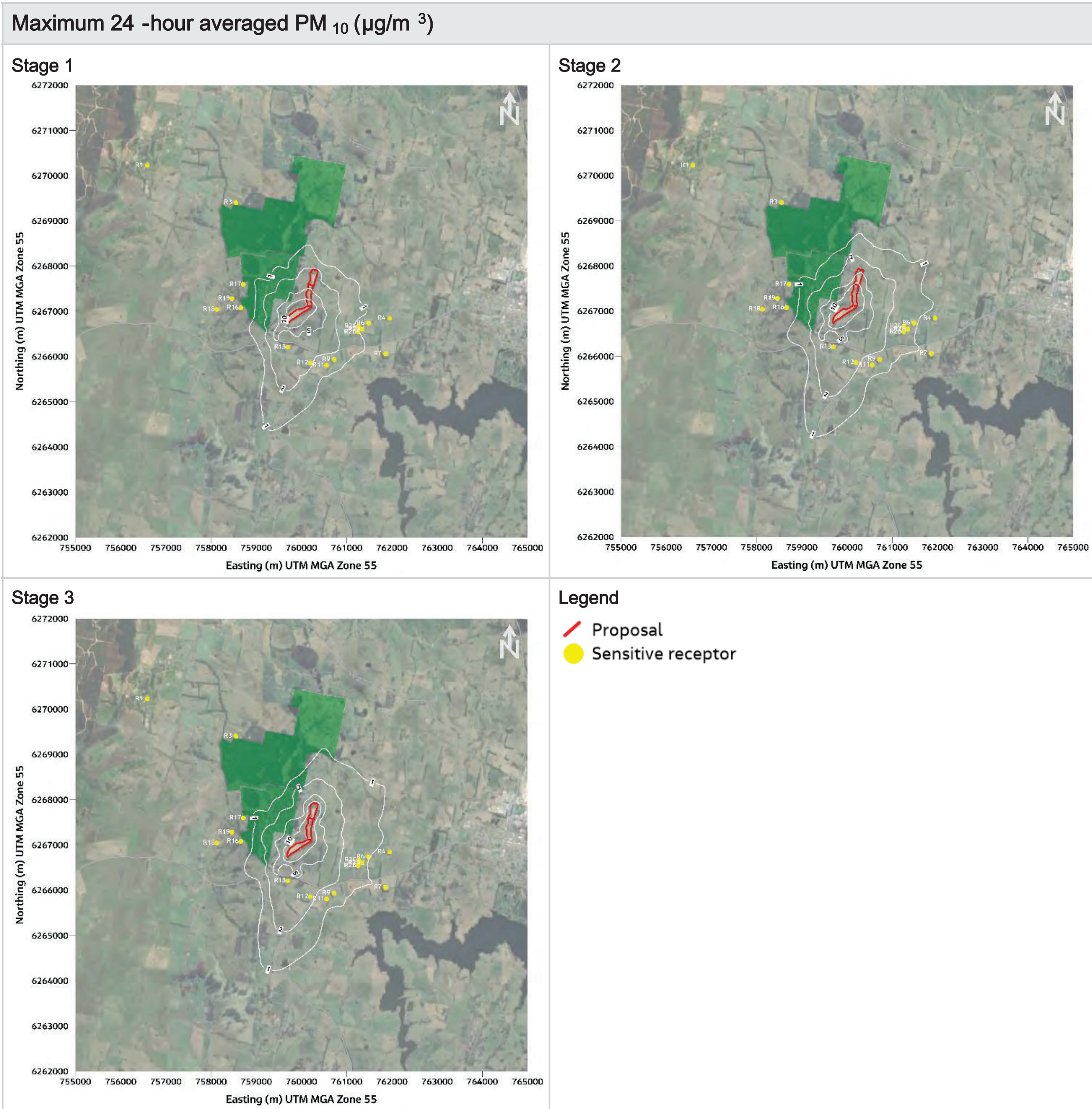


Figure 6.2. Ground-level concentration contours, proposal maximum 24-hour averaged PM_{10} contributions

Based on the results presented and discussed above it was determined that there would be no unacceptable changes in annually averaged and maximum daily PM_{10} concentrations at surrounding sensitive receptors over the operational life of the proposal. Still, measures to control PM_{10} emissions from the proposal are recommended in **Section 7**.

6.1.3 Particulate matter as $PM_{2.5}$

Predicted changes in annually averaged $PM_{2.5}$ concentrations as a result of the proposal are listed below in **Table 6.3**. The cumulative concentrations consider an annual $PM_{2.5}$ background concentration of 5.1 µg/m^3 as determined in **Section 4.5**. Contributions from the proposal are also displayed as ground-level concentration contour plots below in **Table 6.3** for all three assessment stages considered.

Table 6.3. Predicted results, annually averaged $PM_{2.5}$

Receptor	proposal contribution (µg/m^3)			Cumulative concentration (µg/m^3)			EPA criterion (µg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	8
R2A	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R2B	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R2C	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R3	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R4	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R6	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R7	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R9	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R11	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R12	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R13	0.1	0.1	0.1	5.2	5.2	5.2	
R16	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R17	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R18	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	
R19	<0.1	<0.1	<0.1	<5.2	<5.2	<5.2	

As shown, cumulative annually averaged $PM_{2.5}$ concentrations were predicted to remain below the EPA's 8 µg/m^3 impact assessment criterion. The highest predicted contribution (0.1 µg/m^3 at R13) was approximately 1% of the 8 µg/m^3 criterion, demonstrating the negligible expected effect of proposal operations on local annually averaged $PM_{2.5}$.

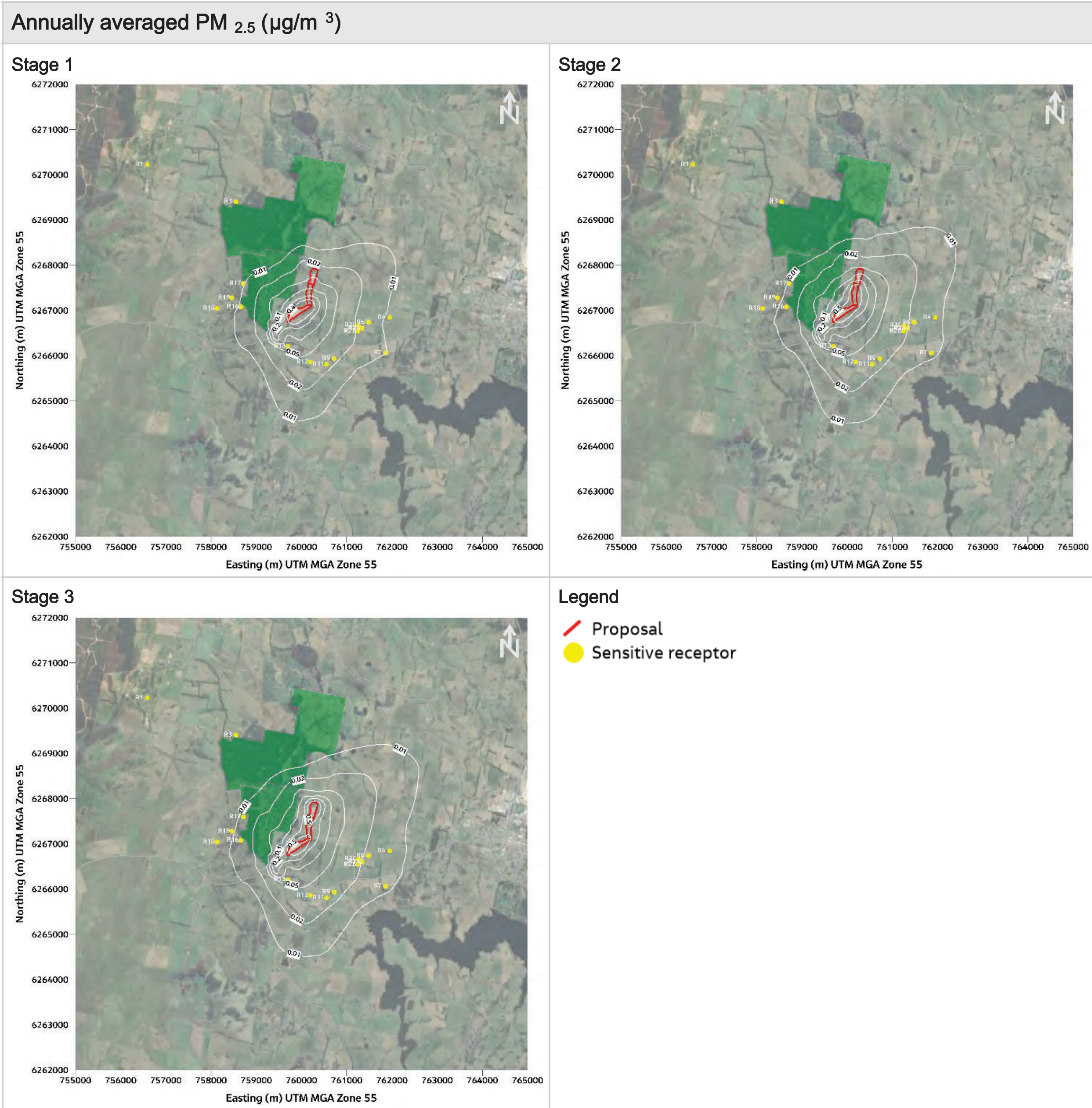


Figure 6.3. Ground-level concentration contours, proposal annually averaged $PM_{2.5}$ contributions

The maximum 24-hour averaged $PM_{2.5}$ concentration in 2021 at the DPE's Bathurst station was 13.8 µg/m^3 (refer to **Section 4.5**). Given that this is below the EPA's 25 µg/m^3 criterion, the objective of the assessment was to assess whether the proposal had the potential to result in exceedances of this value at the surrounding sensitive receptors. The results are listed below in **Table 6.4** with contributions displayed as ground-level concentration contours below in **Figure 6.4**. The. As above, the cumulative concentrations displayed conservatively consider the worst-case (i.e., highest 13.8 µg/m^3 2021 DPE Bathurst measured value) rather than applicable time-varying concentrations.

Table 6.4. Predicted results, maximum 24-hour averaged $PM_{2.5}$

Receptor	proposal contribution (µg/m³)			Cumulative concentration (µg/m³)			EPA criterion (µg/m³)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<13.9	<13.9	<0.1	25
R2A	0.1	0.1	0.1	13.9	13.9	13.9	
R2B	0.2	0.2	0.2	14.0	14.0	14.0	
R2C	0.1	0.2	0.1	13.9	14.0	13.9	
R3	<0.1	<0.1	<0.1	<13.9	<13.9	<0.1	
R4	0.1	0.1	0.1	13.9	13.9	13.9	
R6	0.1	0.1	0.1	13.9	13.9	13.9	
R7	0.1	0.1	0.1	13.9	13.9	13.9	
R9	0.3	0.3	0.2	14.1	14.1	14.0	
R11	0.2	0.2	0.2	14.0	14.0	14.0	
R12	0.4	0.3	0.3	14.2	14.1	14.1	
R13	0.6	0.5	0.5	14.4	14.3	14.3	
R16	0.1	0.1	0.1	13.9	13.9	13.9	
R17	0.1	0.1	0.1	13.9	13.9	13.9	
R18	<0.1	0.1	0.1	<13.9	13.9	13.9	
R19	0.1	0.1	0.1	13.9	13.9	13.9	

Even with this conservative approach to background levels, **Table 6.4** shows that maximum 24-hour averaged concentrations were predicted to remain below 25 µg/m³ for all three assessment stages considered.

Maximum 24-hour averaged $PM_{2.5}$ (µg/m³)

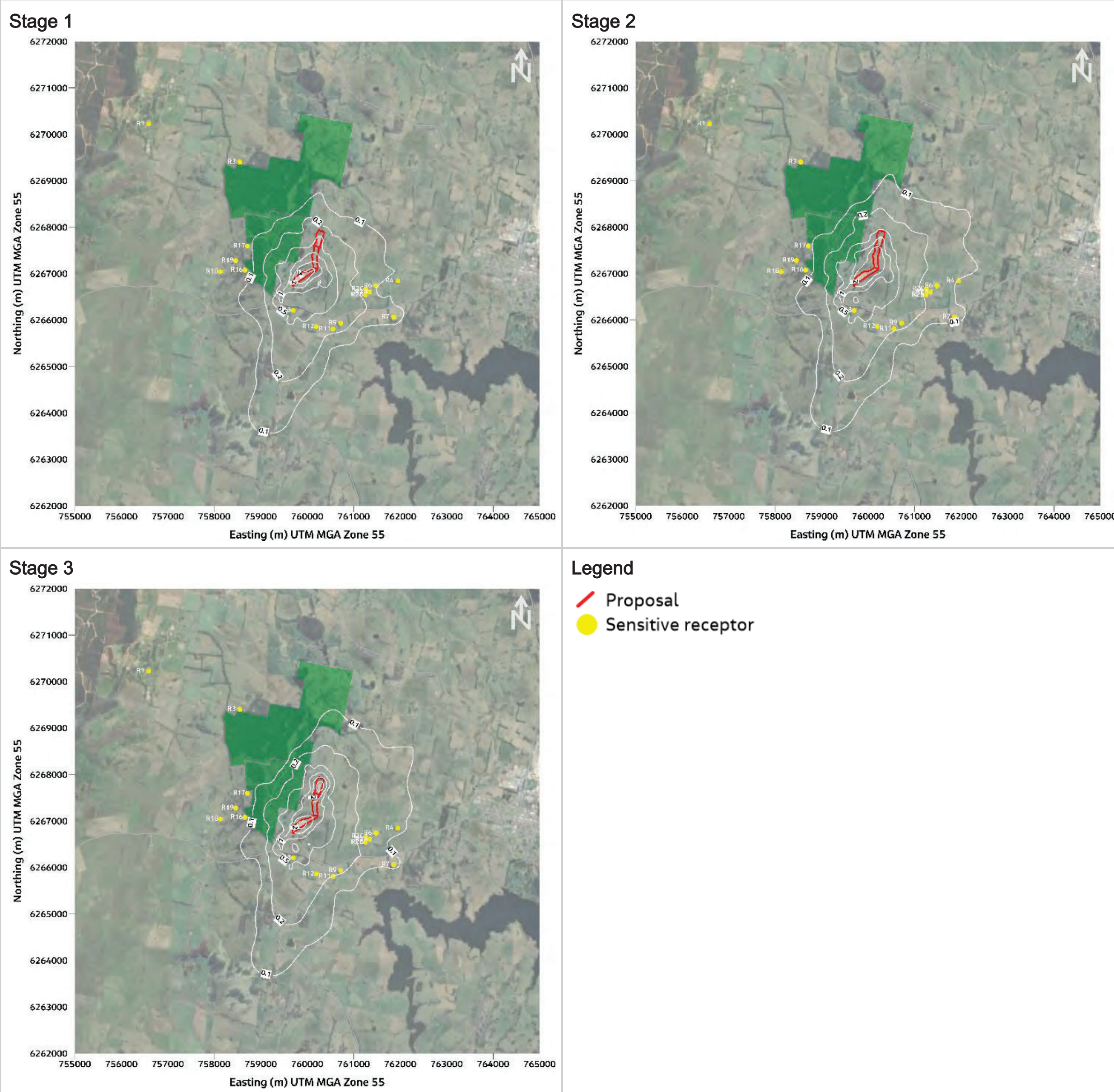


Figure 6.4. Ground-level concentration contours, proposal maximum 24-hour averaged $PM_{2.5}$ contributions

Based on these results it was determined that there would be no unacceptable changes in annually averaged and maximum daily $PM_{2.5}$ concentrations as a result of the proposal. Still, measures committed in the inventory as well as other recommendations to reduce emissions are provided below in Section 7.

6.1.4 Total suspended particulates (TSP)

Changes in annually averaged TSP concentrations at surrounding sensitive receptors was also predicted. The results are displayed below in Table 6.5. A background concentration of 28.3 µg/m³ was applied as determined in Section 4.5. proposal contributions also displayed as ground-level concentration contour plots below Table 6.5 for all three assessment stages considered.

Table 6.5. Predicted results, annually averaged TSP

Receptor	proposal contribution (µg/m^3)			Cumulative concentration (µg/m^3)			EPA criterion (µg/m^3)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<28.4	<28.4	<28.4	90
R2A	0.2	0.3	0.3	28.5	28.6	28.6	
R2B	0.2	0.3	0.3	28.5	28.6	28.6	
R2C	0.2	0.3	0.3	28.5	28.6	28.6	
R3	<0.1	<0.1	<0.1	<28.4	<28.4	<28.4	
R4	0.1	0.2	0.2	28.4	28.5	28.5	
R6	0.2	0.3	0.3	28.5	28.6	28.6	
R7	0.1	0.2	0.2	28.4	28.5	28.5	
R9	0.3	0.4	0.4	28.6	28.7	28.7	
R11	0.3	0.4	0.4	28.6	28.7	28.7	
R12	0.5	0.6	0.6	28.8	28.9	28.9	
R13	1.1	1.1	1.1	29.4	29.4	29.4	
R16	0.2	0.2	0.2	28.5	28.5	28.5	
R17	0.1	0.2	0.2	28.4	28.5	28.5	
R18	0.1	0.1	0.1	28.4	28.4	28.4	
R19	0.1	0.1	0.1	28.4	28.4	28.4	

Table 6.5 and **Figure 6.5** shows how the cumulative annually averaged TSP concentrations at surrounding sensitive receptors were predicted to remain below the EPA's 90 µg/m^3 impact assessment criterion. Based on these findings it was determined that there would be no unacceptable changes in annually TSP concentrations as a result of the proposal.

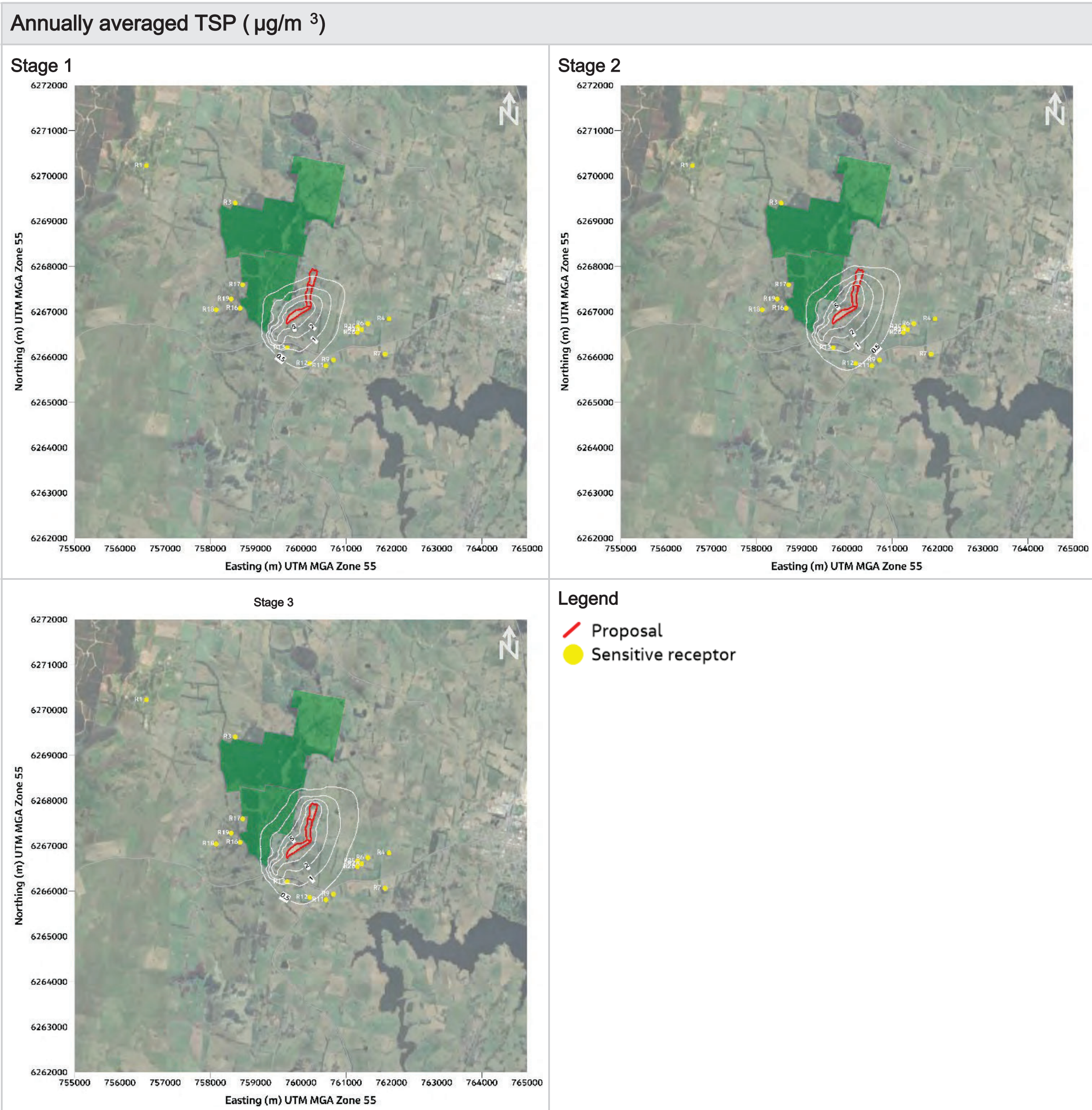


Figure 6.5. Ground-level concentration contours, proposal annually averaged TSP contributions

6.1.5 Deposited dust

Finally, regarding deposited dust, predicted results are listed below in **Table 6.6**. Annually averaged deposited dust contributions from the proposal are also displayed below in **Figure 6.6** for all three assessment stages considered. The cumulative levels in **Table 6.6** consider a background level of 0.9 g/m^2/month as established in **Section 4.5**.

Table 6.6. Predicted results, annually averaged deposited dust

Receptor	proposal contribution (g/m ^{2}/month)			Cumulative concentration (g/m ^{2}/month)			EPA criterion (g/m ^{2}/ month)
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
R1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	4
R2A	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R2B	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R2C	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R3	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R4	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R6	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R7	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R9	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R11	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R12	0.1	<0.1	<0.1	1.0	<1.0	<1.0	
R13	0.2	0.1	0.1	1.1	1.0	1.0	
R16	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R17	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R18	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	
R19	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	

Table 6.6 displays how deposited dust levels were predicted to remain below 4 g/m ^{2}/month at surrounding receptors. Based on this, it is expected that changes in deposited dust associated with the proposal would not result in unacceptable levels at surrounding sensitive receptors.

Annually averaged deposited dust (g/m²/month)

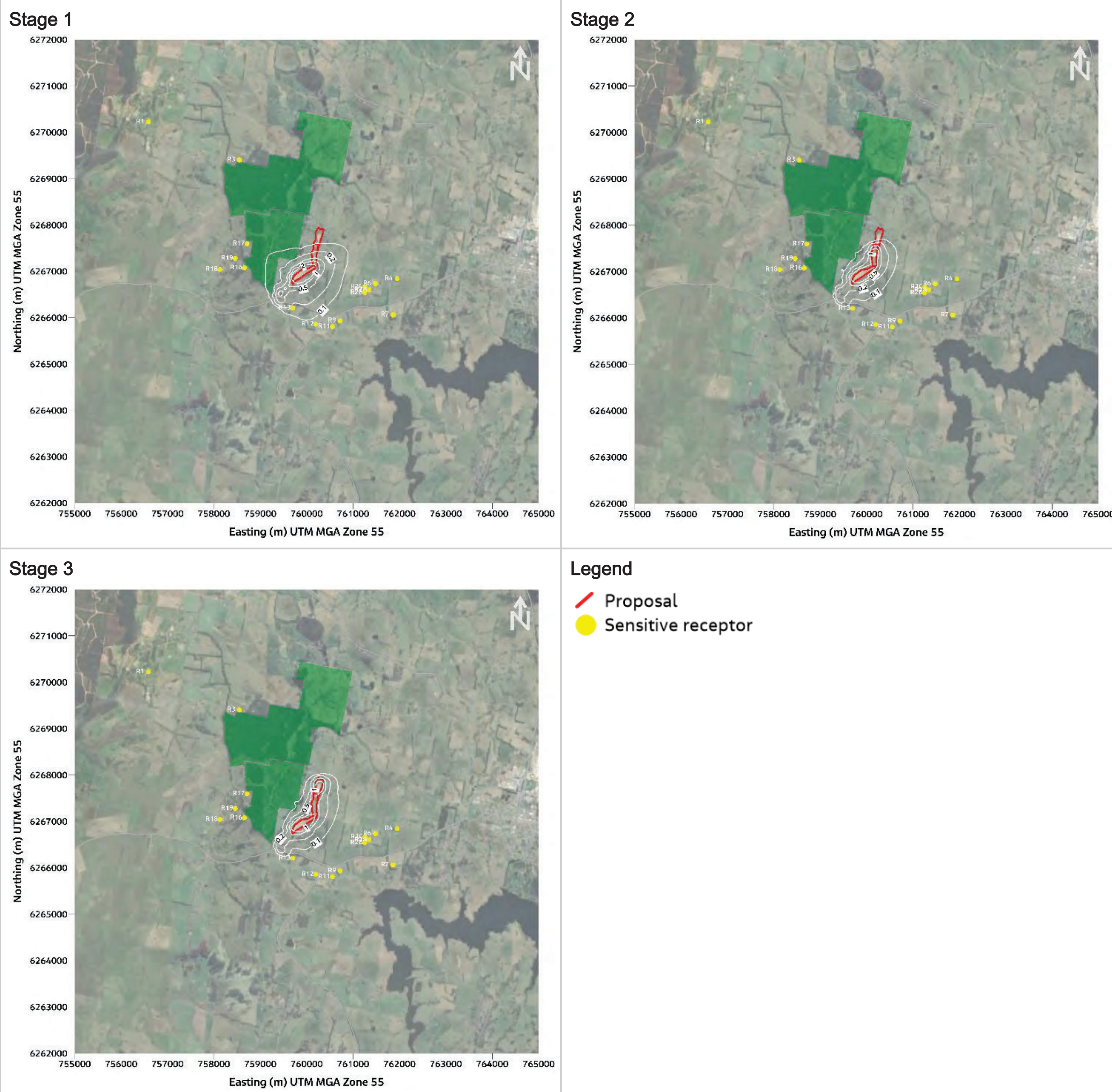


Figure 6.6. Ground-level contours, proposal annually averaged deposited dust contributions

6.2 Operational blast fume

Predicted maximum 1-hour average NO_2 concentrations at the nearest surrounding sensitive receptors due to post-blast fume are listed below in **Table 6.7**. A background concentration of 70.0 µg/m^3 was applied as determined in **Section 4.5**. Proposal contributions also displayed as ground-level concentration contour plots below in **Figure 6.7**.

Table 6.7. Predicted results, maximum 1-hour averaged NO_2 from blasting

Receptor	proposal contribution ($\mu g/m^3$)	Cumulative concentration ($\mu g/m^3$)	EPA criterion ($\mu g/m^3$)
R1	0.5	70.5	164
R2A	4.3	74.3	
R2B	4.1	74.1	
R2C	4.8	74.8	
R3	0.9	70.9	
R4	1.9	71.9	
R6	4.1	74.1	
R7	2.3	72.3	
R9	3.1	73.1	
R11	2.7	72.7	
R12	3.0	73.0	
R13	4.2	74.2	
R16	2.2	72.2	
R17	1.8	71.8	
R18	1.3	71.3	
R19	1.4	71.4	

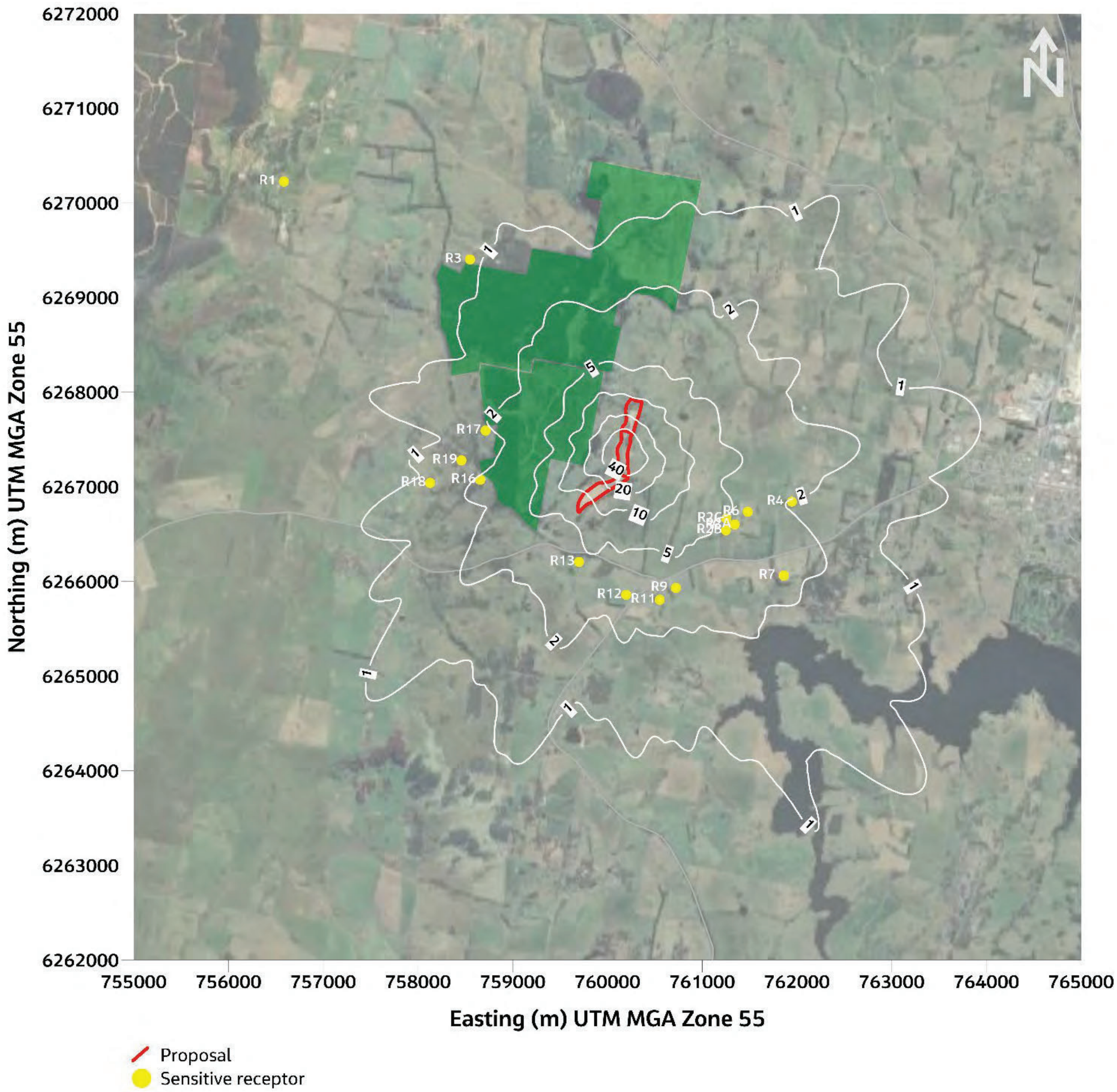


Figure 6.7. Modelled maximum 1 -hour averaged NO_2 from blasting (µg/m ^{3})

The results displayed in **Table 6.7** and **Figure 6.7** demonstrate compliance with the EPA's 164 µg/m^3 impact assessment criterion. The modelling predicts that the proposal will not cause adverse blast fume impacts due to blasting. Still measures to ensure that the proposal will not cause adverse blast fume impacts are included below in **Section 7**.

6.3 Operational diesel exhaust

6.3.1 Particulate matter as PM_{10} and $PM_{2.5}$

The emission factors, presented in **Section 5.1** and Appendix A, represent the contribution from both wheel-generated particulates and the exhaust particulates. These emission factors, with control factors, are based on measured emissions which include diesel particulates in the form of both PM_{10} and $PM_{2.5}$. As noted in **Section 5.3** these emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (i.e., older trucks). Todoroski Air Sciences reported (TAS 2016) that several studies confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission.

Based on the information collated above, the potential impacts of diesel exhaust emissions (as PM_{10} and $PM_{2.5}$) are represented in the preceding results, in **Section 6.1.2** and **Section 6.1.3**. As reported in these sections, PM_{10} and $PM_{2.5}$ emissions from the proposal (including diesel exhaust emissions) were not predicted to result in unacceptable off-site impacts.

6.3.2 Nitrogen dioxide (NO_2)

Predicted NO_2 contributions from diesel exhaust emissions associated with the proposal at the identified surrounding sensitive receptors are summarised below in **Table 6.8**. The cumulative concentrations consider the background concentrations established above in **Section 4.5**. Annual and maximum 1-hour ground level concentration results (proposal contributions) are also displayed in Error! Reference source not found. and Error! Reference source not found..

Table 6.8. Predicted results, maximum 1-hour averaged NO_2 from diesel exhaust

Receptor	Annually averaged NO_2			Maximum 1-hour averaged NO_2		
	proposal (µg/m^3)	Cumulative (µg/m^3)	EPA criterion (µg/m^3)	proposal (µg/m^3)	Cumulative (µg/m^3)	EPA criterion (µg/m^3)
R1	<0.1	<12.1	31	0.1	70.1	164
R2A	<0.1	<12.1		0.6	70.6	
R2B	<0.1	<12.1		0.7	70.7	
R2C	<0.1	<12.1		0.6	70.6	
R3	<0.1	<12.1		0.1	70.1	
R4	<0.1	<12.1		0.4	70.4	
R6	<0.1	<12.1		0.5	70.5	
R7	<0.1	<12.1		0.5	70.5	
R9	<0.1	<12.1		0.9	70.9	
R11	<0.1	<12.1		0.8	70.8	
R12	<0.1	<12.1		1.3	71.3	
R13	0.1	12.1		1.9	71.9	
R16	<0.1	<12.1		0.4	70.4	
R17	<0.1	<12.1		0.2	70.2	
R18	<0.1	<12.1		0.2	70.2	
R19	<0.1	<12.1		0.3	70.3	

As **Figure 6.8**Error! Reference source not found. and **Figure 6.9Error! Reference source not found.** show, annually averaged and maximum 1-hour cumulative NO_2 concentrations from diesel exhaust emissions were also predicted to remain below the relevant EPA impact assessment criteria. Based on these findings, it was determined that diesel exhaust emissions from the proposal are unlikely to present an unacceptable risk. Still measures to ensure that all plant and equipment are operated in a proper and efficient manner in order to preserve this outcome are recommended below in **Section 7**.

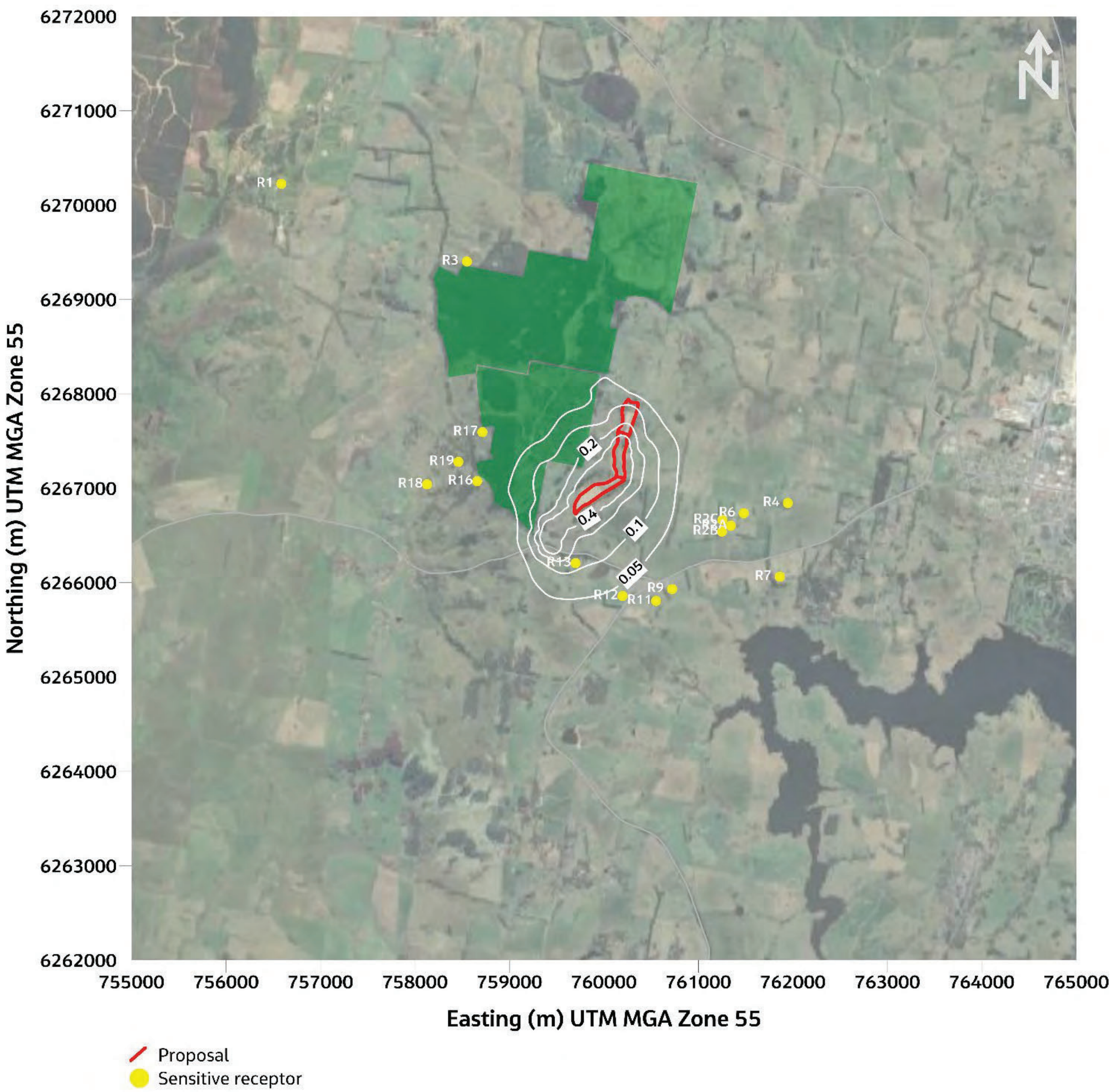


Figure 6.8. Modelled annually averaged NO_2 from diesel emissions (μg/m ^{3})

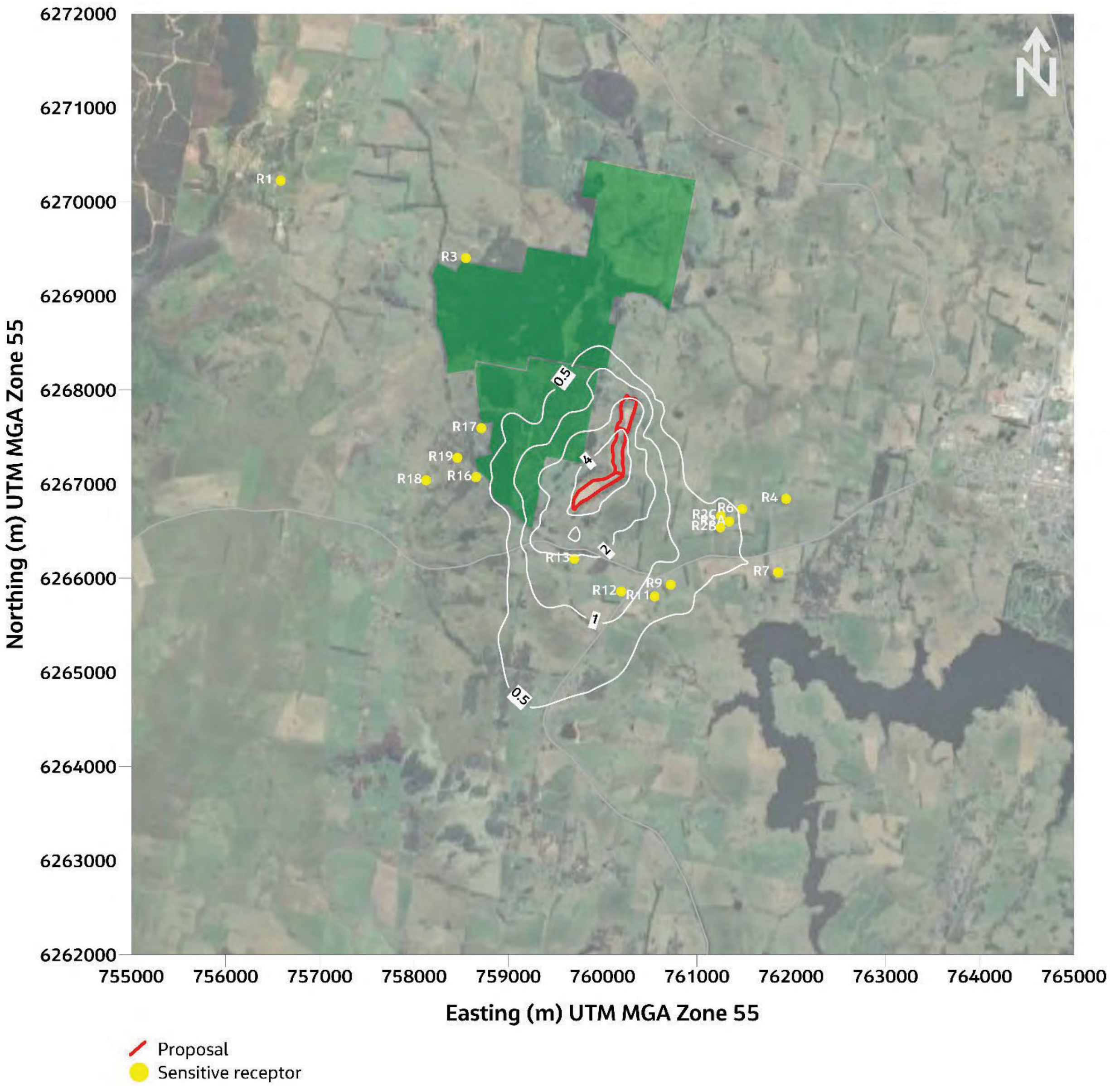


Figure 6.9. Modelled maximum 1 -hour averaged NO_2 from diesel emissions (µg/m[3])

6.4 Road transport

As outlined in **Section 5.4**, Roads and Maritime Services TRAQ was used to predict the effects of diesel emissions from trucks transporting quarry products along public roads. **Table 6.9** show the maximum concentrations at kerbside of key air quality indicators as predicted by TRAQ along the expected typical off-site haulage roads. The background concentrations for NO_2 and PM_{10} were applied as determined in **Section 4.5**, with the maximum 24-hour averaged PM_{10} value of 29.2 µg/m^3 measured at DPE Bathurst in 2021 applied. The default background 1-hour and 8-hour averaged CO concentrations for 'rural' environments were applied. The predictions from TRAQ were combined with these adopted background concentrations to predict resulting changes in cumulative roadside air quality as a result of the additional quarry-related transportation. These concentrations were evaluated by comparing the results against the applicable EPA assessment criteria.

Table 6.9. Predicted maximum concentrations at kerbside due to diesel exhaust emissions

Pollutant	Averaging time	Due to diesel exhaust emissions from proposal traffic	Background level	Cumulative	Criterion
Carbon monoxide (CO) (mg/m^3)	1-hour	<0.1	0.7*	<0.8	30
	8-hour	<0.1	0.7*	<0.8	10
Nitrogen dioxide (NO_2) (µg/m^3)	1-hour	1.2	70	71.2	164
	Annual	0.2	12	12.2	31
Particulate matter (PM_{10}) (µg/m^3)	24-hour	0.9	29.2	30.1	50
	Annual	0.3	11.3	11.6	25

* TRAQ defaults for "rural" environment

As **Table 6.9** shows, diesel exhausts emissions from traffic along on public roads generated from the proposal will not lead to any exceedances of the EPA's impact assessment criteria. On this basis it is considered that additional traffic from the quarry along the public network is unlikely to result in adverse air quality impacts.

6.5 Crystalline silica

Martins Creek Quarry is a hard rock quarry located in the Dungog Shire Council Local Government Area (LGA) operated by Buttai Gravel Pty Ltd. The Report, 'Martins Creek Quarry Extension – Air Quality Impact Assessment', (Jacobs, 2020) describes the outcomes of ambient monitoring of respirable crystalline silica carried out at the quarry in 2019. The monitoring involved the installation of a monitor located on the site boundary and positioned downwind of the quarry activities on a day representative of normal operations. The monitor was fitted with a PVC filter to allow for analysis of crystalline silica. The sampling and analysis was conducted in accordance with the following methods:

- Inhalable Dust – AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust; Gravimetric analysis of samples was performed by GCG Health Safety & Hygiene, Townsville, Queensland, NATA Site Number 20653, NATA accreditation number 16791.
- Respirable Dust – AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust; Gravimetric analysis of samples was performed by GCG Health Safety & Hygiene, Townsville, Queensland, NATA Site Number 20653, NATA accreditation number 16791.
- Analysis for Crystalline Silica was conducted by MPL Laboratories (NATA Accreditation 2901) by direct on filter Infra-Red Spectrometry following ashing and redeposition.

Results from the sampling at Martins Creek were used to estimate a maximum annual average respirable crystalline silica concentration at the proposal site boundary for comparison with the relevant assessment criteria. The results from Martins Creek Quarry have been reproduced below in **Table 6.10**.

Table 6.10. Crystalline silica review outcomesfrom Martins Creek reference site

Substance	Measured result at site boundary	Estimated annual average at Proposal site boundary, based on operating times and assuming quarry operations every day of the year	Criterion
Martins Creek Quarry (reference site), June 2019			
Respirable crystalline silica	4.2 μg/m^3	2.0 μg/m^3	3 μg/m^3

Source: Jacobs, 2020

The estimated annual average at the site boundary for Martins Creek considered a maximum annual extraction rate of 1.1 Mtpa. Up to 0.315 Mtpa of quarry product/sales per year is planned at the proposal, including products associated with imported materials. Scaling the estimated annual average at the site boundary from Martins Creek based on this lower rate of production results in a maximum estimated annual boundary concentration of 0.6 μg/m^3. This does not exceed the 3 μg/m^3 criterion noted by the Victorian EPA.

Additionally, respirable crystalline silica is noted as being a subset of $PM_{2.5}$. The highest annually averaged $PM_{2.5}$ concentration at a surrounding sensitive receiver was 0.1 μg/m^3 (refer to Section 6.1.3). This re-affirms the estimated outcome based on the monitoring from the Martins Creek reference site and suggests that the proposal is unlikely to cause adverse air quality impacts with respect to crystalline silica.

7. Safeguards and monitoring

7.1 Particulate matter

The modelling presented above in Section 6 predicted that the change in dust concentrations and deposited dust levels due to the proposal would not cause any exceedances of the relevant EPA assessment criteria at the nearest private sensitive receptors. These predictions considered the application of the following control measures, which should be implemented during operations:

Table 7.1. Emission control measures

Source/activity	Control measure	Control efficiency (%)	Reference
Drilling	Water sprays	70%	(NPI, 2012), Table 4
Hauling materials	Watering of haulage routes	50%	(NPI, 2012), Table 4
Wind erosion	Water sprays	50%	(NPI, 2012), Table 4
	Water sprays and rehabilitation	65%	(NPI, 2012), Table 4, including multiple concurrent controls equation

The following dust management provisions in the site AQMP should continue to be adhered to:

Table 7.2. Existing site dust management controls (Source: Umwelt, 2019)

Source/activity	Reference
Tree planting around the extraction area in accordance with the Quarry Rehabilitation and Landscape management Plan [to] reduce the effect of wind exposed areas of the Quarry site.	AQMP, Section 5.1
Avoid dusty activities such as soil stripping and rock extraction (by ripping or excavation) during windy (wind speeds greater than 5 m/s) conditions.	
Ensuring that the plant and equipment used for drilling and blasting utilises water injection or suitable alterativ e dust collection controls.	
Use of a water truck to maintain active internal unsealed haul routes, as well as any areas where dust generation is observed.	
Where possible, extracted rock and overburden and imported materials should be stockpiled as close to the completed face of extraction as possible.	
Stockpiles of rock to be crushed and screened is to be wetted down as required to prevent dust lift-off, and to maintain moisture content to reduce dust generation during crushing and screening. Dust suppressior sprays are to be fitted to crushing and screening units as required to reduce associated dust emissions.	
Mobile crushing plant are to be located where the extraction area or stockpiles provide shielding from the effects of wind.	
Education and training to minimise drop heights of products and materials from front end loaders	
Exhausts of earthmoving equipment are to be diverted away from the ground surface.	
Soil stockpiles are to be revegetated to provide 70% coverage within 60 days of establishment (unless tl soil is to be re-excavated and used in rehabilitation within the next 6 months).	
The Quarry Access Road is sealed to reduce dust generation as well as mud tracked onto the public road network.	
All trucks delivering materials for resource recovery and composting, and dispatching products will have their loads covered.	
Progressive rehabilitation over the life of the Quarry to reduce the extent of exposed areas generating dust.	

Additionally, the triggers, complaints and incident management and response provisions of the site AQMP (Section 5.3), as well as the monitoring plan (Section 6.10) remain appropriate and should continue being implemented.

7.2 Post Blast Fume

Although the assessment determined that proposal will not cause adverse blast fume impacts due to blasting, the following measure is recommended to ensure that this outcome is achieved:

- Update the site AQMP to include the following additional provisions to manage blasting activities:
  - It is expected that this plan would define the allowable times of the day when blasting can occur.
  - The plan should also identify weather conditions that may lead to higher potential risks, and the process that would be implemented to avoid or otherwise effectively manage blasting during these conditions.

7.3 Diesel exhaust

Though diesel exhaust emissions from site operations were not determined to present an issue, the following recommendations should be applied:

- Servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance.
- Targeting the maintenance to ensure, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle.
- Defining failure modes, effects and criticality which helps to minimise potential equipment failure.

These measures are consistent with the equipment maintenance and engine replacement strategies from the 'NSW Coal Mining Benchmarking Study: Best practice measures for reducing non-road diesel exhaust emissions', (EPA, 2014), understanding that the proposal is not a coal development but are consistent with best practice.

8. Conclusions

This report has provided an assessment of the potential air quality and greenhouse gas impacts of the Middle Creek Quarry Modification proposal. In summary, the air quality assessment involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling the potential impact of the Project on local air quality. The modelling was carried out in accordance with the assessment procedures prescribed by the EPA.

The key air quality issue was identified as dust during operations. This was the focus of the assessment, along with impacts from diesel exhaust emissions, NO_2 emissions from blasting, impacts from associated road transport activities and the effects of crystalline silica.

As part of the assessment, key features of the existing environment were identified including surrounding sensitive receptors, local meteorology and background air quality. Aerial imagery was used to identify the location of surrounding receptors. Meteorological and ambient air quality data collected at monitors operated by DPE and BoM (Meteorology only) surrounding were reviewed to characterise existing local conditions. The following conclusions were made in relation to the existing environment:

- Meteorological conditions do not vary significantly from year to year, and conditions in 2021 were identified as most representative of the long term, local conditions.
- Air quality conditions are strongly correlated to the climatic conditions. For example, there was a deterioration in air quality conditions between 2017 and early 2020 that were heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the proposal setting.

Air quality emission rates for key dust-generating activities associated with the proposed modification were estimated from local and international guidance. Modelling was then carried out with these emissions to predict potential changes to local air quality. The assessment determined that air quality impacts associated with the proposal would meet the relevant requirements from the EPA's Approved Methods. Specifically, it was predicted that:

- Operational dust emissions due are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on modelling which showed compliance with the EPA assessment criteria.
- No exceedances of the EPA's NO_2 criteria from diesel exhaust emissions or from blasting.
- Emissions from truck diesel exhausts travelling on public roads are not expected to result in any adverse air quality impacts based on modelling which showed that maximum kerbside concentrations would not exceed EPA criteria.
- Monitoring from a similar site and results from modelling suggest that the proposal is not expected to cause, adverse air quality impacts with respect to crystalline silica.

While this assessment has shown the proposal is not expected to cause any adverse air quality impacts s, a range of mitigation and management measures were recommended including a consideration of real-time air quality monitoring.

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Appendix A. Emissions calculations

Emission estimates, controls factors, emission factors and input variables

Stage 1:

Annual emissions and variables

Emission calculations																						
Middle Creek Quarry Cell 1 - Rev 2 27/9/22																						
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	#truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 1 Materials																						
Drilling rock - Cell 1	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 1	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 1 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 1 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 1 raw materials to Processing Units	6846	1947	97	50	4000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.8	8.3	-	-
Unloading Cell 1 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Crushing of Cell 1 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 1 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 1 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling Cell 1 Product to storage Stockpiles	1284	365	18	50	750	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.2	8.3	-	-
Unloading Cell 1 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored Cell 1 Product in stockpiles	550	275	28	50	0.96	ha	1146.4	kg/ha/y	573.2	kg/ha/y	57.3	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 1 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Off-site export of Cell 1 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 1 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-

References

Emission calculations

Middle Creek Quarry Cell 1 - Rev 2 27/9/22

Activity	Reference
Cell 1 Materials	
Drilling rock - Cell 1	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 1	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 1 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 1 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 1 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 1 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 1 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 1 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 1 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 1 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 1 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 1 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 1 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 1 Product via sealed Quarry Access Road	AP42-13.2. 1, Equation 1 (US EPA)
Off-site export of Cell 1 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EETM Mining, 2012 ; AP42-13.2.4-1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2-1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport , 2021); Haulage distances (m) = measured; dump and haulage truck loaded weights (t) = supplied; controls (%) = default values (Tab le 4 EETM Mining, 2012); activity intensities = supplied.

Stage 2:

Annual emissions and variables

Emission calculations

Middle Creek Quarry Cell 2 - Rev 2 27/9/22

Activity	Annual emissions (kg/y) TSP	PM10	PM2.5	Control (%)	Intensity	Units	TSP Factor	Units	PM10 Factor	Units	PM2.5 Factor	Units	Variables: Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 2 Materials and wind erosion from Cell 1																						
Drilling rock - Cell 2	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 2	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 2 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 2 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 2 raw materials to Processing Units	3423	973	49	50	2000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.4	8.3	-	-
Unloading Cell 2 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Crushing of Cell 2 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 2 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 2 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling Cell 2 Product to storage Stockpiles	13691	3893	195	50	8000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	1.6	8.3	-	-
Unloading Cell 2 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored Cell 2 Product in stockpiles	511	255	26	50	0.96	ha	1064.4	kg/ha/y	532.2	kg/ha/y	53.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 2 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Off-site export of Cell 2 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 2 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Cell 2	8234	4117	412	50	4.7	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Total	**74438**	**25193**	**2992**																			

References

Emission calculations

Middle Creek Quarry Cell 2 - Rev 2 27/9/22

Activity	Reference
Cell 2 Materials and wind erosion from Cell 1	
Drilling rock - Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 2 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 2 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 2 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 2 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 2 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 2 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 2 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 2 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 2 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 2 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 2 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 2 Product via sealed Quarry Access Road	AP42-13.2. 1, Equation 1 (US EPA)
Off-site export of Cell 2 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EE TM Mining, 2012; AP42 -13.2.4 -1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2 -1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport, 2021); Haulage distance s (m) = measured; dump and haulage truck loaded weights (t) = supplied; controls (%) = default values (Table 4 EETM Mining, 2012); activity intensities = supplied.

Jacobs

Stage 3:

Annual emissions and variables

Emission calculations																						
Middle Creek Quarry Cell 3 - Rev 2 27/9/22																						
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables									
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)	Silt load (g/m2)
Cell 3 Materials and wind erosion from Cells 1 and 2																						
Drilling rock - Cell 3	9	5	0	70	50	holes/y	0.59	kg/hole	0.31	kg/hole	0.030	kg/hole	-	-	-	-	-	-	-	-	-	-
Blasting rock - Cell 3	70	36	3	0	10	blasts/y	7.0	kg/blast	3.6	kg/blast	0.348	kg/blast	1000	-	-	-	-	-	-	-	-	-
Dozer gathering Cell 3 raw materials	5236	1135	550	0	780	h/y	6.7	kg/h	1.45486	kg/h	0.705	kg/h	-	-	3.4	-	-	-	-	8.3	-	-
Loading Cell 3 raw materials to Trucks	566	268	28	0	200000	t/y	0.00283	kg/t	0.00134	kg/t	0.0001	kg/t	-	1.75	1.6	-	-	-	-	-	-	-
Hauling Cell 3 raw materials to Processing Units	2567	730	36	50	1500	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading Cell 3 raw material from Trucks for processing	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Crushing of Cell 3 raw materials	2000	800	100	0	200000	t/y	0.01	kg/t	0.004	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of Cell 3 raw materials	2500	860	125	0	200000	t/y	0.0125	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Loading of Cell 3 product to Trucks	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Hauling Cell 3 Product to storage Stockpiles	20537	5840	292	50	12000	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	2.4	8.3	-	-
Unloading Cell 3 Product to Storage Stockpiles	5	2	0	0	200000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Wind erosion from stored Cell 3 Product in stockpiles	550	275	28	50	0.96	ha	1146.4	kg/ha/y	573.2	kg/ha/y	57.3	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Loading Cell 3 Product for export	28	10	1	0	200000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Off-site export of Cell 3 Product via sealed Quarry Access Road	3289	631	131	50	8750	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Off-site export of Cell 3 Product via unsealed internal road	2322	660	33	50	1500	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.3	8.3	-	-
Wind Erosion from Cell 1 remaining areas	7796	3898	390	50	4.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind Erosion from Cell 2	5764	2882	288	65	4.7	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Cell 3	7534	3767	377	50	4.3	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Waste Management																						
Import of organic woody waste (haulage along sealed Quarry Access Road)	411	79	16	50	1094	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of organic woody waste (haulage along unsealed internal roads)	1209	344	17	50	781.25	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	1.0	8.3	-	-
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	1809	347	72	50	4813	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	4789	1362	68	50	3093.8	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.9	8.3	-	-
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment a	1320	473	66	0	110000	t/y	0.01200	kg/t	0.0043	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-	-
Import of waste concrete (haulage along sealed Quarry Access Road)	575	110	23	50	1531	VKT/y	0.75	kg/VKT	0.14	kg/VKT	0.03	kg/VKT	-	-	-	-	-	32	1.4	-	-	8.2
Import of waste concrete (haulage along unsealed internal roads)	847	241	12	50	546.88	VKT/y	3.09580	kg/VKT	0.88033	kg/VKT	0.044	kg/VKT	-	-	-	-	-	32	0.7	8.3	-	-
Crushing (primary) of waste concrete	7000	700	350	0	35000	t/y	0.2	kg/t	0.02	kg/t	0.010	kg/t	-	-	-	-	-	-	-	-	-	-
Screening of waste concrete	2800	2100	140	0	35000	t/y	0.08	kg/t	0.06	kg/t	0.004	kg/t	-	-	-	-	-	-	-	-	-	-
Loading to waste concrete product to trucks for storage	5	2	0	0	35000	t/y	0.00014	kg/t	0.00005	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Hauling waste concrete product to storage Stockpiles	449	128	6	50	262.5	VKT/y	3.42281	kg/VKT	0.97332	kg/VKT	0.049	kg/VKT	-	-	-	-	-	40	0.3	8.3	-	-
Unloading waste concrete product to Storage Stockpiles	1	0	0	0	35000	t/y	0.00002	kg/t	8E-06	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-	-
Wind erosion from stored waste products (exc organic woody waste)	858	429	43	50	0.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Wind erosion from Composting area	2628	1314	131	50	1.5	ha	3504.0	kg/ha/y	1752.0	kg/ha/y	175.2	kg/ha/y	-	-	-	-	-	-	-	-	-	-
Total	**85530**	**29448**	**3333**																			

References

Emission calculations	
Middle Creek Quarry Cell 3 - Rev 2 27/9/22	
Activity	Reference
Cell 3 Materials and wind erosion from Cells 1 and 2	
Drilling rock - Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.8, Default values)
Blasting rock - Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.9, Equation 19)
Dozer gathering Cell 3 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.5, Equations 16 and 17
Loading Cell 3 raw materials to Trucks	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.2, Equations 10 and 11)
Hauling Cell 3 raw materials to Processing Units	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 3 raw material from Trucks for processing	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Crushing of Cell 3 raw materials	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for high-moisture material)
Screening of Cell 3 raw materials	AP42-11.19.2-1, value for activity 'SCC 3-05-020-02, 03', screening uncontrolled (crushed stone Processing) (US EPA)
Loading of Cell 3 product to Trucks	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling Cell 3 Product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading Cell 3 Product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored Cell 3 Product in stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Equation 17)
Loading Cell 3 Product for export	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Off-site export of Cell 3 Product via sealed Quarry Access Road	AP42-13.2. 1, Equation 1 (US EPA)
Off-site export of Cell 3 Product via unsealed internal road	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Wind Erosion from Cell 1 remaining areas	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind Erosion from Cell 2	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Cell 3	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Waste Management	
Import of organic woody waste (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of organic woody waste (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Import of VENM, ENM and treated drilling mud (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of VENM, ENM and treated drilling mud (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading of VENM, ENM and treated drilling mud from trucks at waste product storage/treatment area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.6)
Import of waste concrete (haulage along sealed Quarry Access Road)	AP42-13.2. 1, Equation 1 (US EPA)
Import of waste concrete (haulage along unsealed internal roads)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Crushing (primary) of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Screening of waste concrete	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 5.2.2, Table 3, default value for low-moisture material)
Loading to waste concrete product to trucks for storage	AP42-11.19.2-1, value for activity 'SCC 3-05-020-32', loading crushed stone product to trucks from processing (US EPA)
Hauling waste concrete product to storage Stockpiles	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.11)
Unloading waste concrete product to Storage Stockpiles	AP42-11.19.2-1, value for activity 'SCC 3-05-020-31', unloading crushed stone product from trucks (US EPA)
Wind erosion from stored waste products (exc organic woody waste)	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)
Wind erosion from Composting area	NPI EETM Mining V3.1 (DSEWPaC, 2012, Section 1.1.18, Default values)

Where blasting area (m^2) = default blast area (Section 1.1.8, EETM Mining, 2012); moisture content (%) = default value (Section 1.1.5, EETM Mining, 2012 ; AP42-13.2.4-1 (Crushed limestone) for rock materials); silt content (%) haulage areas = default value (Section 1.1.11, AP42 -13.2.2-1); Wind speed and precipitation variables (m/s and mm/y) = (BoM Bathurst airport, 2021); Haulage distances (m) = measured; dump and haulage truck loaded weights (t) = supplied ; controls (%) = default values (Table 4 EETM Mining, 2012); activity intens ities = supplied.

Appendix B. Model input codes

CALMET example input file

CALMET.INP 2.1 Hour Start and End Times with Seconds

Middle Creek Quarry

CALMET Simulation

---------------- Run title (3 lines) --

CALMET MODEL CONTROL FILE

INPUT GROUP: 0 -- Input and Output File Names

Subgroup (a)

Default Name Type File Name

------------ ---- ---------

GEO.DAT input ! GEODAT=GEO.DAT !

SURF.DAT input ! SRFDAT=SURF2021.DAT !

CLOUD.DAT input * CLDDAT= *

PRECIP.DAT input * PRCDAT= *

WT.DAT input * WTDAT= *

CALMET.LST output ! METLST=MET01.LST !

CALMET.LST output ! METDAT=MET01.DAT !

PACOUT.DAT output * PACDAT= *

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = F !

F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

Number of upper air stations (NUSTA) No default ! NUSTA = 1 !

Number of overwater met stations

(NOWSTA) No default ! NOWSTA = 0 !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

Number of MM4/MM5/3D.DAT files

(NM3D) No default ! NM3D = 0 !

Number of IGF-CALMET.DAT files

(NIGF) No default ! NIGF = 0 !

!END!

Subgroup (b)

Upper air files (one per station)

Default Name Type File Name

------------ ---- ---------

UP1.DAT input 1 ! UPDAT=UP1.DAT! !END!

UP2.DAT input 2 * UPDAT=UP2.DAT* *END*

------------------------------- ---

Subgroup (c)

Overwater station files (one per station)

Default Name Type File Name

------------ ---- ---------

SEA1.DAT input 1 * SEADAT=SEA_449.DAT * *END*

Subgroup (d)

MM4/MM5/3D.DAT files (consecutive or overlapping)

Default Name Type File Name

------------ ---- ---------

MM51.DAT input 1 * M3DDAT=LSP2003.DAT * *END*

-- ----------

Subgroup (e)

IGF-CALMET.DAT files (consecutive or overlapping)

Default Name Type File Name

------------ ---- ---------

IGFn.DAT input 1 * IGFDAT=CALMET0.DAT * *END*

Subgroup (f)

Other file names

Default Name Type File Name

------------ ---- ---------

DIAG.DAT input * DIADAT= *

PROG.DAT input * PRGDAT= *

TEST.PRT output * TSTPRT= *

TEST.OUT output * TSTOUT= *

TEST.KIN output * TSKIN= *

TEST.FRD output * TSTFRD= *

TEST.SLP output * TSTSLP= *

DCST.GRD output * DCSTGD= *

-- ------------

NOTES: (1) File/path names can be up to 70 characters in length

(2) Subgroups (a) and (f) must have ONE 'END' (surrounded by

delimiters) at the end of the group

(3) Subgroups (b) through (e) are included ONLY if the corresponding

number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have

an 'END' (surround by delimiters) at the end of EACH LINE

!END!

-- ----------------------

INPUT GROUP: 1 -- General run control parameters

!IBYR = 2021!

!IBMO = 1!

!IBDY = 1 !

!IBHR = 0 !

!IBSEC = 0 !

!IEYR = 2021!

!IEMO = 2!

!IEDY = 1 !

!IEHR = 0 !

!IESEC = 0 !

UTC time zone (ABTZ) -- No default ! ABTZ= UTC+1000 !

(character*8)

PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000

CST = UTC-0600, EST = UTC-0500

Length of modeling time-step (seconds)

Must divide evenly into 3600 (1 hour)

(NSECDT) Default:3600 ! NSECDT = 3600 !

Units: seconds

Run type (IRTYPE) -- Default: 1 ! IRTYPE= 1 !

0 = Computes wind fields only

1 = Computes wind fields and micrometeorological variables

(u*, w*, L, zi, etc.)

(IRTYPE must be 1 to run CALPUFF or CALGRID)

Compute special data fields required

by CALGRID (i.e., 3-D fields of W wind

components and temperature)

in additional to regular Default: T ! LCALGRD = T !

fields ? (LCALGRD)

(LCALGRD must be T to run CALGRID)

Flag to stop run after

SETUP phase (ITEST) Default: 2 ! ITEST= 2 !

(Used to allow checking

of the model inputs, files, etc.)

ITEST = 1 - STOPS program after SETUP phase

ITEST = 2 - Continues with execution of

COMPUTATIONAL phase after SETUP

Test options specified to see if

they conform to regulatory

values? (MREG) No Default ! MREG = 0 !

0 = NO checks are made

1 = Technical options must conform to USEPA guidance

IMIXH -1 Maul-Carson convective mixing height

over land; OCD mixing height overwater

ICOARE 0 OCD deltaT method for overwater fluxes

THRESHL 0.0 Threshold buoyancy flux over land needed

to sustain convective mixing height growth

ISURFT > 0 Pick one representative station, OR

```
              -2      in NOOBS mode (ITPROG=2) average all
                    surface prognostic temperatures to get
                    a single representative surface temp.
          IUPT    > 0     Pick one representative station, OR
              -2      in NOOBS mode (ITPROG>0) average all surface
                    prognostic temperatures to get a single
                    representative surface temp.
          IZICRLX  0     Do NOT use convective mixing height
                    relaxation to equilibrium value

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

   Projection for all (X,Y):
   -------------------------

   Map projection
   (PMAP)                Default: UTM    ! PMAP = UTM  !

      UTM :  Universal Transverse Mercator
      TTM :  Tangential Transverse Mercator
      LCC :  Lambert Conformal Conic
       PS :  Polar Stereographic
       EM :  Equatorial Mercator
     LAZA :  Lambert Azimuthal Equal Area
```

False Easting and Northing (km) at the projection origin

(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 0.000 !

(FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 55 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = S !

N : Northern hemisphere projection

S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin

(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = -34.45N !

(RLON0) No Default ! RLON0 =150.88W !

TTM : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

LCC : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

PS : RLON0 identifies central (grid N/S) meridian of projection

RLAT0 selected for convenience

EM : RLON0 identifies central meridian of projection

RLAT0 is REPLACED by 0.0N (Equator)

LAZA: RLON0 identifies longitude of tangent-point of mapping plane

RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection

(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 30N !

(XLAT2) No Default ! XLAT2 = 60N !

LCC : Projection cone slices through Earth's surface at XLAT1 and XLAT2

PS : Projection plane slices through Earth at XLAT1

(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a

letter N,S,E, or W indicating north or south latitude, and

east or west longitude. For example,

35.9 N Latitude = 35.9N

118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character

string. Many mapping products currently available use the model of the

Earth known as the World Geodetic System 1984 (WGS-84). Other local

models may be in use, and their selection in CALMET will make its output

consistent with local mapping products. The list of Datum-Regions with

official transformation parameters is provided by the National Imagery and

Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

-- -

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)

NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)

NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)

NWS-84 NWS 6370KM Radius, Sphere

ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum - region for output coordinates

(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

Horizontal grid definition:

Rectangular grid defined for projection PMAP,

with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 103 !

No. Y grid cells (NY) No default ! NY = 103 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = 0.1 !

Units: km

Reference grid coordinate of

SOUTHWEST corner of grid cell (1,1)

X coordinate (XORIGKM)   No default   ! XORIGKM = 754.850 !

Y coordinate (YORIGKM)   No default   ! YORIGKM = 6261.850 !

Units: km

Vertical grid definition:

No. of vertical layers (NZ)   No default   ! NZ = 9 !

Cell face heights in arbitrary

vertical grid (ZFACE(NZ+1))   No defaults

Units: m

! ZFACE = 0.,20.,40.,80.,160.,320.,700.,1200.,1500.,2000. !

!END!

INPUT GROUP: 3 Output Options

DISK OUTPUT OPTION

Savemet. fields in an unformatted

output file ?   (LSAVE) Default: T   ! LSAVE = T !

(F = Do not save, T = Save)

Type of unformatted output file:

(IFORMO) Default: 1 ! IFORMO = 1 !

1 = CALPUFF/CALGRID type file (CALMET.DAT)

2 = MESOPUFF-II type file (PACOUT.DAT)

LINE PRINTER OUTPUT OPTIONS:

Print met. fields ? (LPRINT) Default: F ! LPRINT = F !

(F = Do not print, T = Print)

(NOTE: parameters below control which

met. variables are printed)

Print interval

(IPRINF) in hours Default: 1 ! IPRINF = 96 !

(Meteorological fields are printed

every 96 hours)

Specify which layers of U, V wind component

to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T) Defaults: NZ*0

! IUVOUT = 1 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which levels of the W wind component to print

(NOTE: W defined at TOP cell face 9 values)

(IWOUT(NZ))-- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0

! IWOUT = 1 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which levels of the 3D temperature field to print

(ITOUT(NZ))-- NOTE: NZ values must be entered

(0=Do not print, 1=Print)

(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0

! ITOUT = 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 !

Specify which meteorological fields

to print

(used only if LPRINT=T) Defaults: 0 (all variables)

Variable Print ?

(0 = do not print,

1 = print)

-------- ------------------

```
! STABILITY =    1   - PGT stability class
! USTAR     =    0   - Friction velocity
! MONIN     =    0   - Monin-Obukhov length
! MIXHT     =    0   - Mixing height
! WSTAR     =    0   - Convective velocity scale
! PRECIP    =    0   - Precipitation rate
! SENSHEAT  =    0   - Sensible heat flux
! CONVZI    =    0   - Convective mixing ht.


Testing and debug print options for micrometeorological module

   Print input meteorological data and
   internal variables (LDB)       Default: F     ! LDB = F !
   (F = Do not print, T = print)
   (NOTE: this option produces large amounts of output)

   First time step for which debug data
   are printed (NN1)              Default: 1     ! NN1 =  1  !

   Last time step for which debug data
   are printed (NN2)              Default: 1     ! NN2 =  2  !

   Print distance to land
   internal variables (LDBCST)    Default: F     ! LDBCST = F !
   (F = Do not print, T = print)
   (Output in .GRD file DCST.GRD, defined in input group 0)

Testing and debug print options for wind field module
```

(all of the following print options control output to

wind field module's output files: TEST.PRT, TEST.OUT,

TEST.KIN, TEST.FRD, and TEST.SLP)

Control variable for writing the test/debug

wind fields to disk files (IOUTD)

(0=Do not write, 1=write) Default: 0 ! IOUTD = 0 !

Number of levels, starting at the surface,

to print (NZPRN2) Default: 1 ! NZPRN2 = 1 !

Print the INTERPOLATED wind components ?

(IPR0) (0=no, 1=yes) Default: 0 ! IPR0 = 0 !

Print the TERRAIN ADJUSTED surface wind

components ?

(IPR1) (0=no, 1=yes) Default: 0 ! IPR1 = 0 !

Print the SMOOTHED wind components and

the INITIAL DIVERGENCE fields ?

(IPR2) (0=no, 1=yes) Default: 0 ! IPR2 = 0 !

Print the FINAL wind speed and direction

fields ?

(IPR3) (0=no, 1=yes) Default: 0 ! IPR3 = 0 !

Print the FINAL DIVERGENCE fields ?

(IPR4) (0=no, 1=yes) Default: 0 ! IPR4 = 0 !

Print the winds after KINEMATIC effects

are added ?

(IPR5) (0=no, 1=yes) Default: 0 ! IPR5 = 0 !

Print the winds after the FROUDE NUMBER

adjustment is made ?

(IPR6) (0=no, 1=yes) Default: 0 ! IPR6 = 0 !

Print the winds after SLOPE FLOWS

are added ?

(IPR7) (0=no, 1=yes) Default: 0 ! IPR7 = 0 !

Print the FINAL wind field components ?

(IPR8) (0=no, 1=yes) Default: 0 ! IPR8 = 0 !

!END!

INPUT GROUP: 4 Meteorological data options

NO OBSERVATION MODE (NOOBS) Default: 0 ! NOOBS = 0 !

0 = Use surface, overwater, and upper air stations

1 = Use surface and overwater stations (no upper air observations)

Use MM4/MM5/3D.DAT for upper air data

2 = No surface, overwater, or upper air observations

Use MM4/MM5/3D.DAT for surface, overwater, and upper air data

NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

Number of surface stations (NSSTA) No default ! NSSTA = 1 !

Number of precipitation stations

(NPSTA=-1: flag for use of MM5/3D.DAT precip data)

(NPSTA) No default ! NPSTA = 0 !

CLOUD DATA OPTIONS

Gridded cloud fields:

(ICLOUD) Default: 0 ! ICLOUD = 4 !

ICLOUD = 0 - Gridded clouds not used

ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT

ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT

ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity

at 850mb (Teixera)

ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity

at all levels (MM5toGrads algorithm)

FILE FORMATS

Surface meteorological data file format

(IFORMS) Default: 2 ! IFORMS = 2 !

(1 = unformatted (e.g., SMERGE output))

(2 = formatted (free-formatted user input))

Precipitation data file format

(IFORMP) Default: 2 ! IFORMP = 2 !

(1 = unformatted (e.g., PMERGE output))

(2 = formatted (free-formatted user input))

Cloud data file format

(IFORMC) Default: 2 ! IFORMC = 2 !

(1 = unformatted - CALMET unformatted output)

(2 = formatted - free-formatted CALMET output or user input)

!END!

INPUT GROUP: 5 -- Wind Field Options and Parameters

WIND FIELD MODEL OPTIONS

Model selection variable (IWFCOD) Default: 1 ! IWFCOD = 1 !

0 = Objective analysis only

1 = Diagnostic wind module

Compute Froude number adjustment

effects ? (IFRADJ) Default: 1! IFRADJ = 1 !

(0 = NO, 1 = YES)

Compute kinematic effects ? (IKINE) Default: 0 ! IKINE = 0 !

(0 = NO, 1 = YES)

Use O'Brien procedure for adjustment

of the vertical velocity ? (IOBR) Default: 0 ! IOBR = 0 !

(0 = NO, 1 = YES)

Compute slope flow effects ? (ISLOPE) Default: 1 ! ISLOPE = 1 !

(0 = NO, 1 = YES)

Extrapolate surface wind observations

to upper layers ? (IEXTRP) Default: -4 ! IEXTRP = -4 !

(1 = no extrapolation is done,

2 = power law extrapolation used,

3 = user input multiplicative factors

for layers 2 - NZ used (see FEXTRP array)

4 = similarity theory used

-1, -2, -3, -4 = same as above except layer 1 data

at upper air stations are ignored

Extrapolate surface winds even

if calm? (ICALM) Default: 0 ! ICALM = 0 !

(0 = NO, 1 = YES)

Layer-dependent biases modifying the weights of

surface and upper air stations (BIAS(NZ))

-1<=BIAS<=1

Negative BIAS reduces the weight of upper air stations

(e.g. BIAS=-0.1 reduces the weight of upper air stations

by 10%; BIAS=-1, reduces their weight by 100 %)

Positive BIAS reduces the weight of surface stations

(e.g. BIAS= 0.2 reduces the weight of surface stations by 20%; BIAS=1 reduces their weight by 100%)

Zero BIAS leaves weights unchanged (1/R**2 interpolation)

Default: NZ*0

! BIAS = -1 ,-.8 ,-.6 ,-.4 ,-.2 , 0 , 0 , 0 , 0 !

Minimum distance from nearest upper air station

to surface station for which extrapolation

of surface winds at surface station will be allowed

(RMIN2: Set to -1 for IEXTRP = 4 or other situations

where all surface stations should be extrapolated)

Default: 4. ! RMIN2 = 1.0 !

Use gridded prognostic wind field model

output fields as input to the diagnostic

wind field model (IPROG) Default: 0 ! IPROG = 0 !

(0 = No, [IWFCOD = 0 or 1]

1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]

2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]

3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]

4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]

5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]

13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD = 0]

14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]

15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

Timestep (seconds) of the prognostic

model input data (ISTEPPGS) Default: 3600 ! ISTEPPGS = 3600 !

Use coarse CALMET fields as initial guess fields (IGFMET)

(overwrites IGF based on prognostic wind fields if any)

Default: 0 ! IGFMET = 0 !

RADIUS OF INFLUENCE PARAMETERS

Use varying radius of influence Default: F ! LVARY = F!

(if no stations are found within RMAX1,RMAX2,

or RMAX3, then the closest station will be used)

Maximum radius of influence over land

in the surface layer (RMAX1) No default ! RMAX1 = 5. !

Units: km

Maximum radius of influence over land

aloft (RMAX2) No default ! RMAX2 = 20. !

Units: km

Maximum radius of influence over water

(RMAX3) No default ! RMAX3 = 20. !

Units: km

OTHER WIND FIELD INPUT PARAMETERS

Minimum radius of influence used in

the wind field interpolation (RMIN) Default: 0.1 ! RMIN = 0.1 !

Units: km

Radius of influence of terrain

features (TERRAD) No default ! TERRAD = 4. !

Units: km

Relative weighting of the first

guess field and observations in the

SURFACE layer (R1) No default ! R1 = 0.5 !

(R1 is the distance from an Units: km

observational station at which the

observation and first guess field are

equally weighted)

Relative weighting of the first

guess field and observations in the

layers ALOFT (R2) No default ! R2 = 1. !

(R2 is applied in the upper layers Units: km

in the same manner as R1 is used in

the surface layer).

Relative weighting parameter of the

prognostic wind field data (RPROG) No default ! RPROG = 0. !

(Used only if IPROG = 1) Units: km

Maximum acceptable divergence in the

divergence minimization procedure

(DIVLIM) Default: 5.E-6 ! DIVLIM= 5.0E-06 !

Maximum number of iterations in the

divergence min. procedure (NITER) Default: 50 ! NITER = 50 !

Number of passes in the smoothing

procedure (NSMTH(NZ))

NOTE: NZ values must be entered

Default: 2,(mxnz-1)*4 ! NSMTH =

2 , 4 , 4 , 4 , 4 , 4 , 4 , 4 , 4 !

Maximum number of stations used in

each layer for the interpolation of

data to a grid point (NINTR2(NZ))

NOTE: NZ values must be entered Default: 99. ! NINTR2 =

99 , 99 , 99 , 99 , 99 , 99 , 99 , 99 , 99 !

Critical Froude number (CRITFN) Default: 1.0 ! CRITFN = 1. !

Empirical factor controlling the

influence of kinematic effects

(ALPHA) Default: 0.1 ! ALPHA = 0.1 !

Multiplicative scaling factor for

extrapolation of surface observations

to upper layers (FEXTR2(NZ)) Default: NZ*0.0

! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0. !

(Used only if IEXTRP = 3 or 3)

BARRIER INFORMATION

Number of barriers to interpolation

of the wind fields (NBAR) Default: 0 ! NBAR = 0 !

Level (1 to NZ) up to which barriers

apply (KBAR) Default: NZ ! KBAR = 9 !

THE FOLLOWING 4 VARIABLES ARE INCLUDED

ONLY IF NBAR > 0

NOTE: NBAR values must be entered No defaults

for each variable Units: km

X coordinate of BEGINNING

of each barrier (XBBAR(NBAR)) ! XBBAR = 0. !

Y coordinate of BEGINNING

of each barrier (YBBAR(NBAR)) ! YBBAR = 0. !

X coordinate of ENDING

of each barrier (XEBAR(NBAR)) ! XEBAR = 0. !

Y coordinate of ENDING

of each barrier (YEBAR(NBAR)) ! YEBAR = 0. !

DIAGNOSTIC MODULE DATA INPUT OPTIONS

Surface temperature (IDIOPT1) Default: 0 ! IDIOPT1 = 0 !

0 = Compute internally from

hourly surface observations or prognostic fields

1 = Read preprocessed values from

a data file (DIAG.DAT)

Surface met. station to use for

the surface temperature (ISURFT) Default: -1 ! ISURFT = -1 !

(Must be a value from 1 to NSSTA,

or -1 to use 2-D spatially varying

surface temperatures,

or -2 to use a domain-average prognostic

surface temperatures (only with ITPROG=2))

(Used only if IDIOPT1 = 0)

Temperature lapse rate used in the Default: 0 ! IDIOPT2 = 0 !

computation of terrain-induced

circulations (IDIOPT2)

0 = Compute internally from (at least) twice-daily

upper air observations or prognostic fields

1 = Read hourly preprocessed values

from a data file (DIAG.DAT)

Upper air station to use for

the domain-scale lapse rate (IUPT) Default: 1 ! IUPT = 1 !

(Must be a value from 1 to NUSTA,

or -1 to use 2-D spatially varying lapse rate,

or -2 to use a domain-average prognostic

lapse rate (only with ITPROG>0))

(Used only if IDIOPT2 = 0)

Depth through which the domain-scale

lapse rate is computed (ZUPT) Default: 200. ! ZUPT = 200. !

(Used only if IDIOPT2 = 0) Units: meters

Initial Guess Field Winds

(IDIOPT3) Default: 0 ! IDIOPT3 = 0 !

0 = Compute internally from

observations or prognostic wind fields

1 = Read hourly preprocessed domain-average wind values

from a data file (DIAG.DAT)

Upper air station to use for

the initial guess winds (IUPWND) Default: -1 ! IUPWND = -1 !

(Must be a value from -1 to NUSTA, with

-1 indicating 3-D initial guess fields,

and IUPWND>1 domain-scaled (i.e. constant) IGF)

(Used only if IDIOPT3 = 0 and noobs=0)

Bottom and top of layer through

which the domain-scale winds

are computed

(ZUPWND(1), ZUPWND(2)) Defaults: 1., 1000. ! ZUPWND= 1., 1000. !

(Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0) Units: meters

-------------- ------------

Observed surface wind components

for wind field module (IDIOPT4) Default: 0 ! IDIOPT4 = 0 !

0 = Read WS, WD from a surface

data file (SURF.DAT)

1 = Read hourly preprocessed U, V from

a data file (DIAG.DAT)

Observed upper air wind components

for wind field module (IDIOPT5) Default: 0 ! IDIOPT5 = 0 !

0 = Read WS, WD from an upper

air data file (UP1.DAT, UP2.DAT, etc.)

1 = Read hourly preprocessed U, V from

a data file (DIAG.DAT)

LAKE BREEZE INFORMATION

Use Lake Breeze Module (LLBREZE)

Default: F ! LLBREZE = F !

Number of lake breeze regions (NBOX) ! NBOX = 0 !

X Grid line 1 defining the region of interest

! XG1 = 0. !

X Grid line 2 defining the region of interest

! XG2 = 0. !

Y Grid line 1 defining the region of interest

! YG1 = 0. !

Y Grid line 2 defining the region of interest

! YG2 = 0. !

X Point defining the coastline (Straight line)

(XBCST) (KM) Default: none ! XBCST = 0. !

Y Point defining the coastline (Straight line)

(YBCST) (KM) Default: none ! YBCST = 0. !

X Point defining the coastline (Straight line)

(XECST) (KM) Default: none ! XECST = 0. !

Y Point defining the coastline (Straight line)

(YECST) (KM) Default: none ! YECST = 0. !

Number of stations in the region Default: none ! NLB = 0 !

(Surface stations + upper air stations)

Station ID's in the region (METBXID(NLB))

(Surface stations first, then upper air stations)

! METBXID = 0 !

!END!

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters

----

EMPRICAL MIXING HEIGHT CONSTANTS

Neutral, mechanical equation

(CONSTB) Default: 1.41 ! CONSTB = 1.41 !

Convective mixing ht. equation

(CONSTE) Default: 0.15 ! CONSTE = 0.15 !

Stable mixing ht. equation

(CONSTN) Default: 2400. ! CONSTN = 2400.!

Overwater mixing ht. equation

(CONSTW) Default: 0.16 ! CONSTW = 0.16 !

Absolute value of Coriolis

parameter (FCORIOL) Default: 1.E-4 ! FCORIOL = 7.87E-05!

Units: (1/s)

SPATIAL AVERAGING OF MIXING HEIGHTS

Conduct spatial averaging

(IAVEZI) (0=no, 1=yes) Default: 1 ! IAVEZI = 1 !

Max. search radius in averaging

process (MNMDAV) Default: 1 ! MNMDAV = 1 !

Units: Grid

cells

Half-angle of upwind looking cone

for averaging (HAFANG) Default: 30. ! HAFANG = 30. !

Units: deg.

Layer of winds used in upwind

averaging (ILEVZI) Default: 1 ! ILEVZI = 1 !

(must be between 1 and NZ)

CONVECTIVE MIXING HEIGHT OPTIONS:

Method to compute the convective

mixing height(IMIHXH) Default: 1 ! IMIXH = 1 !

1: Maul-Carson for land and water cells

-1: Maul-Carson for land cells only-

OCD mixing height overwater

2: Batchvarova and Gryning for land and water cells

-2: Batchvarova and Gryning for land cells only

OCD mixing height overwater

Threshold buoyancy flux required to

sustain convective mixing height growth

overland (THRESHL) Default: 0.0 ! THRESHL = 0.05 !

(expressed as a heat flux units: W/m3

per meter of boundary layer)

Threshold buoyancy flux required to

sustain convective mixing height growth

overwater (THRESHW) Default: 0.05 ! THRESHW = 0.05 !

(expressed as a heat flux units: W/m3

per meter of boundary layer)

Flag to allow relaxation of convective mixing height

to equilibrium value when 0<QH<THRESHL (overland)

or 0<QH<THRESHW (overwater)

(IZICRLX) Default: 1 ! IZICRLX = 1 !

0 : do NOT use convective mixing height relaxation

to equilibrium value (treatment identical to CALMET v5.8)

1 : use convective mixing height relaxation

to equilibrium value

Relaxation time of convective mixing height to

equilibrium value when 0<QH<THRESHL (overland)

or 0<QH<THRESHW (overwater)

(Used only if IZICRLX = 1 and TZICRLX must be >= 1.)

(TZICRLX) Default: 800. ! TZICRLX = 800. !

Units: seconds

Option for overwater lapse rates used

in convective mixing height growth

(ITWPROG) Default: 0 ! ITWPROG = 0 !

0 : use SEA.DAT lapse rates and deltaT (or assume neutral

conditions if missing)

1 : use prognostic lapse rates (only if IPROG>2)

and SEA.DAT deltaT (or neutral if missing)

2 : use prognostic lapse rates and prognostic delta T

(only if iprog>12 and 3D.DAT version# 2.0 or higher)

Land Use category ocean in 3D.DAT datasets

(ILUOC3D) Default: 16 ! ILUOC3D = 16 !

Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16

if MM4.DAT, typically iluoc3d = 7

OTHER MIXING HEIGHT VARIABLES

Minimum potential temperature lapse

rate in the stable layer above the

current convective mixing ht. Default: 0.001 ! DPTMIN = 0.001 !

(DPTMIN) Units: deg. K/m

Depth of layer above current conv.

mixing height through which lapse Default: 200. ! DZZI = 200. !

rate is computed (DZZI) Units: meters

Minimum overland mixing height Default: 50. ! ZIMIN = 50. !

(ZIMIN) Units: meters

Maximum overland mixing height Default: 3000. ! ZIMAX = 2500. !

(ZIMAX) Units: meters

Minimum overwater mixing height Default: 50. ! ZIMINW = 50. !

(ZIMINW)-- (Not used if observed Units: meters

overwater mixing hts. are used)

Maximum overwater mixing height Default: 3000. ! ZIMAXW = 3000. !

(ZIMAXW)-- (Not used if observed Units: meters

overwater mixing hts. are used)

OVERWATER SURFACE FLUXES METHOD and PARAMETERS

(ICOARE) Default: 10 ! ICOARE = 10 !

0: original deltaT method (OCD)

10: COARE with no wave parameterization (jwave=0, Charnock)

11: COARE with wave option jwave=1 (Oost et al.)

and default wave properties

-11: COARE with wave option jwave=1 (Oost et al.)

and observed wave properties (must be in SEA.DAT files)

12: COARE with wave option 2 (Taylor and Yelland)

and default wave properties

-12: COARE with wave option 2 (Taylor and Yelland)

and observed wave properties (must be in SEA.DAT files)

Note: When ICOARE=0, similarity wind profile stability PSI functions

based on Van Ulden and Holtslag (1985) are substituted for

later formulations used with the COARE module, and temperatures

used for surface layer parameters are obtained from either the

nearest surface station temperature or prognostic model 2D

temperatures (if ITPROG=2).

Coastal/Shallow water length scale (DSHELF)

(for modified z0 in shallow water)

(COARE fluxes only)

Default : 0. ! DSHELF = 0. !

units: km

COARE warm layer computation (IWARM) ! IWARM = 0 !

1: on - 0: off (must be off if SST measured with

IR radiometer) Default: 0

COARE cool skin layer computation (ICOOL) ! ICOOL = 0 !

1: on - 0: off (must be off if SST measured with

IR radiometer) Default: 0

RELATIVE HUMIDITY PARAMETERS

3D relative humidity from observations or

from prognostic data? (IRHPROG) Default:0 ! IRHPROG = 0 !

0 = Use RH from SURF.DAT file

(only if NOOBS = 0,1)

1 = Use prognostic RH

(only if NOOBS = 0,1,2)

TEMPERATURE PARAMETERS

3D temperature from observations or

from prognostic data? (ITPROG) Default:0 ! ITPROG = 0 !

0 = Use Surface and upper air stations

(only if NOOBS = 0)

1 = Use Surface stations (no upper air observations)

Use MM5/3D.DATfor upper air data

(only if NOOBS = 0,1)

2 = No surface or upper air observations

Use MM5/3D.DAT for surface and upper air data

(only if NOOBS = 0,1,2)

Interpolation type

(1 = 1/R ; 2 = 1/R**2) Default:1 ! IRAD = 1 !

Radius of influence for temperature

interpolation (TRADKM) Default: 500. ! TRADKM = 10. !

Units: km

Maximum Number of stations to include

in temperature interpolation (NUMTS) Default: 5 ! NUMTS = 4 !

Conduct spatial averaging of temperatures (IAVET) (0=no, 1=yes) Default: 1 ! IAVET = 1 !

(will use mixing ht MNMDAV,HAFANG

so make sure they are correct)

Default temperature gradient Default: -.0098 ! TGDEFB = -0.0098 !

below the mixing height over Units: K/m

water (TGDEFB)

Default temperature gradient Default: -.0045 ! TGDEFA = -0.0045 !

above the mixing height over Units: K/m

water (TGDEFA)

Beginning (JWAT1) and ending (JWAT2)

land use categories for temperature ! JWAT1 = 999 !

interpolation over water -- Make ! JWAT2 = 999 !

bigger than largest land use to disable

PRECIP INTERPOLATION PARAMETERS

Method of interpolation (NFLAGP) Default: 2 ! NFLAGP = 2 !

(1=1/R,2=1/R**2,3=EXP/R**2)

Radius of Influence (SIGMAP) Default: 100.0 ! SIGMAP = 100. !

(0.0 => use half dist. btwn Units: km

nearest stns w & w/out

precip when NFLAGP = 3)

Minimum Precip. Rate Cutoff (CUTP) Default: 0.01 ! CUTP = 0.01 !

(values < CUTP = 0.0 mm/hr) Units: mm/hr

!END!

INPUT GROUP: 7 Surface meteorological station parameters

SURFACE STATION VARIABLES

(One record per station-- 1 records in all)

1 2

Name ID X coord. Y coord. Time Anem.

(km) (km) zone Ht.(m)

! SS1 ='BATH' 1 746.802 6299.899 10 10 !

* SS2 ='WILL' 2 391.047 6370.956 10 10 *

1

Four character string for station name

(MUST START IN COLUMN 9)

2

Six digit integer for station ID

!END!

--------------- ---

INPUT GROUP: ~~8~~ Upper air meteorological station parameters

----

UPPER AIR STATION VARIABLES

(One record per station-- 1 records in all)

1 2

Name ID X coord. Y coord. Time zone

(km) (km)

! US1 ='BATH' 54321 746.802 6299.899 -10 !

* US2 ='WILL' 54322 391.047 6370.956 -10 *

1

Four character string for station name

(MUST START IN COLUMN 9)

2

Five digit integer for station ID

!END!

-- --

INPUT GROUP: ~~9~~ Precipitation station parameters

PRECIPITATION STATION VARIABLES

(One record per station-- 0 records in all)

(NOT INCLUDED IF NPSTA = 0)

1 2

Name Station X coord. Y coord.

Code (km) (km)

1

Four character string for station name

(MUST START IN COLUMN 9)

2

Six digit station code composed of state

code (first 2 digits) and station ID (last

4 digits)

!END!

CALPUFF example input file

CALPUFF.INP 2.0 File version record

Middle Creek Quarry Stage1

---------------- Run title (3 lines) --

CALPUFF MODEL CONTROL FILE

INPUT GROUP: 0 Input and Output File Names

Default Name Type   File Name

------------   ----   ---------

CALMET.DAT   input   * METDAT =   *

or

ISCMET.DAT   input   * ISCDAT =   *

or

PLMMET.DAT   input   * PLMDAT =   *

or

PROFILE.DAT   input   * PRFDAT =   *

SURFACE.DAT   input   * SFCDAT =   *

RESTARTB.DAT input * RSTARTB=   *

CALPUFF.LST   output   ! PUFLST =PUFF1.LST !

CONC.DAT   output   ! CONDAT =PUFF1.CON   !

DFLX.DAT   output   ! DFDAT =PUFF1.DEP   !

WFLX.DAT   output   * WFDAT =   *

VISB.DAT   output   * VISDAT =   *

TK2D.DAT   output   * T2DDAT =   *

RHO2D.DAT   output   * RHODAT =   *

RESTARTE.DAT output   * RSTARTE=   *

------------------ ---

Emission Files

PTEMARB.DAT input * PTDAT = *

VOLEMARB.DAT input ! VOLDAT =EMISS1.VOL !

BAEMARB.DAT input * ARDAT = *

LNEMARB.DAT input * LNDAT = *

Other Files

OZONE.DAT input * OZDAT = *

VD.DAT input * VDDAT = *

CHEM.DAT input * CHEMDAT= *

AUX input ! AUXEXT =AUX !

(Extension added to METDAT filename(s) for files

with auxiliary 2D and 3D data)

H2O2.DAT input * H2O2DAT= *

NH3Z.DAT input * NH3ZDAT= *

HILL.DAT input * HILDAT= *

HILLRCT.DAT input * RCTDAT= *

COASTLN.DAT input * CSTDAT= *

FLUXBDY.DAT input * BDYDAT= *

BCON.DAT input * BCNDAT= *

DEBUG.DAT output * DEBUG = *

MASSFLX.DAT output * FLXDAT= *

MASSBAL.DAT output * BALDAT= *

FOG.DAT output * FOGDAT= *

RISE.DAT output * RISDAT= *

------------------------------------- ---

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = F !

F = UPPER CASE

NOTE: (1) file/path names can be up to 132 characters in length

Provision for multiple input files

Number of Modeling Domains (NMETDOM)

Default: 1 ! NMETDOM = 1 !

Number of CALMET.DAT files for run (NMETDAT)

Default: 1 ! NMETDAT = 12 !

Number of PTEMARB.DAT files for run (NPTDAT)

Default: 0 ! NPTDAT = 0 !

Number of BAEMARB.DAT files for run (NARDAT)

Default: 0 ! NARDAT = 0 !

Number of VOLEMARB.DAT files for run (NVOLDAT)

Default: 0 ! NVOLDAT = 0 !

!END!

Subgroup (0a)

Provide a name for each CALMET domain if NMETDOM > 1

Enter NMETDOM lines.

a,b

Default Name Domain Name

------------ ------------

none * DOMAIN1= * *END*

none * DOMAIN2= * *END*

none * DOMAIN3= * *END*

The following CALMET.DAT filenames are processed in sequence

if NMETDAT > 1

Enter NMETDAT lines, 1 line for each file name.

a,c,d

Default Name Type File Name

------------ ---- ---------

none input ! METDAT1 = ..\..\CALMET\MET01.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET02.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET03.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET04.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET05.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET06.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET07.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET08.DAT ! !END!

none input ! METDAT1 = ..\..\CALMET\MET09.DAT ! !END!

none input ! METDAT1 = ..\CALMET\MET10.DAT ! !END!

none input ! METDAT1 = ..\CALMET\MET11.DAT ! !END!

none input ! METDAT1 = ..\CALMET\MET12.DAT ! !END!

----

a

The name for each CALMET domain and each CALMET.DAT file is treated

as a separate input subgroup and therefore must end with an input

group terminator.

b

Use DOMAIN1= to assign the name for the outermost CALMET domain.

Use DOMAIN2= to assign the name for the next inner CALMET domain.

Use DOMAIN3= to assign the name for the next inner CALMET domain, etc.

| When inner domains with equal resolution (grid-cell size) |

| overlap, the data from the FIRST such domain in the list will |

| be used if all other criteria for choosing the controlling |

| grid domain are inconclusive. |

----

c

Use METDAT1= to assign the file names for the outermost CALMET domain.

Use METDAT2= to assign the file names for the next inner CALMET domain.

Use METDAT3= to assign the file names for the next inner CALMET domain, etc.

d

The filenames for each domain must be provided in sequential order

----

Subgroup (0b)

The following PTEMARB.DAT filenames are processed if NPTDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type File Name

------------ ---- ---------

none input * PTDAT= * *END*

Subgroup (0c)

The following BAEMARB.DAT filenames are processed if NARDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type File Name

------------ ---- ---------

none input * ARDAT= * *END*

Subgroup (0d)

The following VOLEMARB.DAT filenames are processed if NVOLDAT>0

(Each file contains a subset of the sources, for the entire simulation)

Default Name Type File Name

```
---------   ---  ----         ---------
 none       input      * VOLDAT=EMISS1.VOL    *   *END*

--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

   Option to run all periods found
   in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

      METRUN = 0 - Run period explicitly defined below
      METRUN = 1 - Run all periods in met. file

   Starting date:    Year   (IBYR) --   No default   ! IBYR  =  2021  !
                     Month  (IBMO) --   No default   ! IBMO  =  1  !
                     Day    (IBDY) --   No default   ! IBDY  =  1  !
   Starting time:    Hour   (IBHR) --   No default   ! IBHR  =  0  !
                     Minute (IBMIN) --  No default   ! IBMIN =  0  !
                     Second (IBSEC) --  No default   ! IBSEC =  0  !

   Ending date:      Year   (IEYR) --   No default   ! IEYR  =  2022  !
                     Month  (IEMO) --   No default   ! IEMO  =  1  !
                     Day    (IEDY) --   No default   ! IEDY  =  1  !
   Ending time:      Hour   (IEHR) --   No default   ! IEHR  =  0  !
                     Minute (IEMIN) --  No default   ! IEMIN =  0  !
                     Second (IESEC) --  No default   ! IESEC =  0  !
```

(These are only used if METRUN = 0)

Base time zone: (ABTZ) -- No default ! ABTZ= UTC+1000 !

(character*8)

The modeling domain may span multiple time zones. ABTZ defines the

base time zone used for the entire simulation. This must match the

base time zone of the meteorological data.

Examples:

Los Angeles, USA = UTC-0800

New York, USA = UTC-0500

Santiago, Chile = UTC-0400

Greenwich Mean Time (GMT) = UTC+0000

Rome, Italy = UTC+0100

Cape Town, S.Africa = UTC+0200

Sydney, Australia = UTC+1000

Length of modeling time-step (seconds)

Equal to update period in the primary

meteorological data files, or an

integer fraction of it (1/2, 1/3 ...)

Must be no larger than 1 hour

(NSECDT) Default:3600 ! NSECDT = 3600 !

Units: seconds

Number of chemical species (NSPEC)

Default: 5 ! NSPEC = 3 !

Number of chemical species

to be emitted (NSE) Default: 3 ! NSE = 0 !

Flag to stop run after

SETUP phase (ITEST) Default: 2 ! ITEST = 2 !

(Used to allow checking

of the model inputs, files, etc.)

ITEST = 1 - STOPS program after SETUP phase

ITEST = 2 - Continues with execution of program

after SETUP

Restart Configuration:

Control flag (MRESTART) Default: 0 ! MRESTART = 0 !

0 = Do not read or write a restart file

1 = Read a restart file at the beginning of

the run

2 = Write a restart file during run

3 = Read a restart file at beginning of run

and write a restart file during run

Number of periods in Restart

output cycle (NRESPD) Default: 0 ! NRESPD = 0 !

0 = File written only at last period

>0 = File updated every NRESPD periods

Meteorological Data Format (METFM)

Default: 1 ! METFM = 1 !

METFM = 1 - CALMET binary file (CALMET.MET)

METFM = 2 - ISC ASCII file (ISCMET.MET)

METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)

METFM = 4 - CTDM plus tower file (PROFILE.DAT) and

surface parameters file (SURFACE.DAT)

METFM = 5 - AERMET tower file (PROFILE.DAT) and

surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)

(used only for METFM = 1, 2, 3)

Default: 1 ! MPRFFM = 1 !

MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)

MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2

Averaging Time (minutes) (AVET)

Default: 60.0 ! AVET = 60. !

PG Averaging Time (minutes) (PGTIME)

Default: 60.0 ! PGTIME = 60. !

Output units for binary concentration and flux files

written in Dataset v2.2 or later formats

(IOUTU) Default: 1 ! IOUTU = 1 !

1 = mass - g/m3 (conc) or g/m2/s (dep)

2 = odour - odour_units (conc)

3 = radiation - Bq/m3 (conc) or Bq/m2/s (dep)

Output Dataset format for binary concentration

and flux files (e.g., CONC.DAT)

(IOVERS) Default: 2 ! IOVERS = 2 !

1 = Dataset Version 2.1

2 = Dataset Version 2.2

!END!

INPUT GROUP: 2 -- Technical options

Vertical distribution used in the

near field (MGAUSS) Default: 1 ! MGAUSS = 1 !

0 = uniform

1 = Gaussian

Terrain adjustment method

(MCTADJ) Default: 3 ! MCTADJ = 3 !

0 = no adjustment

1 = ISC-type of terrain adjustment

2 = simple, CALPUFF-type of terrain

adjustment

3 = partial plume path adjustment

Subgrid-scale complex terrain

flag (MCTSG)   Default: 0   ! MCTSG = 0   !

  0 = not modeled

  1 = modeled

Near-field puffs modeled as

elongated slugs? (MSLUG)   Default: 0   ! MSLUG = 0   !

  0 = no

  1 = yes (slug model used)

Transitional plume rise modeled?

(MTRANS)   Default: 1   ! MTRANS = 1   !

  0 = no (i.e., final rise only)

  1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP)   Default: 1   ! MTIP = 1 !

  0 = no (i.e., no stack tip downwash)

  1 = yes (i.e., use stack tip downwash)

Method used to compute plume rise for

point sources not subject to building

downwash? (MRISE)   Default: 1   ! MRISE = 1 !

  1 = Briggs plume rise

  2 = Numerical plume rise

Method used to simulate building

downwash? (MBDW)   Default: 1   ! MBDW =   2 !

  1 = ISC method

2 = PRIME method

Vertical wind shear modeled above

stack top (modified Briggs plume rise)?

(MSHEAR) Default: 0 ! MSHEAR = 0 !

0 = no (i.e., vertical wind shear not modeled)

1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT) Default: 0 ! MSPLIT =! 0

0 = no (i.e., puffs not split)

1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM) Default: 1 ! MCHEM = 0 !

0 = chemical transformation not

modeled

1 = transformation rates computed

internally (MESOPUFF II scheme)

2 = user-specified transformation

rates used

3 = transformation rates computed

internally (RIVAD/ARM3 scheme)

4 = secondary organic aerosol formation

computed (MESOPUFF II scheme for OH)

5 = user-specified half-life with or

without transfer to child species

6 = transformation rates computed

internally (Updated RIVAD scheme with

ISORROPIA equilibrium)

7 = transformation rates computed

internally (Updated RIVAD scheme with

ISORROPIA equilibrium and CalTech SOA)

Aqueous phase transformation flag (MAQCHEM)

(Used only if MCHEM = 6, or 7) Default: 0 ! MAQCHEM = 0 !

0 = aqueous phase transformation

not modeled

1 = transformation rates and wet

scavenging coefficients adjusted

for in-cloud aqueous phase reactions

(adapted from RADM cloud model

implementation in CMAQ/SCICHEM)

Liquid Water Content flag (MLWC)

(Used only if MAQCHEM = 1) Default: 1 ! MLWC = 1 !

0 = water content estimated from cloud cover

and presence of precipitation

1 = gridded cloud water data read from CALMET

water content output files (filenames are

the CALMET.DAT names PLUS the extension

AUXEXT provided in Input Group 0)

Wet removal modeled ? (MWET) Default: 1 ! MWET = 0 !

0 = no

1 = yes

Dry deposition modeled ? (MDRY) Default: 1 ! MDRY = 1 !

0 = no

1 = yes

(dry deposition method specified

for each species in Input Group 3)

Gravitational settling (plume tilt)

modeled ? (MTILT) Default: 0 ! MTILT = 0 !

0 = no

1 = yes

(puff center falls at the gravitational

settling velocity for 1 particle species)

Restrictions:

- MDRY = 1

- NSPEC = 1 (must be particle species as well)

- sg = 0 GEOMETRIC STANDARD DEVIATION in Group 8 is

set to zero for a single particle diameter

Method used to compute dispersion

coefficients (MDISP) Default: 3 ! MDISP = 2 !

1 = dispersion coefficients computed from measured values

of turbulence, sigma v, sigma w

2 = dispersion coefficients from internally calculated

sigma v, sigma w using micrometeorological variables

(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using

the ISCST multi-segment approximation) and MP coefficients in

urban areas

4 = same as 3 except PG coefficients computed using

the MESOPUFF II eqns.

5 = CTDM sigmas used for stable and neutral conditions.

For unstable conditions, sigmas are computed as in

MDISP = 3, described above. MDISP = 5 assumes that

measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)

(Used only if MDISP = 1 or 5) Default: 3 ! MTURBVW = 3 !

1 = use sigma-v or sigma-theta measurements

from PROFILE.DAT to compute sigma-y

(valid for METFM = 1, 2, 3, 4, 5)

2 = use sigma-w measurements

from PROFILE.DAT to compute sigma-z

(valid for METFM = 1, 2, 3, 4, 5)

3 = use both sigma-(v/theta) and sigma-w

from PROFILE.DAT to compute sigma-y and sigma-z

(valid for METFM = 1, 2, 3, 4, 5)

4 = use sigma-theta measurements

from PLMMET.DAT to compute sigma-y

(valid only if METFM = 3)

Back-up method used to compute dispersion

when measured turbulence data are

missing (MDISP2) Default: 3 ! MDISP2 = 3 !

(used only if MDISP = 1 or 5)

2 = dispersion coefficients from internally calculated

sigma v, sigma w using micrometeorological variables

(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using

the ISCST multi-segment approximation) and MP coefficients in

urban areas

4 = same as 3 except PG coefficients computed using

the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]

Method used for Lagrangian timescale for Sigma-y

(used only if MDISP=1,2 or MDISP2=1,2)

(MTAULY) Default: 0 ! MTAULY = 0 !

0 = Draxler default 617.284 (s)

1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF

10 < Direct user input (s) -- e.g., 306.9

[DIAGNOSTIC FEATURE]

Method used for Advective-Decay timescale for Turbulence

(used only if MDISP=2 or MDISP2=2)

(MTAUADV) Default: 0 ! MTAUADV = 0 !

0 = No turbulence advection

1 = Computed (OPTION NOT IMPLEMENTED)

10 < Direct user input (s) -- e.g., 800

Method used to compute turbulence sigma-v &

sigma-w using micrometeorological variables

(Used only if MDISP = 2 or MDISP2 = 2)

(MCTURB) Default: 1 ! MCTURB = 1 !

1 = Standard CALPUFF subroutines

2 = AERMOD subroutines

PG sigma-y,z adj. for roughness? Default: 0 ! MROUGH = 0 !

(MROUGH)

0 = no

1 = yes

Partial plume penetration of Default: 1 ! MPARTL = 1 !

elevated inversion modeled for

point sources?

(MPARTL)

0 = no

1 = yes

Partial plume penetration of Default: 1 ! MPARTLBA = 1 !

elevated inversion modeled for

buoyant area sources?

(MPARTLBA)

0 = no

1 = yes

Strength of temperature inversion Default: 0 ! MTINV = 0 !

provided in PROFILE.DAT extended records?

(MTINV)

0 = no (computed from measured/default gradients)

1 = yes

PDF used for dispersion under convective conditions?

Default: 0 ! MPDF = 0 !

(MPDF)

0 = no

1 = yes

Sub-Grid TIBL module used for shore line?

Default: 0 ! MSGTIBL = 0 !

(MSGTIBL)

0 = no

1 = yes

Boundary conditions (concentration) modeled?

Default: 0 ! MBCON = 0 !

(MBCON)

0 = no

1 = yes, using formatted BCON.DAT file

2 = yes, using unformatted CONC.DAT file

Note: MBCON > 0 requires that the last species modeled

be 'BCON'. Mass is placed in species BCON when

generating boundary condition puffs so that clean

air entering the modeling domain can be simulated

in the same way as polluted air. Specify zero

emission of species BCON for all regular sources.

Individual source contributions saved?

Default: 0 ! MSOURCE = 0 !

(MSOURCE)

0 = no

1 = yes

Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors. Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
emissions and provides cloud information in a specialized format
for further analysis. Output to FOG.DAT is provided in either
'plume mode' or 'receptor mode' format.

Configure for FOG Model output?

Default: 0 ! MFOG = 0 !

(MFOG)

0 = no

1 = yes - report results in PLUME Mode format

2 = yes - report results in RECEPTOR Mode format

Test options specified to see if
they conform to regulatory
values? (MREG) Default: 1 ! MREG = 0 !

0 = NO checks are made

1 = Technical options must conform to USEPA
Long Range Transport (LRT) guidance

METFM 1 or 2

AVET 60. (min)

PGTIME 60. (min)

MGAUSS 1

MCTADJ 3

MTRANS 1

MTIP 1

MRISE 1

MCHEM 1 or 3 (if modeling SOx, NOx)

MWET 1

MDRY 1

MDISP 2 or 3

MPDF 0 if MDISP=3

1 if MDISP=2

MROUGH 0

MPARTL 1

MPARTLBA 0

SYTDEP 550. (m)

MHFTSZ 0

SVMIN 0.5 (m/s)

!END!

INPUT GROUP: 3a, 3b Species list

Subgroup (3a)

The following species are modeled:

! CSPEC = TSP ! !END!

! CSPEC = PM10 ! !END!

! CSPEC = PM25 ! !END!

```
                              Dry              OUTPUT GROUP
 SPECIES     MODELED       EMITTED      DEPOSITED            NUMBER
  NAME       (0=NO, 1=YES)  (0=NO, 1=YES)  (0=NO,            (0=NONE,
(Limit: 12                    1=COMPUTED-GAS      1=1st CGRUP,
 Characters                   2=COMPUTED-PARTICLE   2=2nd CGRUP,
 in length)                   3=USER-SPECIFIED)     3= etc.)

!      TSP  =      1,          1,        2,           0  !
!      PM10=       1,          1,        2,           0  !
!      PM25  =     1,          1,        2,           0  !
```

!END!

Note: The last species in (3a) must be 'BCON' when using the

boundary condition option (MBCON > 0). Species BCON should

typically be modeled as inert (no chem transformation or

removal).

Subgroup (3b)

The following names are used for Species-Groups in which results

for certain species are combined (added) prior to output. The

CGRUP name will be used as the species name in output files.

Use this feature to model specific particle-size distributions

by treating each size-range as a separate species.

Order must be consistent with 3(a) above.

INPUT GROUP: 4 -- Map Projection and Grid control parameters

Projection for all (X,Y):

Map projection

(PMAP) Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator

TTM : Tangential Transverse Mercator

LCC : Lambert Conformal Conic

PS : Polar Stereographic

EM : Equatorial Mercator

LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin

(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 0.000 !

(FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 55 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = S !

N : Northern hemisphere projection

S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin

(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = 0N !

(RLON0) No Default ! RLON0 = 0E !

TTM : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

LCC : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

PS : RLON0 identifies central (grid N/S) meridian of projection

RLAT0 selected for convenience

EM : RLON0 identifies central meridian of projection

RLAT0 is REPLACED by 0.0N (Equator)

LAZA: RLON0 identifies longitude of tangent-point of mapping plane

RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection

(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 0N !

(XLAT2) No Default ! XLAT2 = 0N !

LCC : Projection cone slices through Earth's surface at XLAT1 and XLAT2

PS : Projection plane slices through Earth at XLAT1

(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a

letter N,S,E, or W indicating north or south latitude, and

east or west longitude. For example,

35.9 N Latitude = 35.9N

118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character

string. Many mapping products currently available use the model of the

Earth known as the World Geodetic System 1984 (WGS-84). Other local

models may be in use, and their selection in CALMET will make its output

consistent with local mapping products. The list of Datum-Regions with

official transformation parameters is provided by the National Imagery and

Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)

NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)

NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)

NWS-84 NWS 6370KM Radius, Sphere

ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates

(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

METEOROLOGICAL Grid:

Rectangular grid defined for projection PMAP,

with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 103 !

No. Y grid cells (NY) No default ! NY = 103 !

No. vertical layers (NZ) No default ! NZ = 9 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = .1 !

Units: km

Cell face heights

(ZFACE(nz+1)) No defaults

Units: m

! ZFACE = .0, 20.0, 40.0, 80.0, 160.0, 320.0, 700.0, 1200.0, 1500.0, 2000.0 !

Reference Coordinates

of SOUTHWEST corner of

grid cell(1, 1):

X coordinate (XORIGKM) No default ! XORIGKM = 754.850 !

Y coordinate (YORIGKM) No default ! YORIGKM = 6261.850 !

Units: km

COMPUTATIONAL Grid:

The computational grid is identical to or a subset of the MET. grid.

The lower left (LL) corner of the computational grid is at grid point

(IBCOMP, JBCOMP) of the MET. grid. The upper right (UR) corner of the

computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.

The grid spacing of the computational grid is the same as the MET. grid.

X index of LL corner (IBCOMP) No default ! IBCOMP = 1 !

(1 <= IBCOMP <= NX)

Y index of LL corner (JBCOMP) No default ! JBCOMP = 1 !

(1 <= JBCOMP <= NY)

X index of UR corner (IECOMP) No default ! IECOMP = 103 !

(1 <= IECOMP <= NX)

Y index of UR corner (JECOMP) No default ! JECOMP = 103 !

(1 <= JECOMP <= NY)

SAMPLING Grid (GRIDDED RECEPTORS):

The lower left (LL) corner of the sampling grid is at grid point

(IBSAMP, JBSAMP) of the MET. grid. The upper right (UR) corner of the

sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.

The sampling grid must be identical to or a subset of the computational

grid. It may be a nested grid inside the computational grid.

The grid spacing of the sampling grid is DGRIDKM/MESHDN.

Logical flag indicating if gridded

receptors are used (LSAMP) Default: T ! LSAMP = F !

(T=yes, F=no)

X index of LL corner (IBSAMP) No default ! IBSAMP = 1 !

(IBCOMP <= IBSAMP <= IECOMP)

Y index of LL corner (JBSAMP) No default ! JBSAMP = 1 !

(JBCOMP <= JBSAMP <= JECOMP)

X index of UR corner (IESAMP) No default ! IESAMP = 50 !

(IBCOMP <= IESAMP <= IECOMP)

Y index of UR corner (JESAMP) No default ! JESAMP = 50 !

(JBCOMP <= JESAMP <= JECOMP)

Nesting factor of the sampling

grid (MESHDN)   Default: 1   ! MESHDN = 1 !

(MESHDN is an integer >= 1)

!END!

INPUT GROUP: 5 Output Options

----

*   *

FILE   DEFAULT VALUE   VALUE THIS RUN

----   -------------   --------------

Concentrations (ICON)   1   ! ICON = 1   !

Dry Fluxes (IDRY)   1   ! IDRY = 1   !

Wet Fluxes (IWET)   1   ! IWET = 0   !

2D Temperature (IT2D)   0   ! IT2D = 0   !

2D Density (IRHO)   0   ! IRHO = 0   !

Relative Humidity (IVIS)   1   ! IVIS = 0   !

(relative humidity file is

required for visibility

analysis)

Use data compression option in output file?

(LCOMPRS) Default: T ! LCOMPRS = T !

*

0 = Do not create file, 1 = create file

QA PLOT FILE OUTPUT OPTION:

Create a standard series of output files (e.g.

locations of sources, receptors, grids ...)

suitable for plotting?

(IQAPLOT) Default: 1 ! IQAPLOT = 1 !

0 = no

1 = yes

DIAGNOSTIC PUFF-TRACKING OUTPUT OPTION:

Puff locations and properties reported to

PFTRAK.DAT file for postprocessing?

(IPFTRAK) Default: 0 ! IPFTRAK = 0 !

0 = no

1 = yes, update puff output at end of each timestep

2 = yes, update puff output at end of each sampling step

DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

Mass flux across specified boundaries

for selected species reported?

(IMFLX) Default: 0 ! IMFLX = 0 !

0 = no

1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames

are specified in Input Group 0)

Mass balance for each species

reported?

(IMBAL) Default: 0 ! IMBAL = 0 !

0 = no

1 = yes (MASSBAL.DAT filename is

specified in Input Group 0)

NUMERICAL RISE OUTPUT OPTION:

Create a file with plume properties for each rise

increment, for each model timestep?

This applies to sources modeled with numerical rise

and is limited to ONE source in the run.

(INRISE) Default: 0 ! INRISE = 0 !

0 = no

1 = yes (RISE.DAT filename is

specified in Input Group 0)

LINE PRINTER OUTPUT OPTIONS:

Print concentrations (ICPRT) Default: 0 ! ICPRT = 0 !

Print dry fluxes (IDPRT) Default: 0 ! IDPRT = 0 !

Print wet fluxes (IWPRT) Default: 0 ! IWPRT = 0 !

(0 = Do not print, 1 = Print)

Concentration print interval

(ICFRQ) in timesteps Default: 1 ! ICFRQ = 92 !

Dry flux print interval

(IDFRQ) in timesteps Default: 1 ! IDFRQ = 92 !

Wet flux print interval

(IWFRQ) in timesteps Default: 1 ! IWFRQ = 1 !

Units for Line Printer Output

(IPRTU) Default: 1 ! IPRTU = 3 !

	for Concentration	for Deposition
1 =	g/m**3	g/m**2/s
2 =	mg/m**3	mg/m**2/s
3 =	ug/m**3	ug/m**2/s
4 =	ng/m**3	ng/m**2/s
5 =	Odour Units	

Messages tracking progress of run

written to the screen ?

(IMESG) Default: 2 ! IMESG = 2 !

0 = no

1 = yes (advection step, puff ID)

2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)

SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

```
        ----  CONCENTRATIONS--  ------  DRY FLUXES-----  ------  WET FLUXES-----  --  MASS FLUX-
  SPECIES
  /GROUP      PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON DISK?
  -------     ------------------------   ------------------------   ------------------------   ---------------
!      TSP =    0,        1,        0,        1,        0,        0,        0   !
!     PM10 =    0,        1,    0,        1,        0,        0,        0   !
!     PM25 =    0,        1,        0,        1,        0,        0,        0   !
```

Note: Species BCON (for MBCON > 0) does not need to be saved on disk.

OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

Logical for debug output

(LDEBUG)   Default: F   ! LDEBUG = F !

First puff to track

(IPFDEB)   Default: 1   ! IPFDEB = 1 !

Number of puffs to track

(NPFDEB)   Default: 1   ! NPFDEB = 1 !

Met. period to start output

(NN1)   Default: 1   ! NN1 = 1   !

Met. period to end output

(NN2)   Default: 10   ! NN2 = 10 !

!END!

INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs

----

Subgroup (6a)

Number of terrain features (NHILL) Default: 0 ! NHILL = 0 !

Number of special complex terrain

receptors (NCTREC) Default: 0 ! NCTREC = 0 !

Terrain and CTSG Receptor data for

CTSG hills input in CTDM format ?

(MHILL) No Default ! MHILL = 2 !

1 = Hill and Receptor data created

by CTDM processors & read from

HILL.DAT and HILLRCT.DAT files

2 = Hill data created by OPTHILL &

input below in Subgroup (6b);

Receptor data in Subgroup (6c)

Factor to convert horizontal dimensions Default: 1.0 ! XHILL2M = 1.0 !

to meters (MHILL=1)

Factor to convert vertical dimensions Default: 1.0 ! ZHILL2M = 1.0 !

to meters (MHILL=1)

X-origin of CTDM system relative to No Default ! XCTDMKM = 0 !

CALPUFF coordinate system, in Kilometers (MHILL=1)

Y-origin of CTDM system relative to No Default ! YCTDMKM = 0 !

CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

Subgroup (6b)

----

1 **

HILL information

HILL NO.	XC (km)	YC (km)	THETAH (deg.)	ZGRID (m)	RELIEF (m)	EXPO 1 (m)	EXPO 2 (m)	SCALE 1 (m)	SCALE 2 (m)	AMAX1 (m)	AMAX2 (m)
----	----	----	------	-----	------	------	------	-------	-------	-----	-----

----

Subgroup (6c)

------- --------

COMPLEX TERRAIN RECEPTOR INFORMATION

XRCT YRCT ZRCT XHH

(km) (km) (m)

------ ----- ------ ----

1

Description of Complex Terrain Variables:

XC, YC = Coordinates of center of hill

THETAH = Orientation of major axis of hill (clockwise from

North)

ZGRID = Height of the 0 of the grid above mean sea

level

RELIEF = Height of the crest of the hill above the grid elevation

EXPO 1 = Hill-shape exponent for the major axis

EXPO 2 = Hill-shape exponent for the major axis

SCALE 1 = Horizontal length scale along the major axis

SCALE 2 = Horizontal length scale along the minor axis

AMAX = Maximum allowed axis length for the major axis

BMAX = Maximum allowed axis length for the major axis

XRCT, YRCT = Coordinates of the complex terrain receptors

ZRCT = Height of the ground (MSL) at the complex terrain

Receptor

XHH = Hill number associated with each complex terrain receptor

(NOTE: MUST BE ENTERED AS A REAL NUMBER)

**

NOTE: DATA for each hill and CTSG receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

-- -----------------------------------

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases

----

```
 SPECIES    DIFFUSIVITY     ALPHA STAR     REACTIVITY   MESOPHYLL RESISTANCE    HENRY'S LAW COEFFICIENT
  NAME       (cm**2/s)                                      (s/cm)                  (dimensionless)
 -------    -----------     ----------     ----------   --------------------    -----------------------
```

!END!

INPUT GROUP: 8 -- Size parameters for dry deposition of particles

----

For SINGLE SPECIES, the mean and standard deviation are used to

compute a deposition velocity for NINT (see group 9) size-ranges,

and these are then averaged to obtain a mean deposition velocity.

For GROUPED SPECIES, the size distribution should be explicitly

specified (by the 'species' in the group), and the standard deviation

for each should be entered as 0. The model will then use the

```
deposition velocity for the stated mean diameter.

 SPECIES     GEOMETRIC MASS MEAN      GEOMETRIC STANDARD
  NAME           DIAMETER                DEVIATION
              (microns)             (microns)
 -------      -------------------       ------------------
!      TSP =        17.3,             2.0   !
!     PM10 =         5.0,             2.0   !
!     PM25 =         1.0,             1.0   !

!END!

-- ------------------------------------------------------------------------------

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

    Reference cuticle resistance (s/cm)
    (RCUTR)                       Default: 30   !  RCUTR = 30.0 !
    Reference ground resistance  (s/cm)
    (RGR)                         Default: 10   !   RGR = 10.0 !
    Reference pollutant reactivity
    (REACTR)                      Default: 8    ! REACTR = 8.0 !

    Number of particle-size intervals used to
    evaluate effective particle deposition velocity
    (NINT)                        Default: 9    !   NINT =  9  !
```

Vegetation state in unirrigated areas

(IVEG) Default: 1 ! IVEG =

IVEG=1 for active and unstressed vegetation

IVEG=2 for active and stressed vegetation

IVEG=3 for inactive vegetation

!END!

INPUT GROUP: 10 -- Wet Deposition Parameters

Scavenging Coefficient -- Units: (sec)**(-1)

Pollutant Liquid Precip. Frozen Precip.

--------- -------------- --------------

!END!

INPUT GROUP: 11a, 11b -- Chemistry Parameters

Subgroup (11a)

Several parameters are needed for one or more of the chemical transformation

mechanisms. Those used for each mechanism are:

```
                       M        B
                       A B R R R   C B    N
                     B   V C N N N M K O C   D
                     C M G K I I I H H K F V E
                   M K N N N T T T 2 2 P R C C
                   O O H H H E E E O O M A N A
Mechanism (MCHEM)    2 3 3 3 3 1 2 3 2 2 F C X Y
--------------------  --------------------------------------------
0 None                . . . . . . . . . . . . . .
1 MESOPUFF II          X X . . X X X X . . . . . .
2 User Rates           . . . . . . . . . . . . . .
3 RIVAD                X X . . X . . . . . . . . .
4 SOA                  X X . . . . . . . . X X X .
5 Radioactive Decay    . . . . . . . . . . . . . X
6 RIVAD/ISORRPIA       X X X X X X . . X X . . . .
7 RIVAD/ISORRPIA/SOA   X X X X X X . . X X X X . .
```

Ozone data input option (MOZ) Default: 1 ! MOZ = 0 !

(Used only if MCHEM = 1, 3, 4, 6, or 7)

0 = use a monthly background ozone value

1 = read hourly ozone concentrations from

the OZONE.DAT data file

Monthly ozone concentrations in ppb (BCKO3)

(Used only if MCHEM = 1,3,4,6, or 7 and either

MOZ = 0, or

MOZ = 1 and all hourly O3 data missing)

Default: 12*80.

! BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00 !

Ammonia data option (MNH3) Default: 0 ! MNH3 = 0 !

(Used only if MCHEM = 6 or 7)

0 = use monthly background ammonia values (BCKNH3) - no vertical variation

1 = read monthly background ammonia values for each layer from

the NH3Z.DAT data file

Ammonia vertical averaging option (MAVGNH3)

(Used only if MCHEM = 6 or 7, and MNH3 = 1)

0 = use NH3 at puff center height (no averaging is done)

1 = average NH3 values over vertical extent of puff

Default: 1 ! MAVGNH3 = 1 !

Monthly ammonia concentrations in ppb (BCKNH3)

(Used only if MCHEM = 1 or 3, or

if MCHEM = 6 or 7, and MNH3 = 0)

Default: 12*10.

! BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00 !

Nighttime SO2 loss rate in %/hour (RNITE1)

(Used only if MCHEM = 1, 6 or 7)

This rate is used only at night for MCHEM=1

and is added to the computed rate both day

and night for MCHEM=6,7 (heterogeneous reactions)

Default: 0.2 ! RNITE1 = .2 !

Nighttime NOx loss rate in %/hour (RNITE2)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE2 = 2.0 !

Nighttime HNO3 formation rate in %/hour (RNITE3)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE3 = 2.0 !

H2O2 data input option (MH2O2) Default: 1 ! MH2O2 = 1 !

(Used only if MCHEM = 6 or 7, and MAQCHEM = 1)

0 = use a monthly background H2O2 value

1 = read hourly H2O2 concentrations from

the H2O2.DAT data file

Monthly H2O2 concentrations in ppb (BCKH2O2)

(Used only if MQACHEM = 1 and either

MH2O2 = 0 or

MH2O2 = 1 and all hourly H2O2 data missing)

Default: 12*1.

! BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

--- Data for SECONDARY ORGANIC AEROSOL (SOA) Options

(used only if MCHEM = 4 or 7)

The MCHEM = 4 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

VOC / NOX ratio (after reaction) (VCNX)

The MCHEM = 7 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

These characterize the air mass when computing

the formation of SOA from VOC emissions.

Typical values for several distinct air mass types are:

Month 1 2 3 4 5 6 7 8 9 10 11 12

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Clean Continental

BCKPMF 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.

OFRAC .15 .15 .20 .20 .20 .20 .20 .20 .20 .20 .20 .15

VCNX 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.

Clean Marine (surface)

BCKPMF .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5

OFRAC .25 .25 .30 .30 .30 .30 .30 .30 .30 .30 .30 .25

VCNX 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.

Urban - low biogenic (controls present)

BCKPMF 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30.

OFRAC .20 .20 .25 .25 .25 .25 .25 .25 .20 .20 .20 .20

VCNX 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4.

Urban - high biogenic (controls present)

BCKPMF 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60.

OFRAC .25 .25 .30 .30 .30 .55 .55 .55 .35 .35 .35 .25

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Regional Plume

BCKPMF 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20.

OFRAC .20 .20 .25 .35 .25 .40 .40 .40 .30 .30 .30 .20

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Urban - no controls present

BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.

OFRAC .30 .30 .35 .35 .35 .55 .55 .55 .35 .35 .35 .30

VCNX 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.

Default: Clean Continental

! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

! OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !

! VCNX = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !

--- End Data for SECONDARY ORGANIC AEROSOL (SOA) Option

Number of half-life decay specification blocks provided in Subgroup 11b

(Used only if MCHEM = 5)

```
   (NDECAY)                       Default: 0     ! NDECAY = 0   !

!END!


--------------
Subgroup (11b)
--------------

   Each species modeled may be assigned a decay half-life (sec), and the associated
   mass lost may be assigned to one or more other modeled species using a mass yield
   factor. This information is used only for MCHEM=5.

   Provide NDECAY blocks assigning the half-life for a parent species and mass yield
   factors for each child species (if any) produced by the decay.
   Set HALF_LIFE=0.0 for NO decay (infinite half-life).


                   a           b
     SPECIES      Half-Life   Mass Yield
      NAME         (sec)       Factor
     -------      ---------   ----------

   *  SPEC1   =    3600.,    -1.0   *    (Parent)
   *  SPEC2   =  -1.0,        0.0   *    (Child)
  *END*


--------
  a
```

Specify a half life that is greater than or equal to zero for 1 parent species

in each block, and set the yield factor for this species to -1

b

Specify a yield factor that is greater than or equal to zero for 1 or more child

species in each block, and set the half-life for each of these species to -1

NOTE: Assignments in each block are treated as a separate input

subgroup and therefore must end with an input group terminator.

If NDECAY=0, no assignments and input group terminators should appear.

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters

----

Horizontal size of puff (m) beyond which

time-dependent dispersion equations (Heffter)

are used to determine sigma-y and

sigma-z (SYTDEP) Default: 550. ! SYTDEP = 5.5E02 !

Switch for using Heffter equation for sigma z

as above (0 = Not use Heffter; 1 = use Heffter

(MHFTSZ) Default: 0 ! MHFTSZ = 0 !

Stability class used to determine plume

growth rates for puffs above the boundary

layer (JSUP) Default: 5 ! JSUP = 5 !

Vertical dispersion constant for stable

conditions (k1 in Eqn. 2.7-3) (CONK1) Default: 0.01 ! CONK1 = .01 !

Vertical dispersion constant for neutral/

unstable conditions (k2 in Eqn. 2.7-4)

(CONK2) Default: 0.1 ! CONK2 = .1 !

Factor for determining Transition-point from

Schulman-Scire to Huber-Snyder Building Downwash

scheme (SS used for Hs < Hb + TBD * HL)

(TBD) Default: 0.5 ! TBD = 1.5 !

TBD < 0 ==> always use Huber-Snyder

TBD = 1.5 ==> always use Schulman-Scire

TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which

urban dispersion is assumed

(IURB1, IURB2) Default: 10 ! IURB1 = 10 !

19 ! IURB2 = 19 !

Site characterization parameters for single-point Met data files---------

(needed for METFM = 2,3,4,5)

Land use category for modeling domain

(ILANDUIN) Default: 20 ! ILANDUIN = 100 !

Roughness length (m) for modeling domain

(Z0IN) Default: 0.25 ! Z0IN = .5 !

Leaf area index for modeling domain

(XLAIIN) Default: 3.0 ! XLAIIN = .2 !

Elevation above sea level (m)

(ELEVIN) Default: 0.0 ! ELEVIN = 61.0 !

Latitude (degrees) for met location

(XLATIN) Default: -999. ! XLATIN = -33.80905 !

Longitude (degrees) for met location

(XLONIN) Default: -999. ! XLONIN = 151.30422 !

Specialized information for interpreting single-point Met data files-----

Anemometer height (m) (Used only if METFM = 2,3)

(ANEMHT) Default: 10. ! ANEMHT = 10.0 !

Form of lateral turbulance data in PROFILE.DAT file

(Used only if METFM = 4,5 or MTURBVW = 1 or 3)

(ISIGMAV) Default: 1 ! ISIGMAV = 1 !

0 = read sigma-theta

1 = read sigma-v

Choice of mixing heights (Used only if METFM = 4)

(IMIXCTDM) Default: 0 ! IMIXCTDM = 0 !

0 = read PREDICTED mixing heights

1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)

(XMXLEN) Default: 1.0 ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in

grid units) during one sampling step

(XSAMLEN) Default: 1.0 ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from

one source during one time step

(MXNEW) Default: 99 ! MXNEW = 99 !

Maximum Number of sampling steps for

one puff/slug during one time step

(MXSAM) Default: 99 ! MXSAM = 99 !

Number of iterations used when computing

the transport wind for a sampling step

that includes gradual rise (for CALMET

and PROFILE winds)

(NCOUNT) Default: 2 ! NCOUNT = 2 !

Minimum sigma y for a new puff/slug (m)

(SYMIN) Default: 1.0 ! SYMIN = 1.0 !

Minimum sigma z for a new puff/slug (m)

(SZMIN) Default: 1.0 ! SZMIN = 1.0 !

Maximum sigma z (m) allowed to avoid

numerical problem in calculating virtual

time or distance. Cap should be large

enough to have no influence on normal events.

Enter a negative cap to disable.

(SZCAP_M) Default: 5.0e06 ! SZCAP_M = 5.0E06 !

Default minimum turbulence velocities sigma-v and sigma-w

for each stability class over land and over water (m/s)

(SVMIN(12) and SWMIN(12))

---------- LAND ---------- --------- WATER----------

Stab Class : A B C D E F A B C D E F

--- --- --- --- --- --- --- --- --- --- --- ---

Default SVMIN : .50, .50, .50, .50, .50, .50, .37, .37, .37, .37, .37, .37

Default SWMIN : .20, .12, .08, .06, .03, .016, .20, .12, .08, .06, .03, .016

! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370!

! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

Divergence criterion for dw/dz across puff

used to initiate adjustment for horizontal

convergence (1/s)

Partial adjustment starts at CDIV(1), and

full adjustment is reached at CDIV(2)

(CDIV(2)) Default: 0.0,0.0 ! CDIV = .0, .0 !

Search radius (number of cells) for nearest

land and water cells used in the subgrid

TIBL module

(NLUTIBL) Default: 4 ! NLUTIBL = 4 !

Minimum wind speed (m/s) allowed for

non-calm conditions. Also used as minimum

speed returned when using power-law

extrapolation toward surface

(WSCALM) Default: 0.5 ! WSCALM = .5 !

Maximum mixing height (m)

(XMAXZI) Default: 3000. ! XMAXZI = 3000.0 !

Minimum mixing height (m)

(XMINZI) Default: 50. ! XMINZI = 50.0 !

Default wind speed classes --

5 upper bounds (m/s) are entered;

the 6th class has no upper limit

(WSCAT(5)) Default :

ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

Wind Speed Class : 1 2 3 4 5

--- --- --- --- ---

! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law

exponents for stabilities 1-6

(PLX0(6)) Default : ISC RURAL values

ISC RURAL : .07, .07, .10, .15, .35, .55

ISC URBAN : .15, .15, .20, .25, .30, .30

Stability Class : A B C D E F

--- --- --- --- --- ---

! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient

for stable classes E, F (degK/m)

(PTG0(2)) Default: 0.020, 0.035

! PTG0 = 0.020, 0.035 !

Default plume path coefficients for

each stability class (used when option

for partial plume height terrain adjustment

is selected-- MCTADJ=3)

(PPC(6)) Stability Class : A B C D E F

Default PPC : .50, .50, .50, .50, .35, .35

--- --- --- --- --- ---

! PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor

equal to sigma-y/length of slug

(SL2PF) Default: 10. ! SL2PF = 10.0 !

Puff-splitting control variables ------------------------

VERTICAL SPLIT

Number of puffs that result every time a puff

is split - nsplit=2 means that 1 puff splits

into 2

(NSPLIT) Default: 3 ! NSPLIT = 3 !

Time(s) of a day when split puffs are eligible to

be split once again; this is typically set once

per day, around sunset before nocturnal shear develops.

24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)

0=do not re-split 1=eligible for re-split

(IRESPLIT(24)) Default: Hour 17 = 1

! IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

Split is allowed only if last hour's mixing

height (m) exceeds a minimum value

(ZISPLIT) Default: 100. ! ZISPLIT = 100.0 !

Split is allowed only if ratio of last hour's

mixing ht to the maximum mixing ht experienced

by the puff is less than a maximum value (this

postpones a split until a nocturnal layer develops)

(ROLDMAX) Default: 0.25 ! ROLDMAX = 0.25 !

HORIZONTAL SPLIT

Number of puffs that result every time a puff

is split - nsplith=5 means that 1 puff splits

into 5

(NSPLITH) Default: 5 ! NSPLITH = 5 !

Minimum sigma -y (Grid Cells Units) of puff

before it may be split

(SYSPLITH) Default: 1.0 ! SYSPLITH = 1.0 !

Minimum puff elongation rate (SYSPLITH/hr) due to

wind shear, before it may be split

(SHSPLITH) Default: 2. ! SHSPLITH = 2.0 !

Minimum concentration (g/m^3) of each

species in puff before it may be split

Enter array of NSPEC values; if a single value is

entered, it will be used for ALL species

(CNSPLITH) Default: 1.0E-07 ! CNSPLITH = 1.0E-07 !

Integration control variables ------------ ------------

Fractional convergence criterion for numerical SLUG

sampling integration

(EPSSLUG) Default: 1.0e-04 ! EPSSLUG = 1.0E-04 !

Fractional convergence criterion for numerical AREA

source integration

(EPSAREA) Default: 1.0e-06 ! EPSAREA = 1.0E-06 !

Trajectory step-length (m) used for numerical rise

integration

(DSRISE) Default: 1.0 ! DSRISE = 1.0 !

Boundary Condition (BC) Puff control variables-----------------------

Minimum height (m) to which BC puffs are mixed as they are emitted

(MBCON=2 ONLY). Actual height is reset to the current mixing height

at the release point if greater than this minimum.

(HTMINBC) Default: 500. ! HTMINBC = 500.0 !

Search radius (km) about a receptor for sampling nearest BC puff.

BC puffs are typically emitted with a spacing of one grid cell

length, so the search radius should be greater than DGRIDKM.

(RSAMPBC) Default: 10. ! RSAMPBC = 10.0 !

Near-Surface depletion adjustment to concentration profile used when

sampling BC puffs?

(MDEPBC) Default: 1 ! MDEPBC = 1 !

0 = Concentration is NOT adjusted for depletion

1 = Adjust Concentration for depletion

!END!

---------------------------------- --

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with

parameters provided below (NPT1) No default ! NPT1 = 0 !

Units used for point source

emissions below (IPTU) Default: 1 ! IPTU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with

variable emission parameters

provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point

source emissions are read from

the file: PTEMARB.DAT)

!END!

Subgroup (13b)

----

a

POINT SOURCE: CONSTANT DATA

----

					b	c				
Source	X	Y	Stack	Base	Stack	Exit	Exit	Bldg.	Emission	
No.	Coordinate	Coordinate	Height	Elevation	Diameter	Vel.	Temp.	Dwash	Rates	
	(km)	(km)	(m)	(m)	(m)	(m/s)	(deg. K)			
------	----------	----------	------	------	--------	-----	--------	-----	--------	

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source

(No default)

X is an array holding the source data listed by the column headings

(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)

(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent

the effect of rain-caps or other physical configurations that

reduce momentum rise associated with the actual exit velocity.

(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated

structure that has a significant open area between the surface

and the bulk of the structure, such as an offshore oil platform.

The Base Elevation is that of the surface (ground or ocean),

and the Stack Height is the release height above the Base (not

above the platform). Building heights entered in Subgroup 13c

must be those of the buildings on the platform, measured from

the platform deck. ZPLTFM is used only with MBDW=1 (ISC

downwash method) for sources with building downwash.

(Default: 0.0)

b

0. = No building downwash modeled

1. = Downwash modeled for buildings resting on the surface

2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)

NOTE: must be entered as a REAL number (i.e., with decimal point)

c

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IPTU

(e.g. 1 for g/s).

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

Source a

No. Effective building height, width, length and X/Y offset (in meters)

every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for

MBDW=2 (PRIME downwash option)

------ ---

----

a

Building height, width, length, and X/Y offset from the source are treated

as a separate input subgroup for each source and therefore must end with

an input group terminator. The X/Y offset is the position, relative to the

stack, of the center of the upwind face of the projected building, with the

x-axis pointing along the flow direction.

Subgroup (13d)

----

a

POINT SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 13b. Factors entered multiply the rates in 13b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

------- -

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with

parameters specified below (NAR1) No default ! NAR1 = 0 !

Units used for area source

emissions below (IARU) Default: 1 ! IARU = 1 !

1 = g/m**2/s

2 = kg/m**2/hr

3 = lb/m**2/hr

4 = tons/m**2/yr

5 = Odour Unit * m/s (vol. flux/m**2 of odour compound)

6 = Odour Unit * m/min

7 = metric tons/m**2/yr

8 = Bq/m**2/s (Bq = becquerel = disintegrations/s)

9 = GBq/m**2/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (14d) (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources

with variable location and emission

parameters (NAR2) No default ! NAR2 = 0 !

(If NAR2 > 0, ALL parameter data for

these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

```
                    a
     AREA SOURCE: CONSTANT DATA
     ----------------------------
                              b
Source      Effect.   Base     Initial   Emission
 No.        Height   Elevation  Sigma z    Rates
             (m)      (m)       (m)
-------     ------   ------    --------  ---------
```

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IARU

(e.g. 1 for g/m**2/s).

Subgroup (14c)

COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON

Source a

No. Ordered list of X followed by list of Y, grouped by source

------ ------------------------------------ ------------------------

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

Subgroup (14d)

----

a

AREA SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 14b. Factors entered multiply the rates in 14b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters

Subgroup (15a)

Number of buoyant line sources

with variable location and emission

parameters (NLN2) No default ! NLN2 = 0 !

(If NLN2 > 0, ALL parameter data for

these sources are read from the file: LNEMARB.DAT)

Number of buoyant line sources (NLINES) No default ! NLINES = 0 !

Units used for line source

emissions below (ILNU) Default: 1 ! ILNU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (15c) (NSLN1) Default: 0 ! NSLN1 = 0 !

Maximum number of segments used to model each line (MXNSEG) Default: 7 ! MXNSEG = 7 !

The following variables are required only if NLINES > 0. They are

used in the buoyant line source plume rise calculations.

Number of distances at which Default: 6 ! NLRISE = 6 !

transitional rise is computed

Average building length (XL) No default ! XL = .0 !

(in meters)

Average building height (HBL) No default ! HBL = .0 !

(in meters)

Average building width (WBL) No default ! WBL = .0 !

(in meters)

Average line source width (WML) No default ! WML = .0 !

(in meters)

Average separation between buildings (DXL) No default ! DXL =!.0

(in meters)

Average buoyancy parameter (FPRIMEL) No default ! FPRIMEL = .0 !

(in m**4/s**3)

!END!

Subgroup (15b)

BUOYANT LINE SOURCE: CONSTANT DATA

----

a

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Elevation (m)	Emission Rates

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by ILNTU

(e.g. 1 for g/s).

Subgroup (15c)

----

a

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 15b. Factors entered multiply the rates in 15b.

Skip sources here that have constant emissions.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 16a, 16b, 16c Volume source parameters

Subgroup (16a)

Number of volume sources with

parameters provided in 16b,c (NVL1) No default ! NVL1 = 0 !

Units used for volume source

emissions below in 16b (IVLU) Default: 1 ! IVLU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species

combinations with variable

emissions scaling factors

provided below in (16c) (NSVL1) Default: 0 ! NSVL1 = 0 !

Number of volume sources with

variable location and emission

parameters (NVL2) No default ! NVL2 = 94 !

(If NVL2 > 0, ALL parameter data for

these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

----

a

VOLUME SOURCE: CONSTANT DATA

----

b

X Coordinate (km)	Y Coordinate (km)	Effect. Height (m)	Base Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)	Emission Rates

----

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.

Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IVLU

(e.g. 1 for g/s).

Subgroup (16c)

----

a

VOLUME SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission

rates given in 16b. Factors entered multiply the rates in 16b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

0 = Constant

1 = Diurnal cycle (24 scaling factors: hours 1-24)

2 = Monthly cycle (12 scaling factors: months 1-12)

3 = Hour & Season (4 groups of 24 hourly scaling factors,

where first group is DEC-JAN-FEB)

4 = Speed & Stab. (6 groups of 6 scaling factors, where

first group is Stability Class A,

and the speed classes have upper

bounds (m/s) defined in Group 12

5 = Temperature (12 scaling factors, where temperature

classes have upper bounds (C) of:

0, 5, 10, 15, 20, 25, 30, 35, 40,

45, 50, 50+)

----

a

Data for each species are treated as a separate input subgroup

and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

----

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 867 !

!END!

Subgroup (17b)

----

a

NON-GRIDDED (DISCRETE) RECEPTOR DATA

X Y Ground Height b

Receptor Coordinate Coordinate Elevation Above Ground

No. (km) (km) (m) (m)

-------- ---------- ---------- --------- ------------

1! X = 756.58601984809,6270.223912,1010.663153,0! !End!

2! X = 761.34455790653,6266.599675,1125.182862,0! !End!

3! X = 761.24843114217,6266.537618,1131.066125,0! !End!

4! X = 761.2545151146,6266.664165,1122.896048,0! !End!

5! X = 758.54685129635,6269.398252,1039.610083,0! !End!

6! X = 761.94652115632,6266.839138,1123.85551,0! !End!

7! X = 761.478593 73737,6266.7327,1119.164459,0! !End!

8! X = 761.86026663693,6266.057236,1144.159827,0! !End!

9! X = 760.71951243601,6265.932031,1154.576207,0! !End!

10! X = 760.55242260606,6265.803724,1146.996313,0! !End!

11! X = 760.19622532109,6265.8 57373,1152.020355,0! !End!

12! X = 759.6989360996,6266.208561,1125.858047,0! !End!

13! X = 758.65783978418,6267.073753,1102.913426,0! !End!

14! X = 758.71125393998,6267.593348,1079.563118,0! !End!

15! X = 758.12435910291,6267.04186,1051 .364808,0! !End!

16! X = 758.45611217745,6267.277304,1065.610961,0! !End!

17! X = 759.51543858091,6266.45154,1109.871544,0! !End!

18! X = 759.62726044685,6266.440891,1111.32377,0! !End!

19! X = 759.62193559609,6266.558037,1109.747196,0! !End!

20! X = 759.53673798395,6266.632585,1116.34313,0! !End!

21! X = 759.64855984989,6266.707133,1130.609669,0! !End!

22! X = 759.62193559609,6266.808305,1120.87738,0! !End!

23! X = 759.56336223774,6266.898828,1116.11592,0! !End!

24! X = 759.67518410369,6266.973376,1123.083753,0! !End!

25! X = 759.72310776052,6267.074548,1133.749654,0! !End!

26! X = 759.8296047757,6267.090522,1146.362235,0! !End!

27! X =759.91480238785,6267.106497,1145.789992,0! !End!

28! X = 759.90415268633,6267.223644,1145.060746,0! !End!

29! X = 759.9733757462,6267.16507,1153.979124,0! !End!

30! X = 760.06922305987,6267.159746,1151.321343,0! !End!

31! X = 760.015974 55228,6267.266243,1146.499702,0! !End!

32! X = 759.97870059696,6267.314166,1143.508351,0! !End!

33! X = 760.06922305987,6267.441963,1150.271317,0! !End!

34! X = 760.02129940304,6267.505861,1141.82916,0! !End!

35! X = 760.0266242538,6267 .569759,1137.641245,0! !End!

36! X = 760.09584731367,6267.654957,1135.644878,0! !End!

37! X = 760.09052246291,6267.793403,1139.489119,0! !End!

38! X = 760.13312126898,6267.745479,1143.883888,0! !End!

39! X = 760.09052246291,6267.910549, 1140.02294,0! !End!

40! X = 760.18636977657,6267.995747,1135.807005,0! !End!

41! X = 760.14909582126,6267.894575,1141.129581,0! !End!

42! X = 760.2609176872,6268.006397,1127.970389,0! !End!

43! X = 760.32481589631,6268.06497,1112.750371 ,0! !End!

44! X = 760.38338925466,6267.969123,1123.628125,0! !End!

45! X = 760.42066320998,6267.905225,1127.983862,0! !End!

46! X = 760.5218353744,6267.820027,1117.531426,0! !End!

47! X = 760.41533835922,6267.782753,1136.838289,0! !End!

48! X = 760.4313129115,6267.686906,1128.791692,0! !End!

49! X = 760.36208985163,6267.607033,1130.846065,0! !End!

50! X = 760.38871410542,6267.543135,1120.995704,0! !End!

51! X = 760.41533835922,6267.484561,1119.156613,0! !End!

52! X = 760.27156738872,6267.447287,1143.446251,0! !End!

53! X = 760.35676500087,6267.415338,1127.540208,0! !End!

54! X = 760.287541941,6267.34079,1139.678794,0! !End!

55! X =760.24494313492,6267.260918,1150.849946,0! !End!

56! X = 760.29819164252,6267.228969,1145.389819,0! !End!

57! X = 760.25559283644,6267.143771,1142.840436,0! !End!

58! X = 760.30884134404,6267.095847,1144.36376,0! !End!

59! X = 760.22896 858265,6267,1146.843129,0! !End!

60! X = 760.20766917961,6266.936102,1135.774478,0! !End!

61! X = 760.1437709705,6266.893503,1132.178922,0! !End!

62! X = 760.09052246291,6266.829605,1128.931123,0! !End!

63! X = 759.98935029848,6266.8029 81,1135.724622,0! !End!

64! X = 759.89882783557,6266.765707,1145.377423,0! !End!

65! X = 759.82427992495,6266.65921,1132.274125,0! !End!

66! X = 759.73375746204,6266.653885,1132.982321,0! !End!

67! X = 759.72310776052,6266.558037,1114.1 14964,0! !End!

68! X = 759.78168111887,6266.488814,1117.540723,0! !End!

69! X = 759.73375746204,6266.408942,1116.055267,0! !End!

70! X = 759.83492962646,6266.371668,1124.055897,0! !End!

71! X = 759.88817813406,6266.510114,1129.421133,0! !End!

72! X = 759.87220358178,6266.547388,1128.547281,0! !End!

73! X = 759.98402544772,6266.616611,1126.841857,0! !End!

74! X = 759.96805089544,6266.712458,1136.599554,0! !End!

75! X = 760.07454791063,6266.728433,1127.015638,0! !End!

76! X = 760.1703952243,6266.733757,1130.540385,0! !End!

77! X = 760.27689223948,6266.882853,1128.000138,0! !End!

78! X = 760.287541941,6266.962726,1133.985353,0! !End!

79! X = 760.38871410542,6267.026624,1141.084251,0! !End!

80! X =760.4046886577,6267.197019,1135.512168,0! !End!

81! X = 760.35676500087,6267.282217,1142.922074,0! !End!

82! X = 760.44728746378,6267.356765,1136.810191,0! !End!

83! X = 760.51118567289,6267.489886,1117.810155,0! !End!

84! X =760.49521112061,6267.585734,1114.936971,0! !End!

85! X = 760.56975903124,6267.665606,1107.418678,0! !End!

86! X = 760.60170813579,6267.734829,1106.924134,0! !End!

87! X = 760.55378447896,6267.905225,1102.1572,0! !End!

88! X = 760.553784 47896,6267.995747,1097.386588,0! !End!

89! X = 760.45793716529,6268.091594,1097.371952,0! !End!

90! X = 760.46326201605,6268.033021,1104.385496,0! !End!

91! X = 760.56443418048,6268.118219,1096.244374,0! !End!

92! X = 760.33014074707,62 68.187442,1099.699773,0! !End!

93! X = 760.26624253796,6268.128868,1116.750907,0! !End!

94! X = 760.15442067202,6268.128868,1127.117722,0! !End!

95! X = 760.1171467167,6268.033021,1139.641404,0! !End!

96! X = 760.03727395531,6267.990422 ,1138.224363,0! !End!

97! X = 760.4313129115,6268.182117,1090.080129,0! !End!

98! X = 760.36208985163,6268.25134,1091.450319,0! !End!

99! X = 759.9733757462,6267.825352,1134.590888,0! !End!

100! X = 760.0266242538,6267.72418,1129.520171 ,0! !End!

101! X = 759.94675149241,6267.660281,1129.532291,0! !End!

102! X = 759.95207634317,6267.521835,1140.509678,0! !End!

103! X = 759.98402544772,6267.404689,1146.124368,0! !End!

104! X = 759.92012723861,6267.367415,1142.572347,0! !End!

105! X = 760.06922305987,6267.34079,1155.717933,0! !End!

106! X = 759.84557932798,6267.266243,1135.176629,0! !End!

107! X = 759.81363022343,6267.18637,1142.100296,0! !End!

108! X = 759.69115865596,6267.17572,1128.303297,0! !End!

109! X = 759.65388470065,6267.069223,1126.600712,0! !End!

110! X = 759.47283977484,6267.026624,1128.731039,0! !End!

111! X = 759.49413917787,6266.866879,1113.52643,0! !End!

112! X = 759.39296701345,6266.733757,1103.049878,0! !End!

113! X = 759.52608828243,6266.749732,1114.650607,0! !End!

114! X = 759.45686522256,6266.685834,1117.020826,0! !End!

115! X = 759.424916118,6266.520763,1105.785547,0! !End!

116! X = 759.44621552104,6266.382317,1115.5596,0! !End!

117! X = 759.58466164078,6266.376992,1114.531677,0! !End!

118! X = 759.712458059,6266.323744,1121.4174,0! !End!

119! X = 759.97870059696,6266.382317,1138.34659,0! !End!

120! X = 760.0266242538,6266.504789,1124.561273,0! !End!

121! X = 760.1437 709705,6266.600636,1132.251022,0! !End!

122! X = 760.25559283644,6266.63791,1134.815786,0! !End!

123! X = 760.35676500087,6266.792331,1136.293755,0! !End!

124! X = 760.46326201605,6266.914802,1153.093597,0! !End!

125! X = 759.7177829097 6,6266.866879,1133.93309,0! !End!

126! X = 759.84557932798,6266.914802,1150.213298,0! !End!

127! X = 759.87220358178,6267,1138.059379,0! !End!

128! X = 759.78168111887,6266.856229,1147.905837,0! !End!

129! X = 759.98402544772,6266.96805 1,1157.028532,0! !End!

130! X = 760.07454791063,6267.063898,1149.72256,0! !End!

131! X = 760.17572007505,6267.127796,1151.838412,0! !End!

132! X = 760.13312126898,6267.292867,1160.937799,0! !End!

133! X = 760.18636977657,6267.388714,115 3.759518,0! !End!

134! X = 760.20766917961,6267.457937,1157.680357,0! !End!

135! X = 760.1703952243,6267.607033,1150.131775,0! !End!

136! X = 760.22896858265,6267.654957,1154.497754,0! !End!

137! X = 760.2609176872,6267.788078,1160.3526 55,0! !End!

138! X = 760.27689223948,6267.851976,1151.866952,0! !End!

139! X = 760.33546559783,6267.830677,1148.814118,0! !End!

140! X = 760.287541941,6267.708205,1160.294482,0! !End!

141! X = 760.2609176872,6266.776356,1130.60739,0! !End!

142! X = 760.43663776226,6267.090522,1135.86156,0! !End!

143! X = 760.5484596282,6267.149096,1128.708328,0! !End!

144! X = 760.51651052364,6267.330141,1130.242925,0! !End!

145! X =760.55378447896,6267.420663,1120.729737,0! !End!

146! X = 760.63898209111,6267.505861,1109.845585,0! !End!

147! X = 760.65495664338,6267.766779,1103.296778,0! !End!

148! X = 759.98701500469,6267.094141,1143.521235,0! !End!

149! X = 759.88962753986,6266.928583,1156.660505,0! !End!

150! X = 759.80197882151,6267,1139.233296,0! !End!

151! X = 760.63301852142,6267.88298,1103.863118,0! !End!

152! X = 760.63626477024,6268.029061,1089.629537,0! !End!

153! X = 760.27060829853, 6268.274478,1102.621172,0! !End!

154! X = 760.01745859991,6268.152268,1143.32396,0! !End!

155! X = 759.96508280019,6268.056245,1136.311473,0! !End!

156! X = 759.87778980066,6267.759449,1126.254729,0! !End!

157! X = 759.74685030138,6267. 698344,1133.060408,0! !End!

158! X = 759.78176750119,6267.515029,1142.751933,0! !End!

159! X = 759.62464010204,6267.384089,1136.652159,0! !End!

160! X = 759.59845220218,6267.349172,1133.924918,0! !End!

161! X = 759.75557960133,6267.3928 18,1150.646446,0! !End!

162! X = 759.64209870195,6267.549946,1139.931711,0! !End!

163! X = 759.4849713028,6267.200774,1128.594134,0! !End!

164! X = 759.29292670385,6267.139669,1134.863623,0! !End!

165! X = 759.35403180351,6267,1126.7114 33,0! !End!

166! X = 759.22309230422,6266.869061,1102.592319,0! !End!

167! X = 759.26673880399,6266.738121,1107.843273,0! !End!

168! X = 759.17071650451,6266.607182,1090.490673,0! !End!

169! X = 759.31038530375,6266.563535,1093.234243,0 ! !End!

170! X = 759.31038530375,6266.397678,1106.431534,0! !End!

171! X = 759.38894900332,6266.266739,1106.735944,0! !End!

172! X = 759.47624200285,6266.196904,1109.227773,0! !End!

173! X =759.75557960133,6266.196904,1127.397851,0! !End!

174! X = 759.96508280019,6266.118341,1151.221079,0! !End!

175! X = 760,6266.223092,1141.640763,0! !End!

176! X = 760.183315299,6266.362761,1136.386518,0! !End!

177! X = 760.1658566991,626 6.476242,1129.975089,0! !End!

178! X = 760.14839809919,6266.310385,1135.948434,0! !End!

179! X = 760.32298409824,6266.467513,1136.451377,0! !End!

180! X = 760.34044269815,6266.598452,1134.878307,0! !End!

181! X = 760.46265289748,6266.65 0828,1142.968785,0! !End!

182! X = 760.54121659706,6266.799226,1139.858865,0! !End!

183! X = 760.6808853963,6266.930166,1125.276996,0! !End!

184! X = 760.56740449691,6266.991271,1138.004552,0! !End!

185! X = 760.6808853963,6267.157127,1 117.43208,0! !End!

186! X = 760.61105099668,6267.270608,1120.427135,0! !End!

187! X = 760.75071979592,6267.384089,1110.229578,0! !End!

188! X = 760.75071979592,6267.672156,1096.832469,0! !End!

189! X = 760.8467420954,6267.776908,1094.80 009,0! !End!

190! X = 760.8467420954,6268.11735,1077.799535,0! !End!

191! X = 760.73326119601,6267.925306,1095.815694,0! !End!

192! X = 760.73326119601,6268.178455,1081.512331,0! !End!

193! X = 760.58486309682,6268.440334,1070.318511,0! !End!

194! X = 760.54994589701,6268.300666,1093.513784,0! !End!

195! X = 760.38408919791,6268.510169,1076.19761,0! !End!

196! X = 760.27933759848,6268.353041,1094.301404,0! !End!

197! X = 760.15712739915,6268.3705,1105.850781,0! !End!

198! X = 759.96508280019,6268.431605,1121.61387,0! !End!

199! X = 760.20950319886,6268.527627,1094.204192,0! !End!

200! X = 760.02618789986,6268.300666,1130.106818,0! !End!

201! X = 760.04364649976,6268.518898,1109.191759,0! !End!

202! X = 759.85160190081,6268.274478,1134.270252,0! !End!

203! X = 759.79922610109,6268.064975,1138.548857,0! !End!

204! X = 759.75557960133,6267.916576,1119.281105,0! !End!

205! X = 759.89524840057,6267.916576,1125.791132,0! !End!

206! X = 759.6508280019,6267.759449,1129.808354,0! !End!

207! X = 759.53734710252,6267.584863,1128.06607,0! !End!

208! X = 759.37149040342,6267.480111,1121.110253,0! !End!

209! X = 759.450054 10299,6267.401548,1122.9482,0! !End!

210! X = 759.33657320361,6267.24442,1137.642806,0! !End!

211! X = 759.1532579046,6267.157127,1128.386777,0! !End!

212! X = 759.14452860465,6266.938895,1108.273926,0! !End!

213! X = 759.00485980541,62 66.834143,1094.887121,0! !End!

214! X = 759.08342350498,6266.685745,1085.823829,0! !End!

215! X = 759.00485980541,6266.493701,1080.567685,0! !End!

216! X = 759.16198720456,6266.450054,1094.62946,0! !End!

217! X = 759.21436300427,6266.28 4197,1095.330776,0! !End!

218! X = 759.3191146037,6266.100882,1112.601799,0! !End!

219! X = 759.50242990271,6266.118341,1112.701026,0! !End!

220! X = 759.79049680114,6266.00486,1128.117672,0! !End!

221! X = 759.6508280019,6265.987401,11 30.563504,0! !End!

222! X = 759.99127070005,6265.987401,1146.814792,0! !End!

223! X = 760.14839809919,6265.996131,1146.570793,0! !End!

224! X = 760.15712739915,6266.196904,1142.03185,0! !End!

225! X = 760.29679619839,6266.231822,1146.47 5361,0! !End!

226! X = 760.46265289748,6266.450054,1139.381942,0! !End!

227! X = 760.6983439962,6266.580994,1136.168302,0! !End!

228! X = 760.66342679639,6266.773038,1132.441713,0! !End!

229! X = 760.58486309682,6266.642099,1136.676341,0! !End!

230! X = 760.85547139535,6266.973812,1113.924854,0! !End!

231! X = 760.78563699573,6267.226962,1110.156148,0! !End!

232! X = 760.95149369483,6267.410277,1102.569718,0! !End!

233! X = 760.91657649502,6267.25315,1105.450882,0! !End!

234! X = 760.8642006953,6267.523758,1101.373189,0! !End!

235! X = 761.01259879449,6267.768178,1091.936976,0! !End!

236! X = 760.94276439487,6268.012599,1087.784628,0! !End!

237! X = 760.899117 89511,6267.934035,1088.873003,0! !End!

238! X = 761.06497459421,6267.968952,1085.320115,0! !End!

239! X = 760.92530579497,6268.344312,1073.239233,0! !End!

240! X = 760.75944909587,6268.038787,1091.054468,0! !End!

241! X = 760.7419904959 7,6268.326854,1081.755168,0! !End!

242! X = 760.6983439962,6268.61492,1087.274045,0! !End!

243! X = 760.47138219744,6268.431605,1077.261639,0! !End!

244! X = 760.42773569767,6268.649838,1063.304806,0! !End!

245! X = 759.99127070005,6268 .693484,1075.497044,0! !End!

246! X = 760.27060829853,6268.702213,1074.248112,0! !End!

247! X = 759.84287260085,6268.571274,1100.504245,0! !End!

248! X = 759.79922610109,6268.387959,1121.039486,0! !End!

249! X = 759.6508280019,6268.2570 19,1114.946376,0! !End!

250! X = 759.65955730185,6267.99514,1114.951754,0! !End!

251! X = 759.47624200285,6267.899118,1118.262939,0! !End!

252! X = 759.51115920266,6267.733261,1125.038867,0! !End!

253! X = 759.3016560038,6267.698344,110 3.705993,0! !End!

254! X = 759.26673880399,6267.49757,1123.27424,0! !End!

255! X = 759.19690440437,6267.340443,1131.943502,0! !End!

256! X = 759.05723560513,6267.24442,1125.751456,0! !End!

257! X = 759.00485980541,6266.982541,1114.26996 1,0! !End!

258! X = 758.88264960608,6266.860331,1100.298656,0! !End!

259! X = 758.89137890603,6266.642099,1069.495999,0! !End!

260! X = 758.93502540579,6266.397678,1081.194653,0! !End!

261! X =759.08342350498,6266.179446,1087.878772,0! !End!

262! X = 759.28419740389,6265.917567,1112.966505,0! !End!

263! X = 759.45005410299,6265.935025,1129.462484,0! !End!

264! X = 759.6508280019,6265.830274,1130.476349,0! !End!

265! X = 759.93016560038,6265.812815,1145.781083,0! !End!

266! X = 760.35790129805,6265.978672,1149.068289,0! !End!

267! X = 760.62850959658,6266.354032,1140.94936,0! !End!

268! X = 760.5150286972,6266.231822,1142.88037,0! !End!

269! X = 760.73326119 601,6266.266739,1145.643527,0! !End!

270! X = 760.80309559563,6266.546076,1134.744527,0! !End!

271! X = 760.87292999525,6266.781768,1122.350267,0! !End!

272! X = 761.07370389416,6267.017459,1105.081507,0! !End!

273! X = 760.98641089464, 6267.113481,1102.751746,0! !End!

274! X = 761.15226759373,6267.436465,1094.429961,0! !End!

275! X = 761.0475159943,6267.584863,1092.879434,0! !End!

276! X = 761.17845549359,6267.785637,1082.052741,0! !End!

277! X = 761.11735039392,6268. 178455,1084.0534,0! !End!

278! X = 761.03878669435,6268.571274,1071.674901,0! !End!

279! X = 760.70444684553,6268.933482,1068.649365,0! !End!

280! X = 760.40468223041,6268.858541,1056.799961,0! !End!

281! X = 760.23981169209,6269.038399 ,1054.854174,0! !End!

282! X = 760.02997646151,6268.873529,1043.348189,0! !End!

283! X = 759.55035307732,6268.723647,1100.292287,0! !End!

284! X = 759.8651059232,6269.053388,1070.820611,0! !End!

285! X = 759.61030600035,6268.543788,1101 .794917,0! !End!

286! X = 759.80515300017,6268.843552,1093.661411,0! !End!

287! X = 759.4904001543,6268.318964,1094.952152,0! !End!

288! X = 759.3555060775,6268.064164,1106.756736,0! !End!

289! X =759.08571792389,6268.049176,1089.846963,0! !End!

290! X = 759.37049430825,6268.378917,1088.038162,0! !End!

291! X = 759.23560023145,6268.513811,1086.447867,0! !End!

292! X = 759.20562376994,6268.0192,1092.886876,0! !End!

293! X = 759.02576500086,6267.659482,1125.339732,0! !End!

294! X = 758.9808003086,6267.449647,1112.91367,0! !End!

295! X = 758.80094153953,6267.224823,1112.082891,0! !End!

296! X = 758.86089446255,6267.059953,1107.900546,0! !End!

297! X = 758.59110630 894,6266.925059,1103.133954,0! !End!

298! X = 758.62108277045,6266.685247,1068.20313,0! !End!

299! X = 758.66604746272,6266.460424,1069.030257,0! !End!

300! X = 758.69602392423,6266.190636,1073.662194,0! !End!

301! X = 758.92084738557,6 265.965812,1082.190228,0! !End!

302! X = 759.17564730842,6265.681036,1104.3071,0! !End!

303! X = 759.40047076976,6265.785953,1125.609905,0! !End!

304! X = 759.56534130808,6265.636071,1128.750727,0! !End!

305! X = 759.95503530773,6265.57 6118,1146.843149,0! !End!

306! X = 760.17985876907,6265.516165,1145.513197,0! !End!

307! X = 760.43465869192,6265.591106,1136.765862,0! !End!

308! X = 760.89929384536,6265.681036,1139.069558,0! !End!

309! X = 760.8843056146,6266.040753, 1151.148474,0! !End!

310! X = 761.15409376821,6266.2356,1145.118141,0! !End!

311! X = 760.95924676838,6266.430447,1137.031504,0! !End!

312! X = 761.2590113835,6266.820141,1120.326242,0! !End!

313! X = 761.36392899879,6267.149882,1095.20 1111,0! !End!

314! X = 761.13910553745,6267.239812,1098.736502,0! !End!

315! X = 761.46884661408,6267.539576,1087.160311,0! !End!

316! X = 761.27399961425,6267.824353,1081.175534,0! !End!

317! X =761.40889369106,6268.169082,1082.78382,0! !End!

318! X = 761.28898784501,6268.588752,1077.148176,0! !End!

319! X = 761.42388192181,6268.963458,1077.714288,0! !End!

320! X = 761.06416438367,6268.993435,1077.067473,0! !End!

321! X = 761.06416438367,6268.843552,1066.376093,0! !End!

322! X = 760.73442330704,6269.173293,1076.185675,0! !End!

323! X = 760.49461161495,6269.083364,1072.912316,0! !End!

324! X = 760.23981169209,6269.218258,1065.702472,0! !End!

325! X = 759.68524 715413,6269.293199,1082.507532,0! !End!

326! X = 759.47541192354,6268.918494,1105.175693,0! !End!

327! X = 759.37049430825,6268.678682,1097.342906,0! !End!

328! X = 759.02576500086,6268.69367,1093.469878,0! !End!

329! X = 759.0707296931 3,6268.393905,1075.829474,0! !End!

330! X = 758.80094153953,6268.199058,1068.326577,0! !End!

331! X = 758.95082384709,6267.959247,1095.947135,0! !End!

332! X = 758.65105923197,6267.839341,1073.004896,0! !End!

333! X = 758.63607100121,62 67.329741,1083.093384,0! !End!

334! X = 758.35129461685,6266.775177,1083.660071,0! !End!

335! X = 758.42623577063,6266.475412,1053.03934,0! !End!

336! X = 758.3662828476,6266.115694,1053.705118,0! !End!

337! X = 758.56112984743,6265.905 859,1079.581329,0! !End!

338! X = 758.9808003086,6265.636071,1098.082628,0! !End!

339! X = 759.10070615464,6265.411248,1109.257454,0! !End!

340! X = 759.44543546203,6265.486189,1125.301494,0! !End!

341! X = 759.68524715413,6265.351295,1 139.889657,0! !End!

342! X = 760.1348940768,6265.336306,1145.351861,0! !End!

343! X = 760.67447038402,6265.351295,1106.477373,0! !End!

344! X = 761.10912907594,6265.426236,1087.662127,0! !End!

345! X =761.31896430652,6265.935836,1123.711993,0! !End!

346! X = 761.5287995371,6266.160659,1132.938616,0! !End!

347! X = 761.33395253728,6266.370494,1134.196866,0! !End!

348! X = 761.58875246013,6267.059953,1097.863647,0! !End!

349! X = 761.69367007542,6267.67447,1084.1335,0! !End!

350! X = 761.64870538315,6268.124117,1083.424884,0! !End!

351! X = 761.70865830618,6268.603741,1088.293444,0! !End!

352! X = 761.3939054603,6268.783599,1081.048942,0! !End!

353! X = 761.543787767 86,6268.498823,1087.011187,0! !End!

354! X = 761.61872892164,6268.918494,1077.644388,0! !End!

355! X = 761.33395253728,6269.413105,1077.696693,0! !End!

356! X = 761.00421146065,6269.308188,1086.668986,0! !End!

357! X = 760.56955276873,6 269.443082,1070.027581,0! !End!

358! X = 759.95503530773,6269.488046,1027.732105,0! !End!

359! X = 760.29976461512,6269.488046,1057.29128,0! !End!

360! X = 759.29555315447,6269.173293,1081.790147,0! !End!

361! X = 758.86089446255,6269.0 23411,1088.6199,0! !End!

362! X = 758.80094153953,6268.558776,1068.452601,0! !End!

363! X = 759.13068261616,6268.933482,1105.240583,0! !End!

364! X = 758.6060945397,6268.468847,1058.281916,0! !End!

365! X = 758.32131815534,6268.274,1053 .7514,0! !End!

366! X = 758.3662828476,6267.869317,1042.093853,0! !End!

367! X = 758.15644761702,6267.7644,1035.819993,0! !End!

368! X = 758.21640054004,6267.41967,1046.637867,0! !End!

369! X = 757.8566830019,6267.209835,1019.124127,0! !End!

370! X = 758.12647115551,6266.715224,1060.274102,0! !End!

371! X = 758.03654177097,6266.430447,1035.197199,0! !End!

372! X = 758.06651823249,6266.055741,1045.806299,0! !End!

373! X = 758.44122400138,6265.681036,1074.520784,0! !End!

374! X = 758.71101215499,6265.56113,1092.453651,0! !End!

375! X = 758.95082384709,6265.381271,1108.465894,0! !End!

376! X = 759.41545900052,6265.156448,1130.914293,0! !End!

377! X = 760.10491761529,6265.096495,1142.680785,0! !End!

378! X = 760.46463515343,6264.991577,1106.319229,0! !End!

379! X = 760.95924676838,6265.201412,1093.337589,0! !End!

380! X = 761.37891722955,6265.126471,1073.175753,0! !End!

381! X = 761.6337171524,6265.576118,1078.902343,0! !End!

382! X = 761.73863476769,6265.800942,1102.055819,0! !End!

383! X = 762.1433169981,6265.860894,1104.208935,0! !End!

384! X = 761.903505306,6266.355506,1127.83352,0! !End!

385! X = 761.768611229 2,6266.505388,1125.82115,0! !End!

386! X = 762.11334053659,6266.58033,1126.999035,0! !End!

387! X = 761.903505306,6267.194847,1102.193718,0! !End!

388! X = 761.37891722955,6266.970024,1109.322842,0! !End!

389! X = 761.72364653693,6267.4 49647,1088.653085,0! !End!

390! X = 762.05338761356,6267.7644,1091.59474,0! !End!

391! X = 762.08336407507,6268.318964,1084.53591,0! !End!

392! X = 761.91849353676,6268.768611,1089.062714,0! !End!

393! X = 761.73863476769,6269.36814,108 5.46161,0! !End!

394! X = 761.85854061373,6269.637929,1088.478174,0! !End!

395! X = 761.40889369106,6269.697882,1086.433568,0! !End!

396! X = 760.91428207611,6269.96767,1087.610226,0! !End!

397! X = 760.95924676838,6269.637929,1124.2500 92,0! !End!

398! X = 760.53957630721,6269.907717,1072.923936,0! !End!

399! X = 759.92505884622,6269.847764,1030.157089,0! !End!

400! X = 759.52037661581,6269.817787,1035.680508,0! !End!

401! X = 759.14567084691,6269.413105,1088.834028,0 ! !End!

402! X = 758.81592977028,6269.518023,1060.494443,0! !End!

403! X = 758.48618869365,6269.083364,1052.758715,0! !End!

404! X = 758.11148292475,6268.978446,1043.722312,0! !End!

405! X = 758.096494694,6268.498823,1052.491782,0! !End!

406! X = 757.97658884795,6268.169082,1070.017554,0! !End!

407! X = 758.3662828476,6268.618729,1068.819863,0! !End!

408! X = 757.84169477115,6268.0192,1058.488098,0! !End!

409! X = 757.45200 077149,6267.899294,1035.634957,0! !End!

410! X = 757.7217889251,6267.599529,1047.120264,0! !End!

411! X = 757.39204784847,6267.284776,1034.765493,0! !End!

412! X = 757.73677715586,6267,1018.554363,0! !End!

413! X = 757.43701254074,6266. 685247,1011.192597,0! !End!

414! X = 757.91663592493,6266.115694,1037.154847,0! !End!

415! X = 757.63185954056,6266.415459,1026.268303,0! !End!

416! X = 757.79673007888,6266.7452,1040.213701,0! !End!

417! X = 757.19720084864,6266.955035 ,999.7910113,0! !End!

418! X = 757.10727146411,6266.385483,1025.196798,0! !End!

419! X = 757.54193015603,6266.2356,1039.684515,0! !End!

420! X = 757.87167123266,6265.740989,1048.895323,0! !End!

421! X = 758.15644761702,6265.336306,1078. 715055,0! !End!

422! X = 758.87588269331,6265.186424,1105.275783,0! !End!

423! X = 759.19063553918,6264.886659,1124.250785,0! !End!

424! X = 759.83512946168,6264.811718,1147.843318,0! !End!

425! X = 760.47962338419,6264.706801,1106.0738 4,0! !End!

426! X = 760.95924676838,6264.571907,1078.917238,0! !End!

427! X = 761.03418792216,6264.901648,1080.432105,0! !End!

428! X = 761.69367007542,6264.79673,1066.97821,0! !End!

429! X = 761.88851707525,6265.336306,1067,0! !End!

430! X = 762.2782110749,6265.501177,1081.657094,0! !End!

431! X = 762.60795215153,6265.965812,1113.569963,0! !End!

432! X = 762.45806984397,6266.445435,1154.996051,0! !End!

433! X = 762.62294038229,6266.820141,1140.95818,0! !End!

434! X = 762.32317576717,6267.449647,1096.843054,0! !End!

435! X = 762.20326992112,6266.985012,1119.566603,0! !End!

436! X = 762.57797569002,6267.299765,1121.29841,0! !End!

437! X = 761.94846999827,6267.404682,1094.080087,0! !End!

438! X = 761.94846999827,6268.079153,1081.822071,0! !End!

439! X = 762.53301099775,6268.0192,1092.936315,0! !End!

440! X = 762.30818753641,6268.633717,1084.940164,0! !End!

441! X = 762.62294038 229,6268.978446,1090.564861,0! !End!

442! X = 762.20326992112,6269.128329,1076.258215,0! !End!

443! X = 762.05338761356,6269.577976,1077.855607,0! !End!

444! X = 762.47305807473,6269.577976,1073.797852,0! !End!

445! X = 761.94846999827, 6268.993435,1091.548417,0! !End!

446! X = 761.85854061373,6270.027623,1101.713563,0! !End!

447! X = 760.94425853762,6270.162517,1073.593787,0! !End!

448! X = 760.40468223041,6270.372352,1059.136169,0! !End!

449! X = 760.23981169209,6270 .147528,1066.81627,0! !End!

450! X = 759.53536484657,6270.432305,1000.307705,0! !End!

451! X = 759.41545900052,6270.162517,1029.394709,0! !End!

452! X = 759.23560023145,6270.027623,1036.184969,0! !End!

453! X = 758.54614161668,6269.9376 93,1019.735973,0! !End!

454! X = 758.35129461685,6269.832776,1018.081425,0! !End!

455! X = 757.90164769417,6269.533011,1018.209192,0! !End!

456! X = 757.8566830019,6269.188282,1044.202085,0! !End!

457! X = 757.5868948483,6268.783599,104 2.816094,0! !End!

458! X = 757.42202430998,6268.753623,1030.016753,0! !End!

459! X = 757.37705961771,6268.453858,1026.429047,0! !End!

460! X = 757.7217889251,6268.408894,1040.805922,0! !End!

461! X = 756.89743623352,6268.079153,1033.4417,0! !End!

462! X = 757.12225969486,6267.539576,1005.7665,0! !End!

463! X = 756.85247154126,6267.449647,990.7012195,0! !End!

464! X = 756.91242446428,6267.164871,996.669835,0! !End!

465! X = 756.91242 446428,6266.445435,1023.316366,0! !End!

466! X = 757.22717731015,6265.860894,1061.855534,0! !End!

467! X = 757.52694192527,6265.456212,1064.659422,0! !End!

468! X = 757.88665946341,6265.336306,1070.492889,0! !End!

469! X = 758.441224001 38,6265.021554,1096.212312,0! !End!

470! X = 758.81592977028,6264.616871,1107.179289,0! !End!

471! X = 759.26557669296,6264.511954,1134.988464,0! !End!

472! X = 759.97002353849,6264.302118,1093.18005,0! !End!

473! X = 760.14988230756,62 64.586895,1106.606857,0! !End!

474! X = 760.71943507628,6264.317107,1080.845813,0! !End!

475! X = 761.21404669123,6264.12226,1082.825241,0! !End!

476! X = 761.40889369106,6264.182213,1088.357924,0! !End!

477! X = 762.12832876734,6264.52 6942,1075.661104,0! !End!

478! X = 762.2782110749,6264.736777,1076.098611,0! !End!

479! X = 762.23324638263,6265.111483,1067,0! !End!

480! X = 762.6529168438,6265.261365,1081.493223,0! !End!

481! X = 762.81778738211,6265.291342,1088.967 243,0! !End!

482! X = 762.87774030514,6265.56113,1089.063478,0! !End!

483! X = 763.31239899706,6266.355506,1130.229578,0! !End!

484! X = 763.23745784328,6267.044965,1148.81621,0! !End!

485! X = 763.0276226127,6266.385483,1124.889535,0! !End!

486! X = 763.1625166895,6265.905859,1099.435345,0! !End!

487! X = 762.75783445909,6267.059953,1127.409547,0! !End!

488! X = 763.13254022799,6267.479623,1118.58406,0! !End!

489! X = 762.86275207438,6268.199058,1092.932218,0! !End!

490! X = 762.71286976682,6268.708658,1098.644784,0! !End!

491! X = 763.31239899706,6268.408894,1107.488851,0! !End!

492! X = 763.0276226127,6269.218258,1087.807594,0! !End!

493! X = 762.75783445909,6269.697882,1091.97898,0! !End!

494! X = 762.21825815188,6270.777034,1045.997225,0! !End!

495! X = 761.48383484484,6270.64214,1073.69372,0! !End!

496! X = 762.42809338246,6270.147528,1069.246062,0! !End!

497! X = 762.533 01099775,6270.462281,1073.088789,0! !End!

498! X = 762.03839938281,6270.38734,1083.705686,0! !End!

499! X = 760.96233846438,6270.95628,1056.001509,0! !End!

500! X = 760.23523829129,6270.849354,1055.237059,0! !End!

501! X = 759.593679315 04,6271.148748,1014.011412,0! !End!

502! X = 758.95212033878,6270.699657,1032.167794,0! !End!

503! X = 758.26779076411,6270.678271,994.5333651,0! !End!

504! X = 757.86147007915,6270.22918,1017.625702,0! !End!

505! X = 758.84519384274,62 70.400263,1017.082478,0! !End!

506! X = 758.39610255936,6271.383986,992.6715464,0! !End!

507! X = 757.54069059102,6270.934895,972.5472604,0! !End!

508! X = 756.92051691397,6270.336107,993.8027951,0! !End!

509! X = 757.13436990606,6269.5 87621,1009.850985,0! !End!

510! X = 756.17203144168,6269.288227,1008.327995,0! !End!

511! X = 756.64250802426,6268.988833,1028.683953,0! !End!

512! X = 755.91540785117,6268.347274,975.683528,0! !End!

513! X = 756.21480204009,6267.748485 ,1008.026143,0! !End!

514! X = 755.87263725276,6267.149697,1004.333422,0! !End!

515! X = 756.45004033139,6266.764762,995.796281,0! !End!

516! X = 755.82986665434,6266.144588,1001.338326,0! !End!

517! X = 756.68527862268,6265.781038,1019 .143587,0! !End!

518! X = 755.74432545751,6264.989782,1048.953094,0! !End!

519! X = 756.00094904801,6264.348223,1086.896273,0! !End!

520! X = 756.79220511872,6264.262682,1079.387179,0! !End!

521! X =756.53558152822,6265.139479,1052.276517,0! !End!

522! X = 757.34822289814,6265.096708,1072.921594,0! !End!

523! X = 757.86147007915,6264.412379,1126.15556,0! !End!

524! X = 756.70666392189,6263.663893,1048.531876,0! !End!

525! X = 756.30034323693,6262.808481,1006.051194,0! !End!

526! X = 755.57324306384,6263.749435,1066.735723,0! !End!

527! X = 755.42354596938,6262.658784,1053.298559,0! !End!

528! X = 756.17203144168,6263.321729,1034.384872,0! !End!

529! X = 757.09159930764,6262.573243,1015.263792,0! !End!

530! X = 757.81869948073,6263.364499,1062.331646,0! !End!

531! X = 758.37471726015,6262.530472,1052.527161,0! !End!

532! X = 757.92562597677,6262.487702,1042.727856,0! !End!

533! X = 757.219911102 89,6263.343114,1039.864845,0! !End!

534! X = 757.39099349656,6264.262682,1110.671866,0! !End!

535! X = 758.90934974037,6263.621123,1170.908971,0! !End!

536! X = 758.4816437562,6264.284067,1120.900104,0! !End!

537! X = 759.35844102374,62 64.091599,1131.731711,0! !End!

538! X = 759.87168820475,6263.107876,1094.632773,0! !End!

539! X = 760.68432957467,6263.535582,1097.941498,0! !End!

540! X = 759.89307350396,6264.048829,1108.730335,0! !End!

541! X = 759.23012922849,6263.0 00949,1090.289362,0! !End!

542! X = 759.97861470079,6262.573243,1085.244361,0! !End!

543! X = 759.31567042533,6262.444931,1080.966428,0! !End!

544! X = 761.24034735409,6262.380775,1096.796137,0! !End!

545! X = 760.72710017309,6262.89402 3,1103.983689,0! !End!

546! X = 760.23523829129,6263.556967,1097.698345,0! !End!

547! X = 761.53974154301,6263.193417,1083.503131,0! !End!

548! X = 762.30961231452,6264.048829,1070.820144,0! !End!

549! X = 762.86563009394,6262.936793,1095.774064,0! !End!

550! X = 762.2668417161,6262.444931,1075.021493,0! !End!

551! X = 763.95628035357,6262.444931,1129.162316,0! !End!

552! X = 764.66199522746,6262.444931,1106.343315,0! !End!

553! X = 764.23428924329,6263.749435,1129.467135,0! !End!

554! X = 764.72615112508,6264.583461,1066.810866,0! !End!

555! X = 764.55506873141,6265.58857,1089.222846,0! !End!

556! X = 763.99905095199,6265.716882,1081.811306,0! !End!

557! X = 764.020436 2512,6264.690388,1067,0! !End!

558! X = 763.42164787336,6265.032552,1066.808328,0! !End!

559! X = 763.14363898365,6264.155755,1084.023069,0! !End!

560! X = 763.18640958207,6263.257573,1108.27154,0! !End!

561! X = 763.87073915674,6263.00 0949,1165.038432,0! !End!

562! X = 764.5336834322,6263.150646,1078.651304,0! !End!

563! X = 763.12225368444,6262.380775,1133.694775,0! !End!

564! X = 762.43792410977,6263.08649,1084.749073,0! !End!

565! X = 762.03160342481,6263.621123,1 066.999134,0! !End!

566! X = 761.24034735409,6263.663893,1086.823894,0! !End!

567! X = 763.59273026703,6263.899132,1089.232007,0! !End!

568! X = 764.34121573933,6265.22502,1067,0! !End!

569! X = 764.40537163695,6264.198526,1097.095576,0 ! !End!

570! X = 764.44814223537,6266.615065,1104.423108,0! !End!

571! X = 764.04182155041,6266.379826,1108.187075,0! !End!

572! X = 763.57134496782,6266.828918,1120.574809,0! !End!

573! X = 764.21290394408,6267.342165,1104.88085,0! !End!

574! X = 763.87073915674,6268.496971,1107.257212,0! !End!

575! X = 763.69965676307,6268.09065,1113.591299,0! !End!

576! X = 764.17013334566,6267.791256,1107.782711,0! !End!

577! X = 764.66199522746,6268.240347,1101.611647,0! !End!

578! X = 764.74753642429,6267.577403,1099.201883,0! !End!

579! X = 764.34121573933,6268.796365,1100.772413,0! !End!

580! X = 764.38398633774,6269.566236,1095.84357,0! !End!

581! X = 764.66199522746,6270.18641,1096.639068,0! !End!

582! X = 764.512298133,6271.448142,1086.320851,0! !End!

583! X = 763.5285743694,6271.619225,1057.525074,0! !End!

584! X = 762.86563009394,6271.170133,1040.417564,0! !End!

585! X = 763.977665652 78,6271.063207,1072.123855,0! !End!

586! X = 763.37887727494,6270.54996,1080.699675,0! !End!

587! X = 763.44303317257,6270.122254,1083.045018,0! !End!

588! X = 763.59273026703,6269.651777,1094.036873,0! !End!

589! X = 763.80658325911,62 69.181301,1095.626836,0! !End!

590! X = 764.06320684962,6269.929786,1086.963273,0! !End!

591! X = 764.23428924329,6270.485804,1083.348118,0! !End!

592! X = 764.68338052666,6270.785198,1097.511542,0! !End!

593! X = 764.70476582587,6269.4 16539,1098.177047,0! !End!

594! X = 764.23428924329,6269.13853,1101.274283,0! !End!

595! X = 763.63550086545,6270.91351,1068.85712,0! !End!

596! X = 763.22918018049,6271.105977,1053.742626,0! !End!

597! X = 762.71593299948,6271.64061,10 31.252644,0! !End!

598! X = 761.92467692877,6271.298445,1044.258476,0! !End!

599! X = 761.11203555884,6271.704766,1017.296947,0! !End!

600! X = 764.10597744803,6271.64061,1071.058449,0! !End!

601! X = 761.47558564539,6271.298445,1044.75 0383,0! !End!

602! X = 762.0102181256,6271.64061,1037.488729,0! !End!

603! X = 762.48069470819,6271.31983,1038.743746,0! !End!

604! X = 760.17108239367,6271.597839,1094.496217,0! !End!

605! X = 760.66294427546,6271.298445,1045.072946,0! !End!

606! X = 760.96233846438,6271.426757,1028.968704,0! !End!

607! X = 759.12320273245,6271.704766,978.2789147,0! !End!

608! X = 758.82380854353,6271.148748,1013.349575,0! !End!

609! X = 757.81869948073,6271.619225,958.8844339,0! !End!

610! X = 756.66389332347,6271.490913,1011.678127,0! !End!

611! X = 755.38077537096,6271.619225,1032.073849,0! !End!

612! X = 755.93679315038,6271.341216,1068.044005,0! !End!

613! X = 755.38077537096,6271.084592,1073.994196,0! !End!

614! X = 756.00094904801,6270.699657,1056.001097,0! !End!

615! X = 756.57835212664,6270.849354,996.2563148,0! !End!

616! X = 757.17714050448,6271.683381,962.5666243,0! !End!

617! X = 755.4449 3126859,6270.250565,1076.142941,0! !End!

618! X = 756.25757263851,6269.822859,1042.04324,0! !End!

619! X = 755.63739896146,6269.416539,1028.49319,0! !End!

620! X = 755.76571075671,6268.839136,972.1792476,0! !End!

621! X = 755.4235459693 8,6268.561127,952.2724678,0! !End!

622! X = 756.42865503218,6268.261733,1017.584668,0! !End!

623! X = 755.55185776463,6267.834027,978.1350113,0! !End!

624! X = 756.4714256306,6267.342165,984.107074,0! !End!

625! X = 755.44493126859,6266 .828918,981.7022359,0! !End!

626! X = 756.19341674089,6266.401212,994.8344378,0! !End!

627! X = 755.4663165678,6265.738267,993.1190027,0! !End!

628! X = 756.17203144168,6265.58857,1040.445606,0! !End!

629! X = 755.44493126859,6264.92562 6,1028.130336,0! !End!

630! X = 756.30034323693,6264.797314,1061.582631,0! !End!

631! X = 755.59462836305,6264.155755,1080.446804,0! !End!

632! X = 756.02233434722,6263.706664,1079.666812,0! !End!

633! X = 755.487701867,6263.150646,1081 .627881,0! !End!

634! X = 755.89402255197,6262.616014,1001.036949,0! !End!

635! X = 757.19852580369,6263.065105,1022.511005,0! !End!

636! X = 758.5030290554,6262.765711,1046.905039,0! !End!

637! X =758.35333196094,6263.599737,1103.516673,0! !End!

638! X = 758.11809366965,6263.941902,1145.020049,0! !End!

639! X = 757.92562597677,6264.840085,1094.973717,0! !End!

640! X = 756.77081981951,6264.711773,1055.678349,0! !End!

641! X = 757.11298460685,6265.5458,1050.226389,0! !End!

642! X = 761.7535945351,6262.487702,1080.881253,0! !End!

643! X = 760.66294427546,6262.402161,1103.902393,0! !End!

644! X = 762.09575932243,6262.958178,1070.884448,0! !End!

645! X = 763.7210420 6228,6263.214802,1160.63276,0! !End!

646! X = 763.93489505437,6265.032552,1067,0! !End!

647! X = 763.54995966861,6265.716882,1094.53489,0! !End!

648! X = 764.10597744803,6267.021385,1110.813747,0! !End!

649! X = 764.5336834322,6266.2515 15,1125.358871,0! !End!

650! X = 761.58251214143,6265.139479,1066.998207,0! !End!

651! X = 761.79636513351,6264.219911,1066.97913,0! !End!

652! X = 761.36865914934,6263.578352,1088.081113,0! !End!

653! X = 760.57740307863,6263.899132,10 88.553644,0! !End!

654! X = 758.93073503957,6263.941902,1160.993565,0! !End!

655! X = 757.62623178786,6264.49792,1103.511456,0! !End!

656! X = 756.96328751239,6265.075323,1043.044706,0! !End!

657! X = 756.64250802426,6265.845194,1015.16 1357,0! !End!

658! X = 756.59973742585,6266.615065,1007.819292,0! !End!

659! X = 756.64250802426,6268.133421,1053.132909,0! !End!

660! X = 757.07021400843,6268.796365,1014.32299,0! !End!

661! X = 757.04882870923,6269.266842,1008.525069, 0! !End!

662! X = 757.11298460685,6270.421648,985.5174917,0! !End!

663! X = 759.08043213403,6270.892124,1022.590719,0! !End!

664! X = 758.2464054649,6271.063207,983.7087455,0! !End!

665! X = 757.92562597677,6270.827969,997.5484861,0! !End!

666! X = 758.75965264591,6270.314721,1008.951232,0! !End!

667! X = 758.11809366965,6270.207795,1020.063684,0! !End!

668! X = 757.56207589023,6269.887015,987.1619146,0! !End!

669! X = 757.41237879577,6269.245456,1004.973775,0! !End!

670! X = 755.89402255197,6267.427706,1000.770187,0! !End!

671! X = 755.44493126859,6267.427706,998.1663293,0! !End!

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673! X = 760,6265 .165851,1144.113111,0! !End!

674! X = 758.19097649387,6268.18089,1051.321958,0! !End!

675! X = 758.47991774832,6268.846711,1059.238648,0! !End!

676! X = 759.00754960428,6268.93465,1104.509887,0! !End!

677! X = 758.91961096162,6269.23615 4,1086.829442,0! !End!

678! X = 758.39197910566,6269.525095,1022.13531,0! !End!

679! X = 758.15328850416,6269.386906,1022.010621,0! !End!

680! X = 758.39197910566,6269.148215,1046.908356,0! !End!

681! X = 757.96484855561,6267.741197,104 6.795249,0! !End!

682! X = 758.00253654532,6267.389443,1026.309995,0! !End!

683! X = 757.67590730115,6267.138189,1014.310722,0! !End!

684! X = 757.61309398497,6266.912061,1013.734057,0! !End!

685! X = 757.7261579541,6266.535181,1028.547 938,0! !End!

686! X = 758.24122714682,6266.120614,1049.099539,0! !End!

687! X = 759.77387206173,6265.718608,1138.982523,0! !End!

688! X = 759.37186683815,6265.957299,1120.670153,0! !End!

689! X = 759.19598955283,6265.932174,1106.072427, 0! !End!

690! X = 759.23367754254,6265.706046,1106.460236,0! !End!

691! X = 759.45980548081,6265.567856,1122.970766,0! !End!

692! X = 759.52261879699,6265.49248,1131.932065,0! !End!

693! X = 759.74874673526,6265.580419,1143.325484,0! !End!

694! X = 760.06281331619,6265.668358,1150.049125,0! !End!

695! X = 760.25125326474,6265.542731,1146.137623,0! !End!

696! X = 760.46481853977,6265.354291,1117.741815,0! !End!

697! X = 760.76632245746,6265.592982,1127.610426,0! !End!

698! X = 760.99245039572,6265.831672,1128.599153,0! !End!

699! X = 760.52763185595,6266.120614,1147.169327,0! !End!

700! X = 760.89194908983,6266.19599,1145.080606,0! !End!

701! X = 761.05526 371191,6266.321616,1141.252926,0! !End!

702! X = 761.14320235457,6266.836685,1112.97023,0! !End!

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704! X = 761.40701828254,6267.502507,1088.978605,0! !End!

705! X = 761.38189295607 ,6267.854261,1079.138579,0! !End!

706! X = 761.26882898694,6268.293954,1093.826524,0! !End!

707! X = 761.55777024139,6268.407018,1080.838053,0! !End!

708! X = 761.9346501385,6268.381893,1088.521432,0! !End!

709! X = 762.60047129006,6268 .331642,1087.622128,0! !End!

710! X = 762.97735118717,6268.608021,1093.679682,0! !End!

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713! X = 763.81904962405,6268.947 213,1092.35177,0! !End!

714! X = 763.21604178867,6269.625597,1091.720457,0! !End!

715! X = 763.07785249307,6270.077852,1092.165194,0! !End!

716! X = 762.91453787098,6270.555234,1064.243569,0! !End!

717! X = 764.02005223584,6270.504983,1 077.20128,0! !End!

718! X = 763.7687989711,6269.776349,1091.806699,0! !End!

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721! X = 763.90698826671,6267.263816,1113.37 9028,0! !End!

722! X = 764.15824153145,6266.095488,1120.434892,0! !End!

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725! X = 762.65072194301,6264.663345,1067,0! !End!

726! X = 762.72609792243,6263.796521,1080.92404,0! !End!

727! X = 762.67584726948,6263.281452,1099.363535,0! !End!

728! X = 761.39445561931,6263.143262,1089.234454,0! !End!

729! X = 760.74119713 098,6262.979948,1105.367614,0! !End!

730! X = 760.35175457064,6263.168388,1096.006051,0! !End!

731! X = 759.29649085873,6263.74627,1146.410912,0! !End!

732! X = 758.90704829838,6264.160838,1140.775328,0! !End!

733! X = 758.10303785121,6 264.814097,1098.951578,0! !End!

734! X = 757.47490468936,6264.952286,1082.06623,0! !End!

735! X = 757.12315011873,6264.675907,1066.026219,0! !End!

736! X = 756.68345690543,6264.185963,1074.684952,0! !End!

737! X = 756.49501695688,6265.3 41728,1037.507988,0! !End!

738! X = 755.91713444797,6265.731171,1006.195654,0! !End!

739! X = 755.94225977445,6265.06535,1049.532171,0! !End!

740! X = 756.35682766127,6263.959835,1056.897579,0! !End!

741! X = 756.85933419075,6263.080449 ,1011.897505,0! !End!

742! X = 756.52014228335,6262.464879,1023.204405,0! !End!

743! X = 757.90203523942,6263.005073,1037.030847,0! !End!

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745! X = 760.15075195884,6263.909585,109 8.253531,0! !End!

746! X = 761.23114099723,6262.904572,1101.04923,0! !End!

747! X = 762.28640470913,6262.791508,1066.986642,0! !End!

748! X = 762.91453787098,6262.364377,1112.673159,0! !End!

749! X = 763.36679374752,6262.766382,1132.650 179,0! !End!

750! X = 764.43462012266,6262.703569,1088.537191,0! !End!

751! X = 763.98236424613,6263.457329,1157.704489,0! !End!

752! X = 763.36679374752,6263.758833,1106.151487,0! !End!

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755! X = 761.21857833399,6265.706046,1093.993466,0! !End!

756! X = 762.42459400474,6266.786435,1135.438178,0! !End!

757! X = 762.26127938266,6266.309054,1141.524196,0! !End!

758! X = 761.98490079145,6266.585432,1121.71812,0! !End!

759! X = 761.84671149584,6267.050251,1115.243761,0! !End!

760! X = 762.18590340324,6266.886936,1123.159284,0! !End!

761! X = 761.57033 290463,6266.43468,1125.097919,0! !End!

762! X = 756.96539318843,6270.048215,989.7539831,0! !End!

763! X = 756.74766355173,6269.408634,1024.555167,0! !End!

764! X = 756.32581238062,6270.061823,1034.004428,0! !End!

765! X = 755.6590153682 1,6269.816877,1074.048245,0! !End!

766! X = 756.48910960814,6270.551715,1008.051919,0! !End!

767! X = 756.80209596091,6270.646971,986.4555745,0! !End!

768! X = 756.78848785861,6269.857701,996.8165985,0! !End!

769! X = 756.65240683567,62 69.599148,1015.349926,0! !End!

770! X = 757.42806866643,6269.844093,990.3752309,0! !End!

771! X = 757.59136589396,6270.483674,998.3207453,0! !End!

772! X = 758.04043326966,6271.449849,973.4416751,0! !End!

773! X = 758.72083838436,6271.7 49228,988.9875548,0! !End!

774! X = 759.68754576781,6271.561832,1042.935644,0! !End!

775! X = 760.06249084644,6271.061905,1056.669696,0! !End!

776! X = 760.59366304116,6270.843187,1051.715293,0! !End!

777! X = 760.6561538876,6271.686813 ,1044.942379,0! !End!

778! X = 761.09358981266,6270.577601,1055.623194,0! !End!

779! X = 761.51540302612,6270.811942,1050.499753,0! !End!

780! X = 762.03095250923,6270.952546,1077.278458,0! !End!

781! X = 762.67148368521,6270.936923,1061.602215,0! !End!

782! X = 762.32778402981,6269.874579,1064.850097,0! !End!

783! X = 762.9839379174,6270.34326,1071.311138,0! !End!

784! X = 756.59424886914,6267.765513,1018.116773,0! !End!

785! X = 755.79749057706,6267.999854,966.3864528,0! !End!

786! X = 755.46941363326,6269.062198,995.4200149,0! !End!

787! X = 757.60972512376,6262.406923,1021.31852,0! !End!

788! X = 762.57774741556,6262.21945,1093.081716,0! !End!

789! X = 755.95371769 315,6262.360055,1005.039487,0! !End!

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791! X = 755.34443194039,6264.437875,1047.423686,0! !End!

792! X = 755.25069567073,6266.375092,992.9329275,0! !End!

793! X = 755.29756380556, 6268.046722,973.6953466,0! !End!

794! X = 755.23507295912,6269.780843,1079.367462,0! !End!

795! X = 755.29756380556,6270.640092,1051.713409,0! !End!

796! X = 755.92247226994,6271.061905,1083.481653,0! !End!

797! X = 756.21930379051,6271 .718059,1009.470186,0! !End!

798! X = 756.40677632983,6271.108773,1038.665226,0! !End!

799! X = 757.48474343088,6271.311868,962.8252914,0! !End!

800! X = 758.03153833721,6270.999414,996.5394059,0! !End!

801! X = 759.12512814987,6271.327 491,989.2921207,0! !End!

802! X = 759.73441390264,6270.796319,997.6568159,0! !End!

803! X = 762.34340674142,6271.077528,1048.766956,0! !End!

804! X = 763.79631892109,6271.249378,1067.115793,0! !End!

805! X = 764.49934094352,6270.983791, 1093.11848,0! !End!

806! X = 764.7961724641,6270.390128,1100.531526,0! !End!

807! X = 764.81179517571,6269.733975,1098.073612,0! !End!

808! X = 764.7961724641,6268.874725,1099.065685,0! !End!

809! X = 764.53058636674,6267.906117,1103.920993,0! !End!

810! X = 764.70243619444,6266.812527,1104.097184,0! !End!

811! X = 764.65556805961,6266.25011,1121.825525,0! !End!

812! X = 764.53058636674,6265.125275,1067,0! !End!

813! X = 764.04628230 685,6263.953571,1098.529737,0! !End!

814! X = 763.45261926569,6264.266025,1070.505468,0! !End!

815! X = 762.51525656912,6265.000293,1067,0! !End!

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817! X = 760.84362642691,6263.79 7344,1092.409576,0! !End!

818! X = 761.04672167783,6263.391154,1095.945854,0! !End!

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821! X = 761.9840843744,6262.313187,10 82.479739,0! !End!

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823! X = 760.92173998496,6263.094322,1099.222057,0! !End!

824! X = 758.47037286505,6265.322344,1077.812762,0! !End!

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826! X = 763.91041775628,6265.310009,1067.084457,0! !End!

827! X = 763.81173213467,6266.062487,1099.780798,0! !End!

828! X = 763.52801097255,6266.56825,1128.590935,0! !End!

829! X = 762.86188302668,6267.468757,1115.69818,0 ! !End!

830! X = 763.0592542699,6268.048535,1097.480921,0! !End!

831! X = 763.25662551312,6268.171892,1103.765639,0! !End!

832! X = 763.12093278341,6269.516483,1086.969697,0! !End!

833! X = 762.63984037806,6269.257434,1084.063292,0! !End!

834! X = 758.39635864884,6270.24429,1005.945665,0! !End!

835! X = 758.61840129746,6270.811732,1008.189863,0! !End!

836! X = 759.91365008109,6270.194947,1054.482282,0! !End!

837! X = 760.07401421621,6270.602025,1027.120056,0! !End!

838! X = 760.6809751602,6266.141043,1146.741527,0! !End!

839! X = 760.58811491108,6265.537451,1126.640387,0! !End!

840! X = 760.92086413709,6265.413637,1102.143051,0! !End!

841! X =761.16849146807,6266.032706,1129.015373,0! !End!

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843! X = 761.56314752682,6266.605344,1113.49994,0! !End!

844! X = 761.82625156599,6266.690466,1115.429285,0! !End!

845! X = 762.17447750018,6266.791064,1124.076658,0! !End!

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848! X = 761.46254892361,6267.332749,1089.861411,0! !End!

849! X = 762.097093 95925,6267.255366,1100.414537,0! !End!

850! X = 761.97328029376,6267.054168,1116.510539,0! !End!

851! X = 762.34472129023,6267.108337,1110.50099,0! !End!

852! X = 762.27507610339,6266.674989,1130.543219,0! !End!

853! X = 762.25186104112 ,6266.489269,1131.841235,0! !End!

854! X = 758.70769486644,6266.783326,1075.793129,0! !End!

855! X = 758.34399222406,6266.938093,1072.740282,0! !End!

856! X = 758.04993476852,6266.852971,1041.920164,0! !End!

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858! X = 757.87969097847,6267.379179,1025.291596,0! !End!

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860! X = 758.19696349629,6267.588115,1037.012757,0! !End!

861! X = 757.41538973288,6267.43 3348,1037.640968,0! !End!

862! X = 757.65527870977,6267.325011,1028.836653,0! !End!

863! X = 757.33800619195,6267.023215,1007.72946,0! !End!

864! X = 758.72928692847,6269.093552,1076.582318,0! !End!

865! X = 758.54180467201,6269.67683,1 025.187378,0! !End!

866! X = 759.02092599406,6269.874728,1029.464183,0! !End!

867! X = 759.35422778332,6269.635167,1048.546587,0! !End!

----

a

Data for each receptor are treated as a separate input subgroup

and therefore must end with an input group terminator.

b

Receptor height above ground is optional. If no value is entered,

the receptor is placed on the ground.

APPENDIX 7

Noise Impact Assessment

Noise Impact Assessment

Middle Creek Quarries - Modification
Oberon, NSW

Prepared for: Oberon Earthmoving Pty Ltd
July 2022
MAC190984-01RP1

MAC
Muller Acoustic Consulting

Document Information

Noise Impact Assessment

Middle Creek Quarries - Modification

Oberon, NSW

Prepared for: Umwelt (Australia) Pty Limited

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

Document ID	Date	Prepared By	Signed	Reviewed By	Signed
MAC190984-01RP1	4 July 2022	Louis Abell		Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Oberon Earthmoving Pty Ltd (Oberon Earthmoving) to complete a Noise Impact Assessment (NIA) for a modification of the existing operations at Middle Creek Quarries (the 'Quarry') located at Oberon, NSW.

The NIA has been undertaken to quantify potential acoustic impacts to the surrounding community and has been prepared to accompany the Environmental Assessment (EA) for the development consent modification of DA-10.2016.38.1 that is being prepared by Umwelt for submission to Oberon Shire Council (OSC).

This NIA has also considered and applied the following policy, guidelines and standards where relevant:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment and Climate Change (DECCW), NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), March 2011;
- Noise Monitoring Assessment, Middle Creek Quarries, Muller Acoustic Consulting Pty Ltd, 2022, (MAC, 2022);
- Noise and Vibration Impact Assessment, Proposed Middle Creek Quarries Extension, Muller Acoustic Consulting Pty Ltd, 2016, (MAC, 2016);
- Acoustic Management Plan (AMP 4432/R06), Middle Creek Quarries, Umwelt (Australia) Pty Limited, 2019;
- Development Application (DA) # DA-10.2016.38.1;and
- NSW Environment Protection Authority (EPA), Environmental Protection Licence (EPL) #21098.

This report has not included an assessment of blasting, as there are no proposed changes to existing blast locations as a result of the modification.

A glossary of terms, definitions and abbreviations used in this report, along with a list of common noise sources and their typical sound level is provided in **Appendix A**.

1.1 Background

Middle Creek Quarry is located approximately 4km to the west of Oberon, NSW and is operated by Oberon Earthmoving. The Quarry is classed as a Designated Development and operates under development consent DA-10.2016.38.1, permitting the extraction of gravel and the importation of waste materials including raw mulch, treated drilling mud and Excavated Natural Material (ENM).

The existing development consent for the Quarry allows for a total extraction of no greater than 5,000,000 tonnes of material over the life of the quarry, from an area of approximately 15ha. The layout of the approved Quarry site is shown in **Figure 1**. Key features of the approved Quarry operations are as follows:

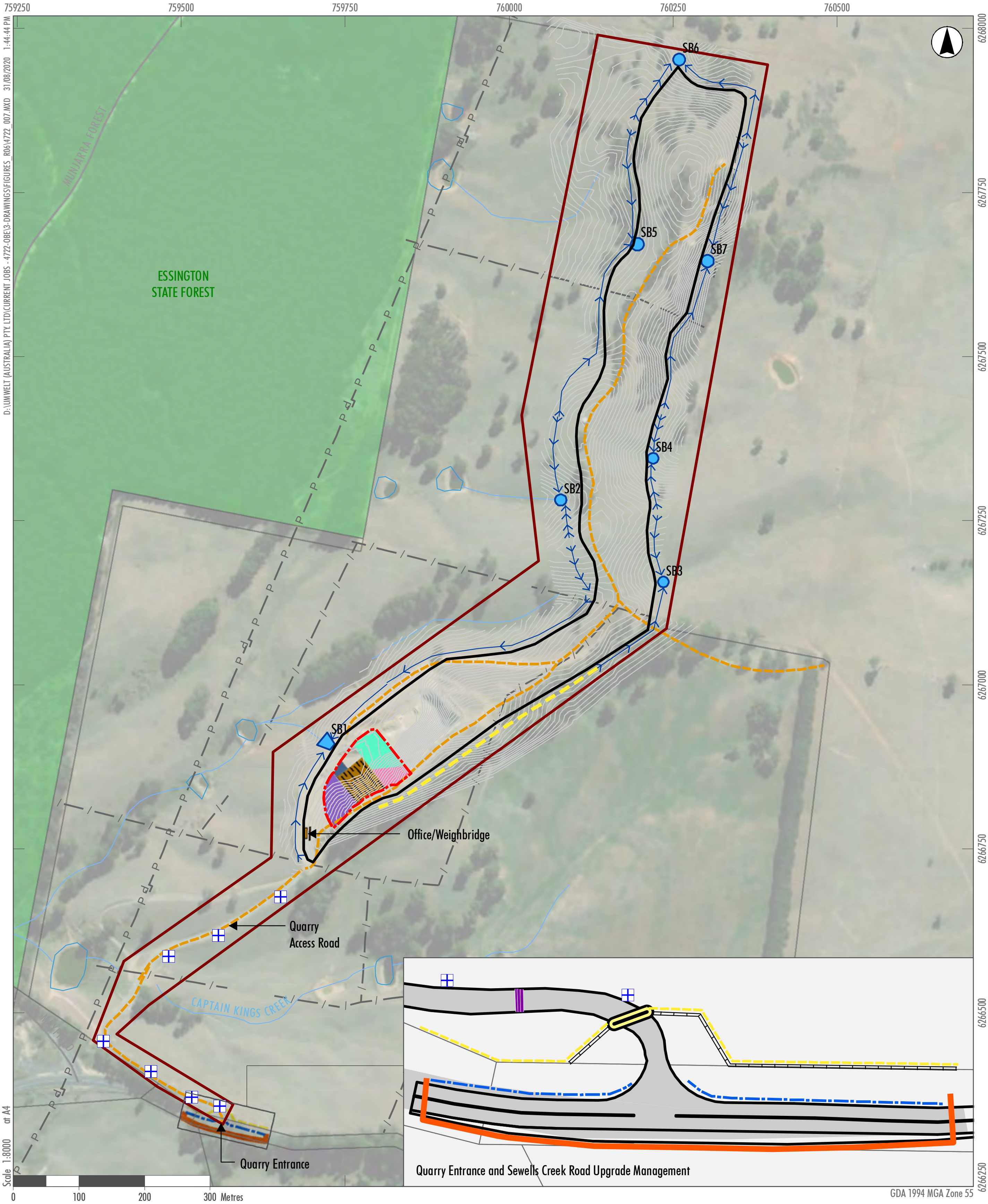
- Extraction of up to 150,000 tonnes per annum (tpa);
- Combined production of all products of up to 250,000 tpa;
- On-site crushing, screening and stockpiling of extracted material to produce a range of aggregate and crushed rock products;
- Importation of mulch and clean fill material for application to land, composting or other processing to produce composts and other specialty products; and
- Rehabilitation of a final landform that will be geotechnically stable and will be suitable for a final land use of intermittent grazing, consistent with the current land use.

1.2 Project Description

The modification to DA-10.2016.38.1 proposes the following amendments:

- Construction and operation of an out of pit processing and stockpile area;
- Importation of waste concrete for crushing and sale;
- Addition of washing circuit;
- Combined production rate of up to 315,000 tpa (increase of 65,000 tpa); and
- Increase in road truck movements.

No change is proposed for the hours of operation, the workforce number or extraction area for the Quarry. The layout of proposed modifications to the Quarry site is shown in **Figure 2**.



Legend

- Quarry Site Boundary
- Extraction Area
- Initial Processing Resource Recovery and Processing Area
- Office
- Weighbridge
- Collection Sump (900mm @ 1 x 10^{-9} m/s)
- Compost and Mulch Product Storage
- Windrow Composting
- Mulch Storage
- VENM, ENM and Treated Drilling Mud Storage
- Existing Roads
- Mire Drain
- Diversion Drains
- Sediment Fence
- Sediment Basin
- Fence
- Power Line and Staunchion
- Contours (1m)
- Watercourse / drainage line
- Dam

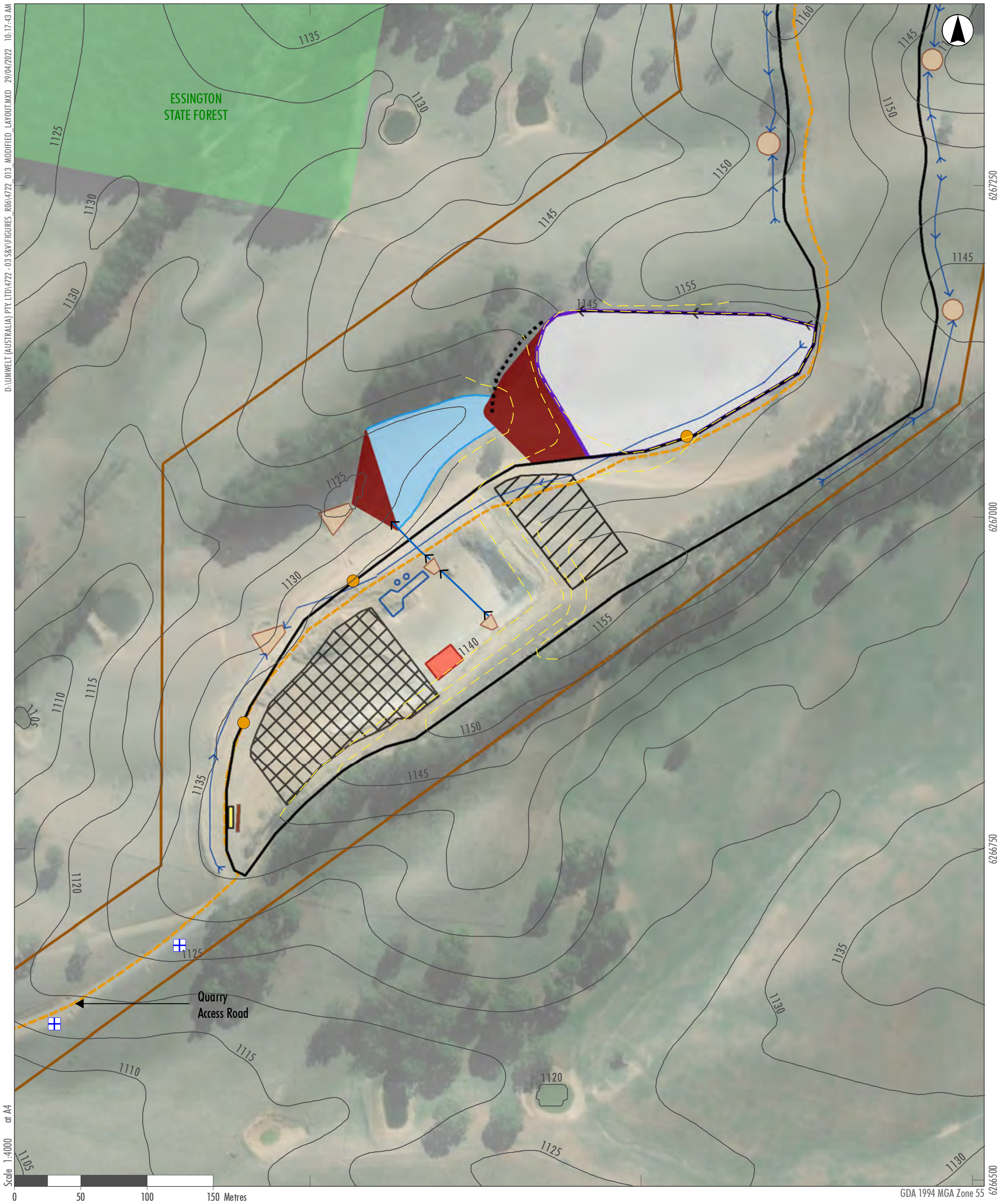
Inset Legend

- Construction zone
- Sediment Fence
- Table Drain
- New Fence
- Stabilised Acces
- Shaker Grid

FIGURE 2.1

Approved Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)



Legend

- Project Site Boundary Extent
- Extraction Area
- Batter Slope
- Composting Area
- Crushing Unit
- Office
- Pollution Control Dam
- Sediment Basin
- VENM, ENM and Treated Drilling Mud Storage
- Wash Plant
- Weighbridge
- Quarry Sales Product Stockpiles
- Access Roads
- Mire Drain
- Spillway
- Dirty (sediment) Water Drain
- Contaminated Water Drain
- Gravity Pipe
- Access Points
- Contours
- Modified Contours

FIGURE 3.1

Modified Quarry Site Layout

Image Source: ESRI Basemap Data source: DFSI (2020), Umwelt (2018)

2 Noise Policy and Guidelines

2.1 Current Operational Noise Criteria

Table 1 reproduces the hours of operation for the quarry as per Condition L6.3 of EPL (21098).

Table 1 Hours of Operations	
Days	Hours
Monday to Friday	7.00am to 6.00pm
Saturday	8.00am to 2.00pm
Sunday	No Works Permitted

Table 2 reproduces the noise criteria for the quarry as per Condition L4.1 of EPL (21098) and Condition 4.1 of the AMP (4432/R06). It is noted that the quarry operates during the daytime period only, however, evening and night periods have been presented in accordance with the AMP (4432/R06).

Table 2 Project Specific Noise Criteria[1]			
Receiver	Day	Evening[2]	Night[2]
All Residential	39	35	35

Note 1: Noise limits presented do not apply at any sensitive receivers where the licensee has written agreement with the sensitive receiver to exceed the noise limits.

Note 2: Currently no operations during the evening or night time are permitted.

It is noted that Condition L4.3 of EPL 21098 states that the noise criteria in Table 2 of schedule 3 are to apply under all meteorological conditions except the following applicable meteorological conditions:

The noise limits set out in conditions L4.1 apply under all meteorological conditions except for any one of the following:

(a) Wind speeds greater than 3 meters/second at 10 meters above ground level; or

(b) Stability category F temperature inversion conditions and wind speeds greater than 2 meters/second at 10 meters above ground level; or

(c) Stability category G temperature inversion conditions.

2.1.1 Differences Between INP and NPI Noise Assessment Criteria

The existing Project Approval and Consent Conditions are based on the historic assessment (MAC, 2016) completed in accordance with the NSW Industrial Noise Policy 2000 (INP). The INP methodology to determine the noise assessment criteria has since been superseded by the NSW Noise Policy for Industry (NPI). The EPA released the NPI in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The most significant difference in noise assessment criteria from the implementation of the NPI is the change in the minimum applicable daytime Rating Background Level (RBL). The minimum applicable daytime RBL in the INP was established at 30dB $L_{A90(daytime)}$ and is now instituted as 35dB $L_{A90(daytime)}$ in the NPI. It is noted that the minimum applicable daytime RBLs for evening and night periods has remained at 30dB L_{A90} in the NPI.

2.1.2 Proposed Contemporary Criteria

The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.

In consideration of the preceding discussion of the contemporary noise criteria in accordance with the NPI, the assessment has adopted the minimum assumed Rating Background Noise Levels (RBLs) outlined in Section 2.3 of the Noise Policy for Industry (NPI, 2017) to establish Project Noise Trigger Levels (PNTLs) (RBL+5) with project intrusiveness levels adopted as the most stringent criteria for the assessment of Middle Creek Quarry Operations. This criteria is reproduced in **Table 3**.

Table 3 Project Noise Trigger Levels[1]

Receiver	Day	Evening[2]	Night[2]
All Residential	40	35	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Currently no operations during the evening or night time are permitted.

2.2 Construction Noise Management Levels

Construction activities within the proposed quarry include upgrade of the site entrance intersection and construction of an out of pit stockpiling area. Noise associated with construction activities for extractive industries are often assessed as operational noise, as the emissions from plant and associated construction equipment are similar. Therefore, this assessment has adopted a construction noise management level (NML) of 40dB $L_{Aeq(15min)}$.

2.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (2011).

The 'Freeway/arterial/sub-arterial road' categories as specified in the RNP are adopted for Sewells Creek Road and Abercrombie Road for this assessment. **Table 4** presents the road traffic noise assessment criteria reproduced from the RNP relevant for this road type.

Table 4 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/development	Assessment Criteria - dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial road	Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments	60dBA $L_{Aeq(15hr)}$	55dBA $L_{Aeq(9hr)}$

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level. In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered.

Receivers experiencing increases in total traffic noise levels above those presented in **Table 5** due to the addition of quarry vehicles on the roads surrounding the project should be considered for mitigation.

Table 5 Increase Criteria for Residential Land Uses

Road Category	Type of Project/Development	Total Traffic Noise Level Increase - dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq(15hr)}$ +12dB (external)	Existing traffic $L_{Aeq(9hr)}$ + 12dB (external)

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3 Receiver Review

The Quarry is located in a rural area on the northern side of Sewells Creek Road, approximately 3.5km west of Oberon, NSW. Receivers in the locality surrounding the quarry are primarily rural/residential. **Figure 3** provides a locality plan identifying the position of receivers in relation to the quarry. The receiver addresses, MGA(56) coordinates and approximate distance to the project are summarised in **Table 6**.

Table 6 Receiver Locations

Receivers	Description	Coordinates (GDA94/MGA56)		Distance to Extraction Area (m)
		Easting, m	Northing, m	
R2	278 Abercrombie Road	204083	6265044	1130
R4	280 Abercrombie Road	205386	6265776	1760
R6	278 Abercrombie Road	205238	6265622	1330
R9	349 Abercrombie Road	205116	6265592	1260
R11	353 Abercrombie Road	204673	6264945	1240
R12	153 Sewells Creek Road	204517	6264803	1020
R13	79 Sewells Creek Road	203640	6265164	610
R16	1006 Mayfield Road	202593	6265951	1040
R17	979 Mayfield Road	202603	6266454	1240
R18	310 Sewells Creek Road	202129	6265925	1520
R19	1002 Mayfield Road	202378	6266133	1300

FIGURE 3

Locality Plan

MAC190984-01

Middle Creek Quarry

KEY

Receiver

Quarry Site Boundary

0 100 200 300 400 500 m

4 Noise Assessment Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2022.1) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics – Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

4.1 Construction Noise Modelling Parameters

The modification would involve the construction of an out of pit stockpiling area (composting area, and VENM,ENM/treated drilling mud storage area), water diversion, and the establishment of ancillary infrastructure and upgrades to the Quarry Access Road.

MAC understands that construction activities associated with the stockpile areas, water diversion and the installation of the wash plant and associated fines settling ponds would be undertaken within the existing disturbance area and would occur concurrently with operational activities during periods of reduced production. Earth moving equipment to be used for the construction activities would generally be consistent with earth moving equipment used on site.

The construction noise assessment has therefore considered Quarry Access Road upgrade works only, which involves the upgrade of the intersection of Quarry Access Road with Sewells Creek Road (nearest to receivers R13 and R12).

4.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the Quarry, as derived from the current quarry layout and the surrounding land base topography, superimposed on each other. Plant and equipment were modelled at various locations and heights, representative of proposed operating conditions for the proposed modification. The two following scenarios were adopted for this assessment:

> **Scenario 1:** This modelling scenario was adopted to represent noise emissions during operation at the quarry within Cell 1, this is the closest cell to surrounding receivers and is a worst case scenario with drill, dozer and haul truck operating at surface of existing topography.
>
> **Scenario 2:** Was completed to represent noise emissions during operation at the quarry within Cell 2 was also assessed as receivers to the west (R16 - R19) may experience source to receiver winds under prevailing meteorology (east and northeast winds).

4.3 Road Traffic Noise Modelling Parameters

Predicted noise levels from project related traffic at the nearest receiver (15m from Majors Creek Road) has been calculated using the United States Department of Transport, Federal Highway Administration Traffic Noise Model (TNM) Low Volume Calculation Tool.

The majority of truck movements from the project would be to and from the east, via Sewells Creek Road and Abercrombie Road, towards Oberon and beyond. It is indicated that current operations facilitate a maximum of 100 truck movements per day. For the proposed modification, it has been indicated that a maximum of 180 proposed daily truck movements associated with product dispatch from the quarry will occur per day. The road noise calculations assume that all trucks travel along Sewells Creek Road to and from the east. The calculations have adopted a worst case scenario assuming a minimum receiver setback of 15m from the road.

4.4 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source. As the strength of the wind increases, the noise produced by the wind will mask the audibility of most industrial sources.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for potential enhancements, the NPI specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions.

To determine the prevailing conditions for the Quarry, weather data during the period November 2018 to November 2020 was obtained from the Bureau of Meteorology's (BOM) Mount Boyce (ID:063292) Automatic Weather Station. The data was analysed using the EPA's Noise Enhancement Wind Analysis (NEWA) program in order to determine the frequency of occurrence of winds of speeds up to 3m/s in each season. Table 7 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season. The results of the detailed analysis of meteorological data are presented in Appendix B.

Table 7 Seasonal Frequency of Occurrence Wind Speed Intervals			
Season	Period	Wind Direction ±(45°)	% Wind Speeds (m/s) 0.5 to 3 m/s
Summer	Day	NE (45°)	42
Autumn	Day	E (90°)	36
Winter	Day	ENE, E (67.5°, 90°)	20
Spring	Day	NE, ENE (45°,67.5°)	26

Based on the results of this analysis, prevailing winds are applicable for the assessment. The relevant meteorological conditions adopted are summarised in **Table 8**.

Table 8 Modelled Site Specific Meteorological Parameters				
Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Calm - Day	20°C	n/a	60%	n/a
Prevailing wind day – Summer	20°C	3m/s @ 45°	60%	n/a
Prevailing wind day - Autumn	20°C	3m/s @ 90°	60%	n/a

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

4.5 Sound Power Levels

Mobile plant noise emissions used in modelling for this assessment were obtained via direct measurement of onsite plant or the MAC database of sources. The noise emission levels used in modelling are summarised in **Table 9**.

Table 9 Single Octave Equipment Sound Power Levels, dB LAeq(15min) *(re10^{-12}W)*

Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dBA
	63	125	250	500	1000	2000	4000	8000	
Operational Equipment									
Bulldozer (Komatsu D155) (x1)	84	93	97	105	101	100	98	88	108
Excavator (30t) (x1)	76	90	90	97	96	94	90	83	102
Loader (x1)	76	94	93	99	100	97	92	89	105
Haul Truck (40t) (x1)	92	96	102	102	103	100	93	84	108
Road Trucks (x1)	88	94	89	88	92	96	91	84	101
Wash Plant (x1)	82	90	93	102	101	100	96	89	107
Crusher & Screening Plant (x1)	99	98	99	111	108	106	100	92	114
Drill Rig (x1)	81	103	104	106	109	108	100	92	114
Construction Equipment									
Bulldozer (Komatsu D155) (x1)	84	93	97	105	101	100	98	88	108
Excavator (30t) (x1)	76	90	90	97	96	94	90	83	102
Road Trucks (x1)	88	94	89	88	92	96	91	84	101
Loader (x1)	76	94	93	99	100	97	92	89	105

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Truck movements per 15 minute period from pit.

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5 Noise Modelling Results and Discussion

5.1 Operational Noise Results

The predicted noise levels at each assessed receiver for the meteorologic conditions (refer **Table 8**) for proposed operations for Scenario 1 and Scenario 2 are provided in **Table 10**. **Appendix C** presents the noise contours for these scenarios. Results of modelling identify the proposed operations will satisfy relevant criteria at all assessed receivers under calm and prevailing meteorological conditions.

Table 10 Predicted Operational Noise Levels (by receiver), dB $L_{Aeq(15min)}$

Receiver	Calm - Day		Predictions for Worst Case Meteorology[2]		Day Criteria
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	
R2	29	34	29	34	40
R4	27	33	27	33	40
R6	29	33	29	33	45
R9	30	32	30	35	40
R11	30	32	31	34	40
R12	33	33	35	35	40
R13	37	35	39	36	40
R16	36	32	38	34	40
R17	33	28	35	30	40
R18	28	25	30	26	40
R19	30	26	32	28	40

Note 1: Day period is 7am to 6pm, evening is 6pm to 10pm, night period is 10pm to 7am.

Note 2: Based on the highest predicted noise levels during either prevailing winds or inversion meteorological conditions.

5.2 Construction Noise Results

Noise associated with construction activities for extractive industries are often assessed as operational noise, as the emissions from plant and associated equipment are similar.

This assessment has quantified potential noise emissions from the proposed construction of the access/haul road and potential intersection upgrade which, if completed will be conducted during daytime hours (ie. standard hours).

Table 11 provides a summary of the project construction NML for worst case prevailing meteorological conditions.

Table 11 Predicted Noise Levels from Construction, dB $LA_{eq(15min)}$

Receiver	Worst Case Construction Predictions[1]	NML
R2	<30	40
R4	<30	40
R6	<30	40
R9	<30	40
R11	<30	40
R12	32	40
R13	50	40
R16	30	40
R17	<30	40
R18	<30	40
R19	<30	40

Note1: Includes assessment of noise emissions during prevailing meteorological conditions.

The results of the analysis demonstrate that noise levels associated with construction activities are anticipated to exceed the relevant NMLs during Quarry Access Road upgrades at the closest receiver (R13). It is therefore recommended that during Quarry Access Road upgrade construction activities, noise management strategies as per the ICNG should be implemented to minimise noise emissions from the works to the surrounding area. Where standard noise management strategies are implemented, it is conservatively considered that a up to a 10dB reduction of received noise levels could be achieved. Noise management strategies outlined in the ICNG are detailed in **Section 5.2.1**.

5.2.1 Construction Noise Management Recommendations

During construction activities, the following mitigation strategies (see **Table 12**) may be employed to manage noise.

Table 12 Construction Noise Mitigation Measures

Mitigation Level	Mitigation Measures
Standard Mitigation	▪ Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers; ▪ Training (of employees to conduct quieter work practices); ▪ Equipment which is used intermittently is to be shut down when not in use; ▪ Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers; ▪ Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers; ▪ The quietest suitable machinery reasonably available will be selected for each work activity; ▪ Avoid queuing of vehicles adjacent to any receivers; ▪ Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers; ▪ Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm; ▪ Minimising the need for reversing or movement alarms.
Level 1 Mitigation (Including Standard Mitigation Level)	▪ Scheduling of construction activities to minimise the number of work fronts and simultaneous activities occurring along the northern boundary to minimise noise; ▪ Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise noise impacts; ▪ Where vehicle queuing is required, for example due to safety reasons, engines are to be switched off to reduce their overall noise impacts on receivers; ▪ Notification of OOH works;
Level 2 Mitigation (Including Mitigation Level 1)	▪ optimise the positioning of plant and equipment to minimise line of site to receivers or substitute noisy equipment to reduce the noise level at nearby receivers for these activities; ▪ Respite periods;

Employing these strategies could potentially result in the following noise level reductions:

- Standard Mitigation – up to 10dBA in instances where space requirements place limitations on the attenuation options available;
- Level 1 Mitigation – potentially up to 20dBA depending on mixture of measures and noise sources in operation, location and proximity to receivers; and
- Level 2 Mitigation - potentially over 20dBA where the use of enclosures, silencers, etc) can be combined with noise barriers and management techniques (eg avoidance of clustering). Level 2 mitigation is not expected to be feasible to due the duration and scale of the constructions works.

Given that the predicted noise levels are expected to exceed the established NMLs during worst case conditions at the closest receiver, standard mitigation measures should be considered to manage exceedances for this phase of the project.

5.3 Road Traffic Noise Results

The results of the traffic noise calculations are presented in **Table 13** and demonstrate the noise levels from quarry road trucks would remain below the relevant criteria for receivers at a distance of 15m from the roadway.

Table 13 Operational Road Traffic Noise Levels, Day dB $LA_{eq(15hr)}$

Distance to Nearest Receiver(m)	Assessment Criteria	Current (100 movements)	Proposed (180 movements)	Relative Increase
15	60	47.5	50.1	2.6

Results indicate that the relative increase in road traffic noise contributions from proposed quarry operations will be below 12dBA and therefore mitigation of road traffic noise is not considered for the modification.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Noise Impact Assessment (NIA) of potential impacts associated with the proposed modification of the existing operations at Middle Creek Quarries located at Oberon, NSW. The assessment has quantified potential construction and operational noise emissions pertaining to extraction, processing and dispatch of Quarry products via road trucks.

The results of the assessment demonstrate that noise levels associated with construction activities are anticipated to exceed the NMLs at receiver R13 during Quarry Access Road upgrades works. It is therefore recommended that standard noise management strategies as per the ICNG are implemented. Where the standard noise management strategies are implemented, it is anticipated that a up to 10dB reduction in noise emissions could be achieved, and construction noise levels would remain below the relevant NMLs at all receiver locations.

The results of the NIA demonstrate that operational noise levels (including minor construction activities) comply with the relevant NPI criteria for all assessment periods at the most affected sensitive receiver locations.

Additionally, the NIA demonstrates that the road noise criteria as specified in the RNP will be satisfied at the nearest potentially affected receivers for worst case operational road traffic.

Based on the NIA results, there are no noise related issues which would prevent the approval of the extension of the Quarry. The results of the assessment show compliance with the relevant operational and road noise criteria.

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Appendix A – Glossary of Terms

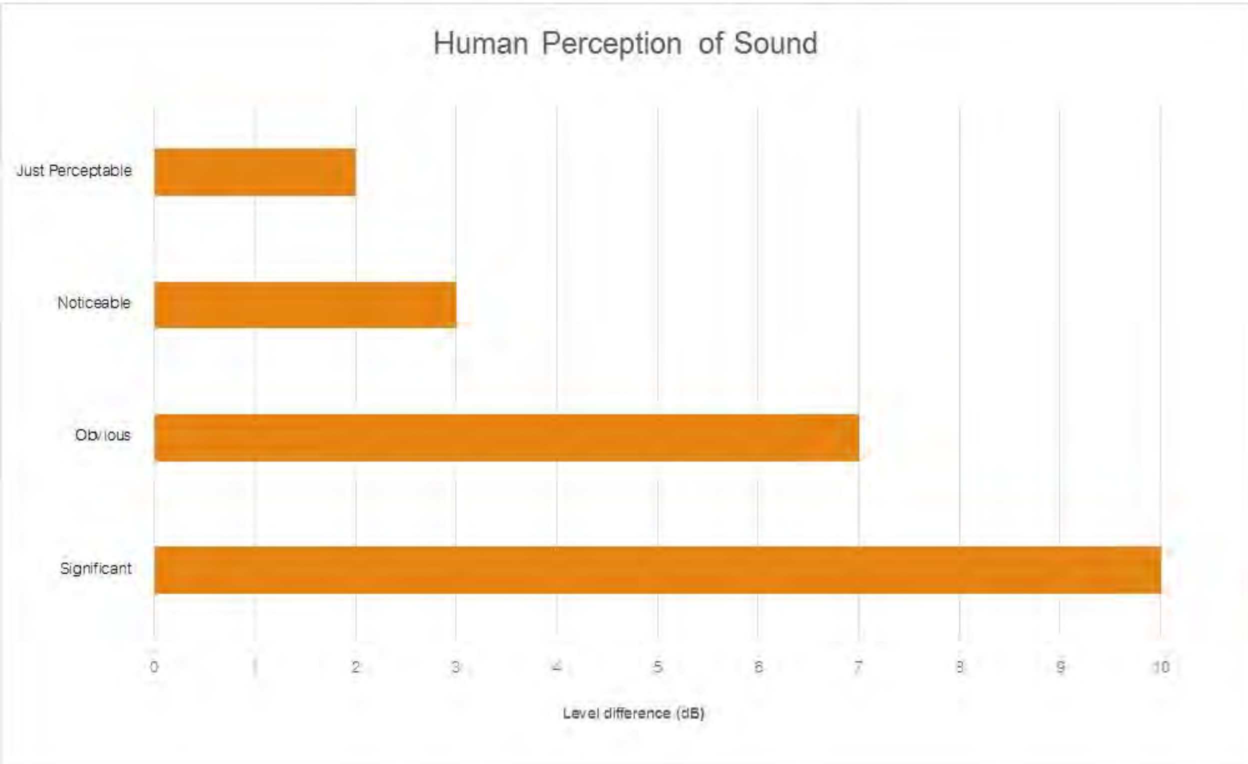
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by: = 10.log10 (W/Wo) Where: W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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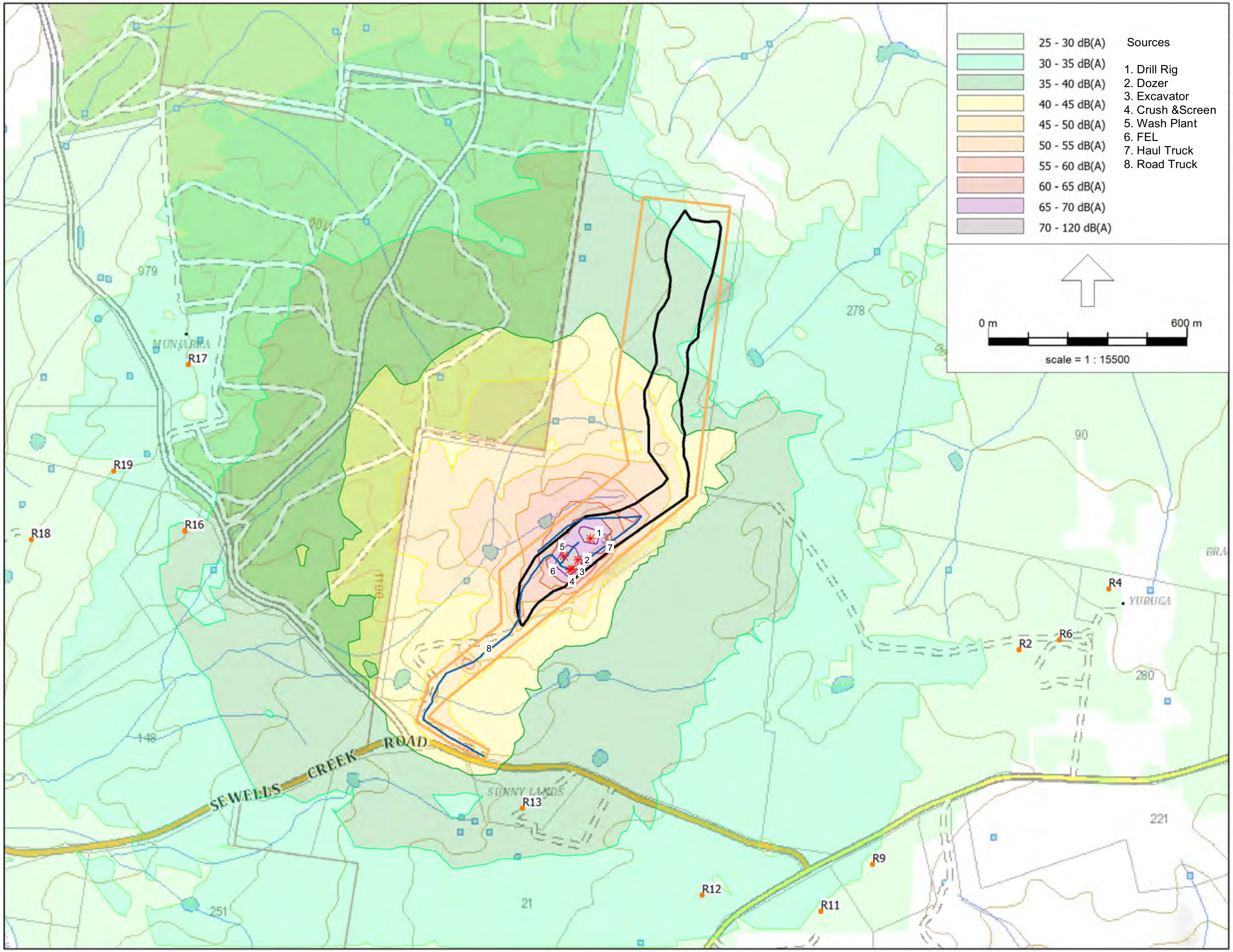
Appendix B – Assessment of Noise Enhancing Conditions

Table B1 NEWA Analysed Daytime Meteorological Conditions, Mount Boyce AWS NSW 2018-2022					
Direction ± 45°	Season	Day Percentage Occurrence %	Direction	Season	Day Percentage Occurrence %
0	Summer	5	180	Summer	2
0	Autumn	6	180	Autumn	3
0	Winter	4	180	Winter	5
0	Spring	4	180	Spring	4
22.5	Summer	19	202.5	Summer	3
22.5	Autumn	17	202.5	Autumn	4
22.5	Winter	10	202.5	Winter	5
22.5	Spring	13	202.5	Spring	5
45	Summer	42	225	Summer	9
45	Autumn	34	225	Autumn	10
45	Winter	18	225	Winter	12
45	Spring	26	225	Spring	10
67.5	Summer	39	247.5	Summer	10
67.5	Autumn	36	247.5	Autumn	13
67.5	Winter	20	247.5	Winter	14
67.5	Spring	25	247.5	Spring	11
90	Summer	41	270	Summer	10
90	Autumn	36	270	Autumn	13
90	Winter	20	270	Winter	13
90	Spring	24	270	Spring	11
112.5	Summer	32	292.5	Summer	11
112.5	Autumn	24	292.5	Autumn	14
112.5	Winter	16	292.5	Winter	14
112.5	Spring	18	292.5	Spring	11
135	Summer	6	315	Summer	8
135	Autumn	7	315	Autumn	10
135	Winter	7	315	Winter	10
135	Spring	5	315	Spring	6
157.5	Summer	3	337.5	Summer	4
157.5	Autumn	3	337.5	Autumn	5
157.5	Winter	4	337.5	Winter	4
157.5	Spring	2	337.5	Spring	3

Appendix C – Noise Contours

Proposed Operations Scenario 1
Calm, LAeq(15-min), dBA



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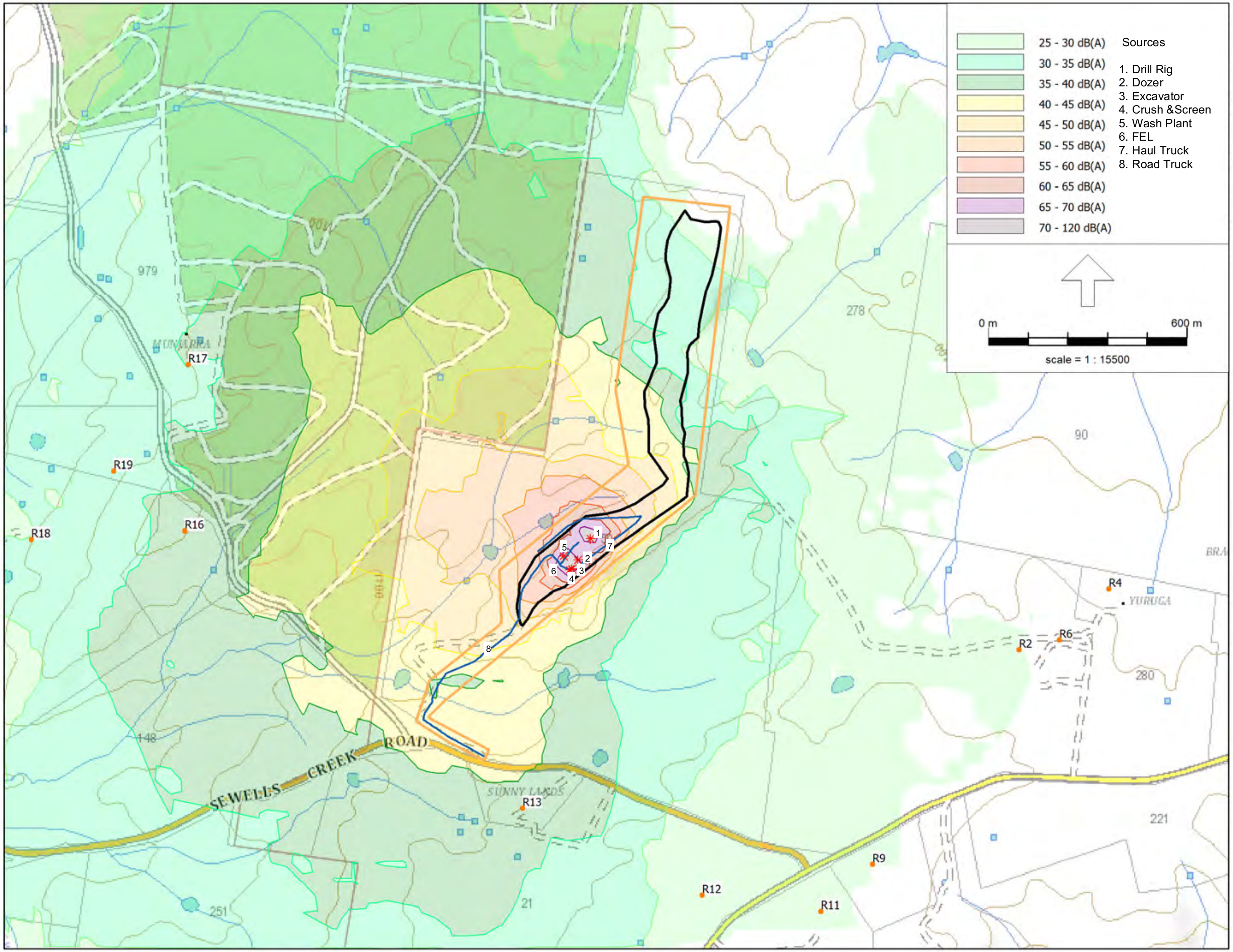
Proposed Operations Scenario 1
E winds@3m/s, LAeq(15-min), dBA



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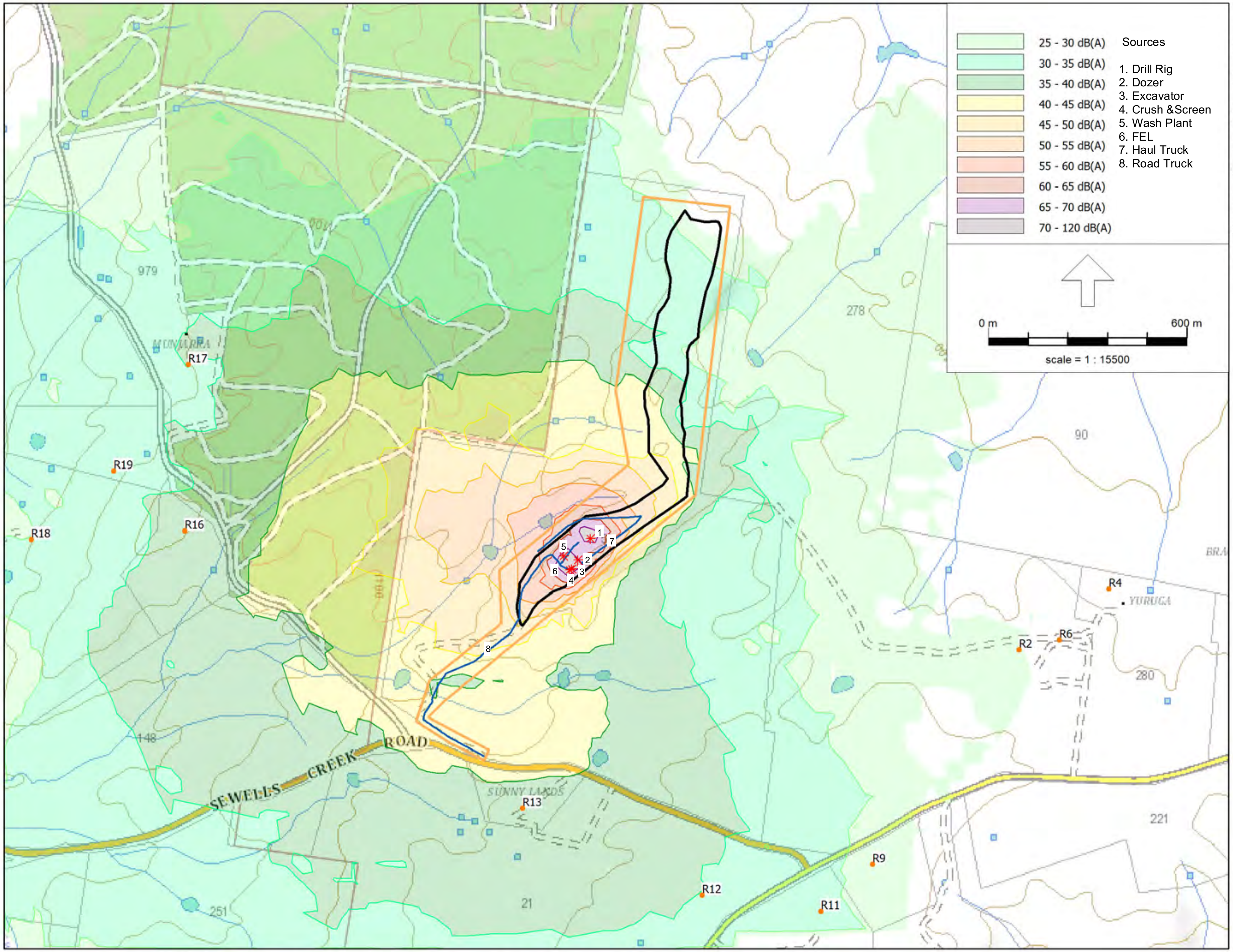
Proposed Operations Scenario 1

NE winds@3m/s, LAeq(15-min), dBA



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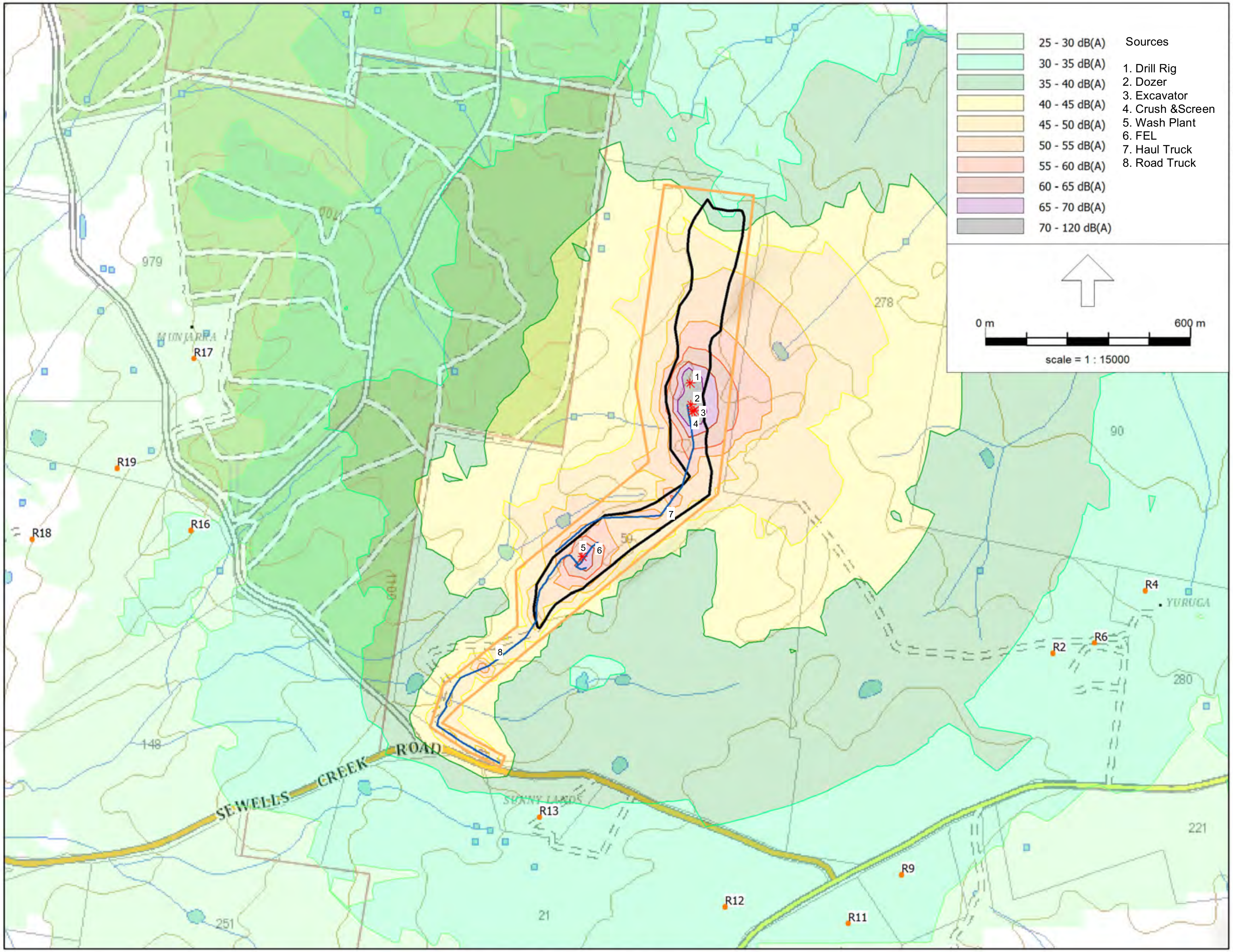
Operations Scenario 2
Calm, LAeq(15-min),dBA



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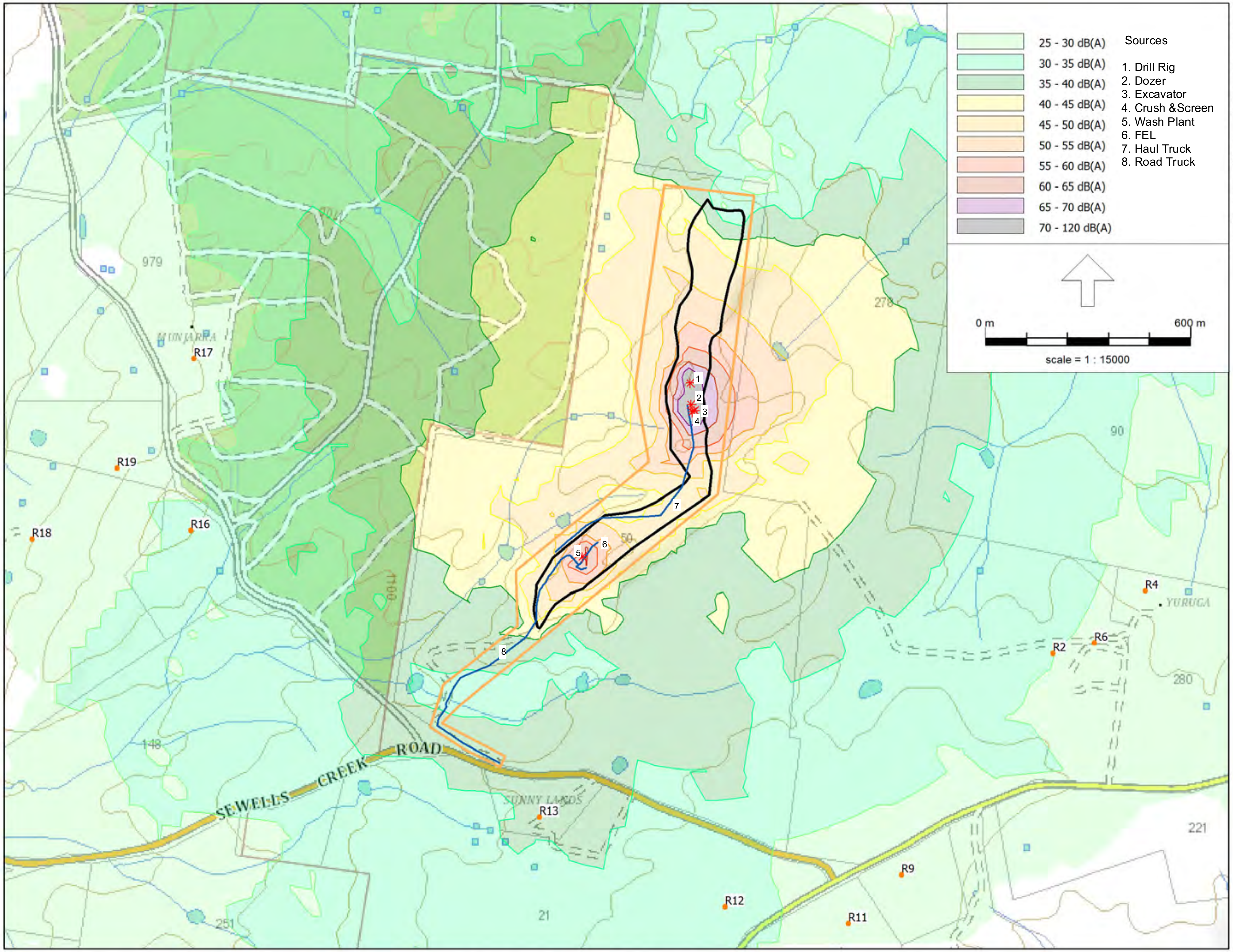
Operations Scenario 2

E winds@3m/s, LAeq(15-min),dBA



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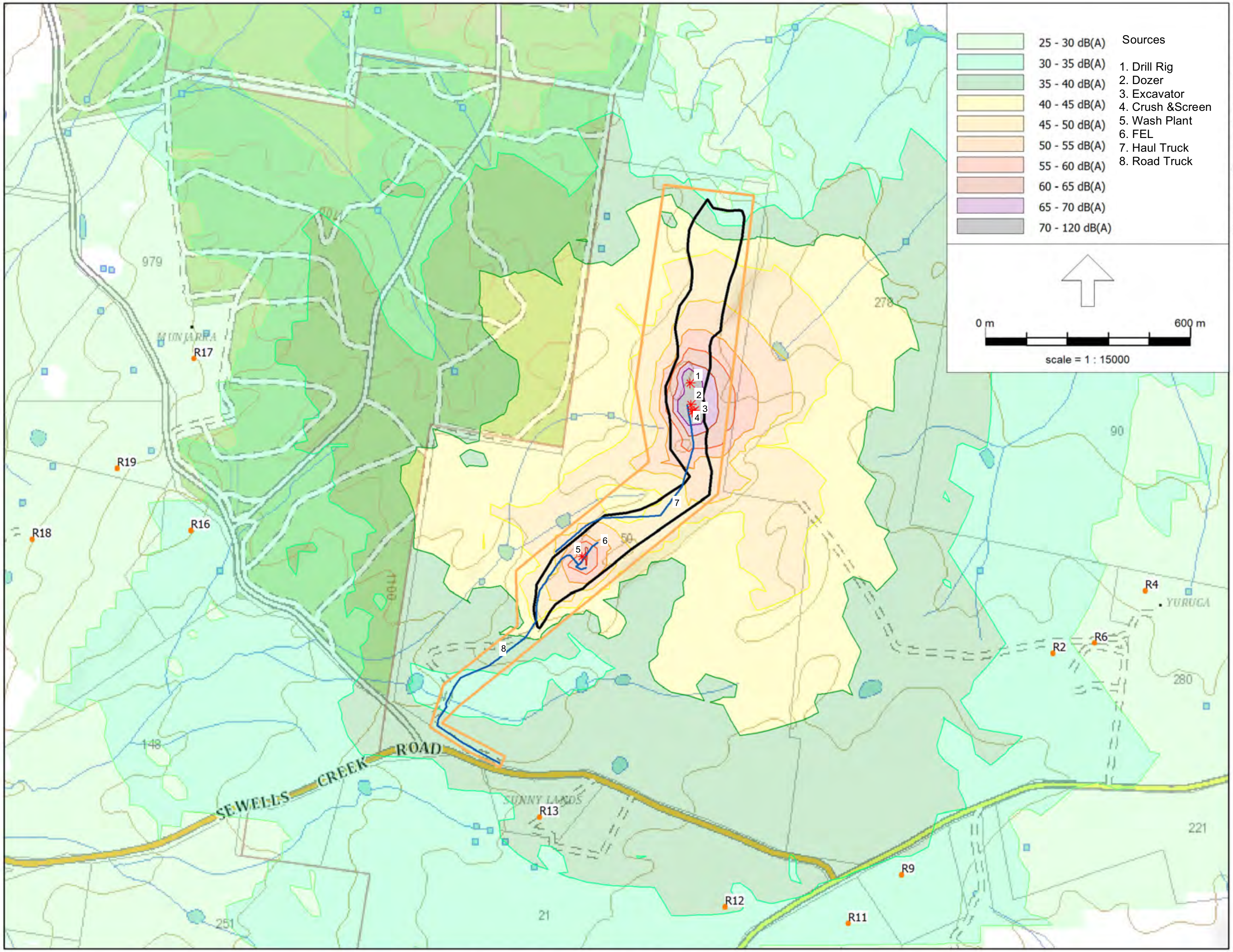
Operations Scenario 2
NE winds@3m/s, LAeq(15-min),dBA



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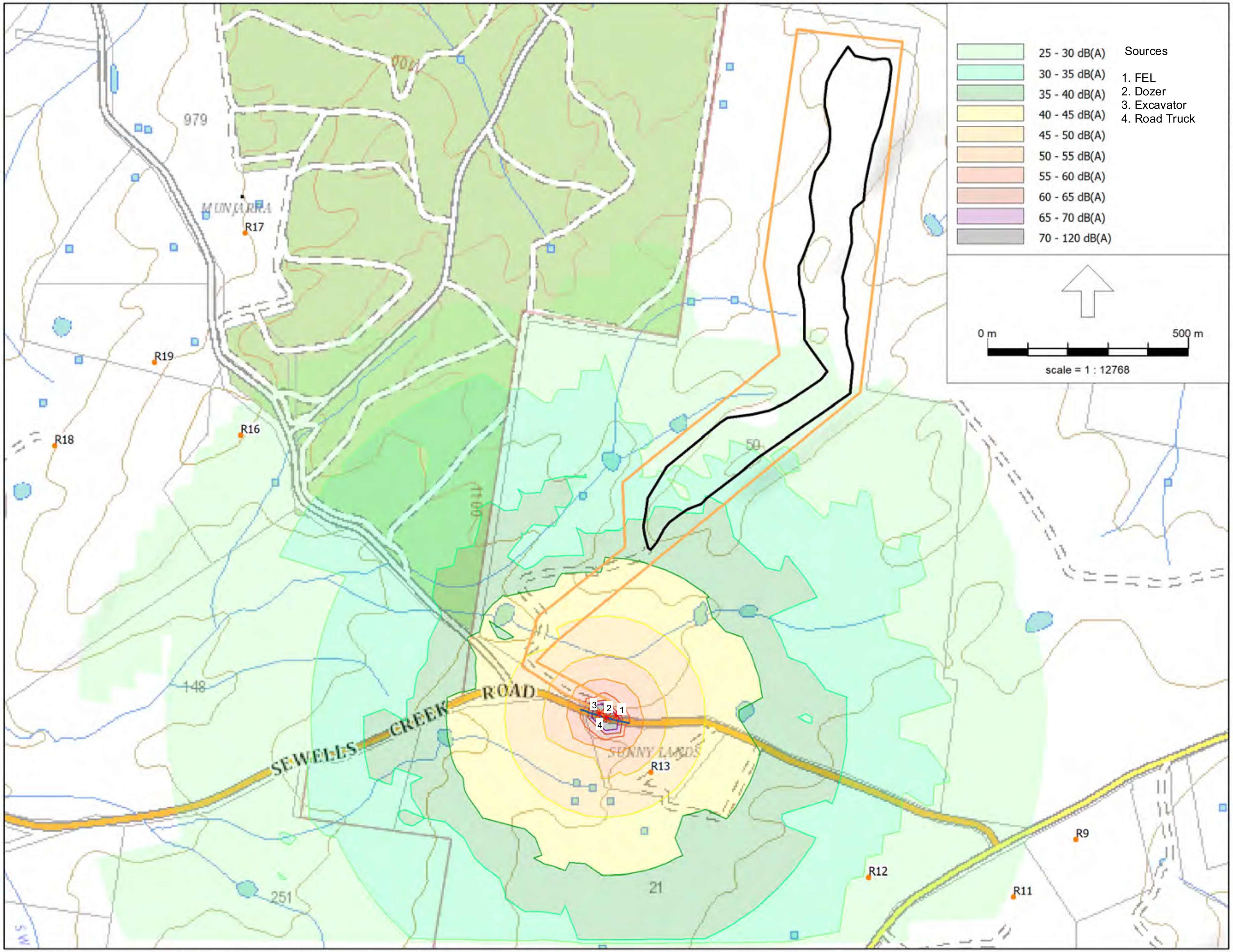
Construction - Haul Road Intersection

Noise Enhancing, LAeq(15-min), dBA



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Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

Ph: +61 2 4920 1833

www.mulleracoustic.com

MAC

Muller Acoustic Consulting

Environmental & Social
Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

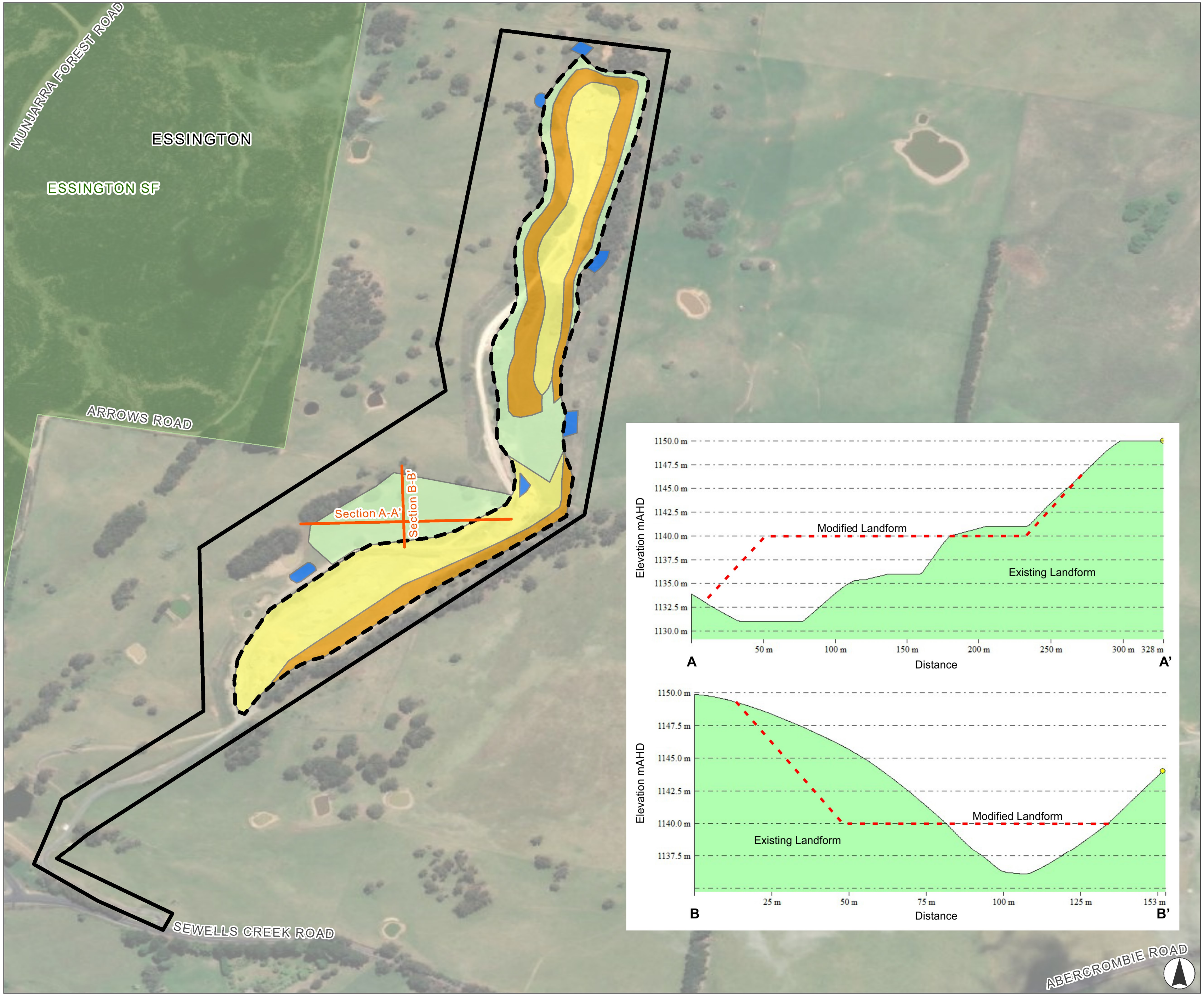


FIGURE 1

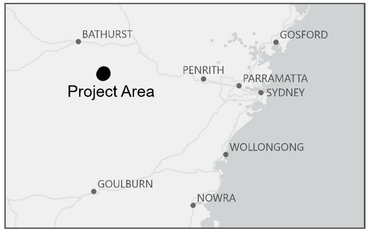
Quarry Cross-Sections

Legend

- Quarry Site Boundary
- Approved Extraction Area
- State Forest
- Section Line

Modified Landform

- Open Woodland (10 - 30°)
- Pasture/Grassland (<10°)
- Steep Face (>30°)
- Retained Sediment Basin



0 150 300

Metres

Scale 1:10,000 at A4
GDA2020

Image Source: ESRI Basemap (2024) | **Data Source:** NSW DFSI (2024)