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HUNTER VALLEY OPERATIONS

PROPOSED MODULAR AMMONIUM NITRATE EMULSION PLANT

Statement of Environmental Effects

FINAL

July 2021

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FINAL

Prepared by
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on behalf of
Hunter Valley Operations

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1.0 Introduction

Hunter Valley Operations (HVO) is located approximately 24 km north-west of Singleton in the Hunter Valley, NSW and is a multi-pit open cut coal mining complex comprising two mine sites; HVO North and HVO South (refer to **Figure 1.1**) which are separated by the Hunter River. The operations are approved under two separate development consents (DA 450-10-2003 and PA 06_0261 respectively) but operate as one complex, with fully integrated environmental management systems. HVO is owned by subsidiary companies of Yancoal and Glencore, as participants in the unincorporated HVO Joint Venture (JV). The HVO JV is jointly controlled through a Joint Venture Management committee, with HV Operations Pty Ltd as the appointed manager of the JV.

Coal mining has been undertaken at HVO since 1949 and has been an important contributor to the Hunter Valley economy, producing high quality thermal and semi-soft coking coal suitable for use in international markets.

HVO intend to lodge an application to modify HVO South SSD Project Approval PA 06_0261 for the construction and operation of a modular Ammonium Nitrate Emulsion (ANE) manufacturing plant within the existing approved HVO South mine disturbance area (herein referred to as the 'Proposed Modification'). ANE is not an explosive and is classified by the *Australian Dangerous Goods Code* (2020) as oxidisers or explosive precursor and are currently supplied directly to the site.

This Statement of Environmental Effects (SEE) has been prepared to assess the environmental and social impacts of the Proposed Modifications to PA 08_0184. This SEE will support a modification application under section 4.55 1(A) of the EP&A Act 1979.

1.1 Proposed Modification Overview

Figure 1.2 illustrates two suitable location options for the Proposed Modification, in relation to the currently approved mining operations at HVO South.

The Proposed Modification will involve the construction and operation of a modular ANE manufacturing plant at one of two locations within the approved HVO South mine disturbance area. The facility would supply the HVO Complex (HVO North and South). The Proposed Modification has potential to reduce AN and ANE transport-associated truck movement through the township of Singleton as well as assist in the stabilisation and diversification of ANE sources for supply to mining operations in the Hunter Valley. The ANE storage resulting from the Proposed Modification would continue to be undertaken in accordance with both the existing storage of ANE at HVO, and the Australasian Explosives Industry Safety Group (AEISG) *Code of Practice for Storage and Handling of UN3375.*

The Proposed Modification will not result in any increase to the overall volume of material currently approved to be transported to site via road freight for use in blasting. Rather, the Proposed Modification will enable raw materials for the production of ANE to be delivered to and processed at HVO South for use at HVO Operations.

No other changes to currently approved operations are proposed as part of the Proposed Modification.

The Proposed Modification has been designed through a multi-disciplinary social and environmental risk-based approach, aimed at maximising efficiency of resourcing and optimising the use of existing site infrastructure while minimising impacts on the environment and community.

Further details of the Proposed Modification are contained in **Section 3.0**.

As discussed in later sections of this SEE, the key learnings from the history of mining operations at the site, predicted need for ANE supply. The relevant traffic and air quality factors, hazard thresholds and separation distances have all been considered in the project design.

1.2 The Proponent

As discussed in **Section 1.0**, HVO South is owned by participants in the HVO JV. Coal & Allied Operations Pty Ltd (wholly owned subsidiary of Yancoal) holds 51% of interest in the JV, and Anotero Pty Ltd (wholly owned subsidiary of Glencore) holds 49% interest.

HV Operations Pty Ltd (HVO) is the proponent of the Project.

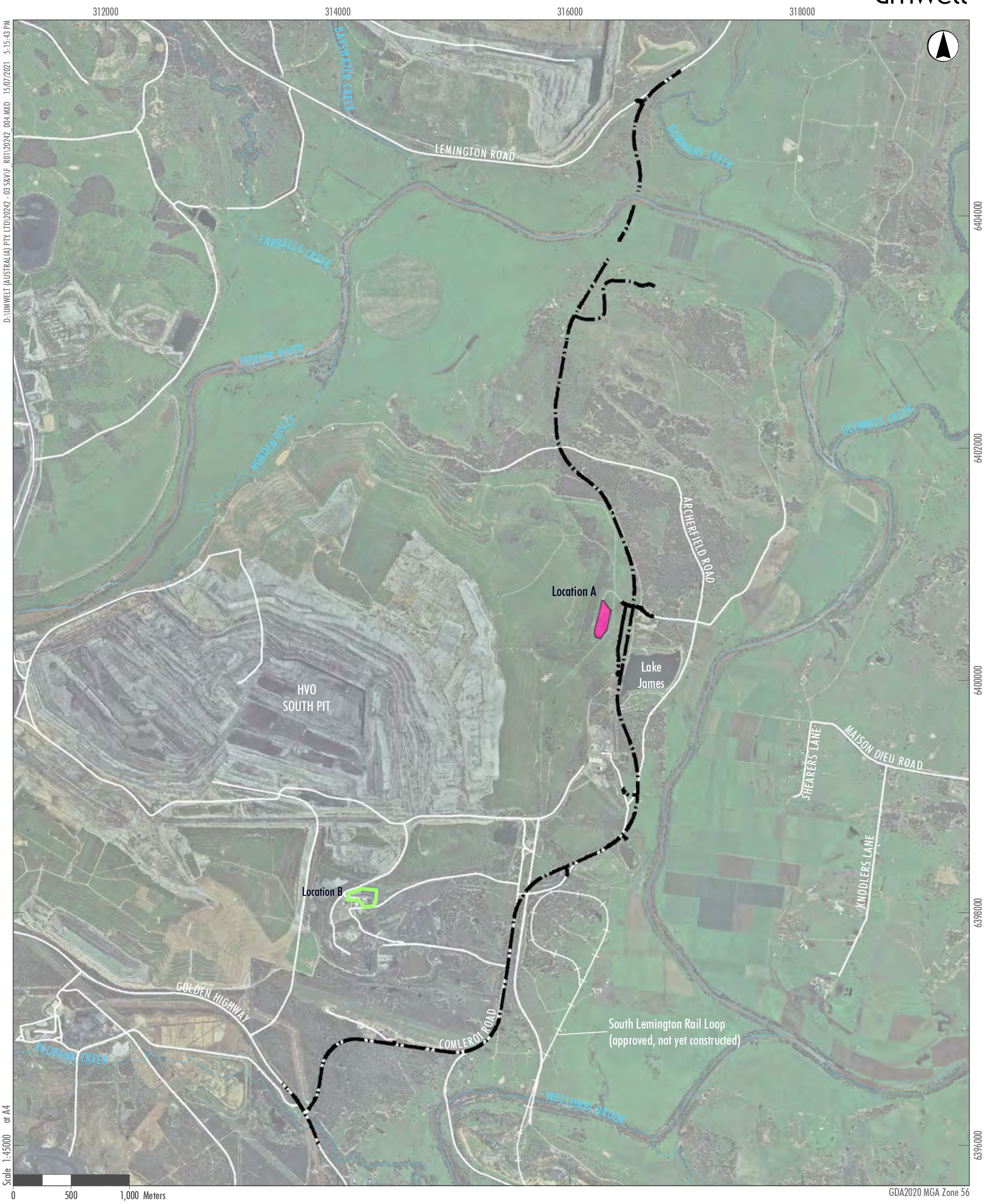
Legend

- Location A (Existing AN and ANE Storage Pad)
- Location B (Proposed HVO ANE Plant Assessment)
- Road
- Railway
- Watercourses
- NPWS Estate

FIGURE 1.1

Locality Plan

Image Source: HVO (2020) Data source: HVO (2021)



Legend

- Location B (Proposed HVO ANE Plant Assessment)
- Location A (Existing AN and ANE Storage Pad)
- Proposed Lemington Road Realignment (HVO Continuation Project)

FIGURE 1.2

Proposed Modification

Image Source: ESRI Base Maps 2020 Data source: HVO 2021

1.3 Brief History of Operations at the HVO Complex

Mining in the HVO area has been undertaken since 1949, with both HVO North and HVO South subject to several modifications since commencement of operations.

HVO South, the location of the Proposed Modification, was granted Project Approval (PA 06_0261) under Section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 24 March 2009 for the HVO South Coal Project. PA 06_0261 provided for the extraction and continuation of operations until 2030 and has been modified 5 times since grant (further approval history is detailed in **Section 2.0**).

The combined HVO North and South operations are currently approved to mine up to 42Mtpa ROM coal.

1.4 Overview of Existing Environment

1.4.1 Environmental Context

The HVO Complex straddles the Hunter River, which borders HVO South to the east and west. Redbank Creek is located to the south of HVO South and is a tributary of Wollombi Brook, which flows south between neighbouring operations United-Wambo and Mount Thorley-Warkworth mines (refer to **Figure 1.2**).

1.4.2 Land Use and Ownership

The HVO Complex is located within the Singleton Local Government Area (LGA), where the surrounding land uses are predominately comprised of land cleared for the purposes of coal mining, industrial development and agriculture.

Much of the land within and around the location of the Proposed Modification is owned by HVO and has been previously cleared for mining and agricultural purposes. Land ownership, including private and non-private ownership, is shown on **Figure 1.3** and **Figure 1.4**.

1.4.3 Existing Ammonium Nitrate Resources

HVO currently use both AN (prill) and ANE for blasting operations.

ANE is mostly used for blasting to ensure that explosives placed in blast holes do not deteriorate due to the presence of water in the blast hole or surrounding strata. The use of ANE (as opposed to AN) is a key control in the minimisation of blast plumes during wet conditions.

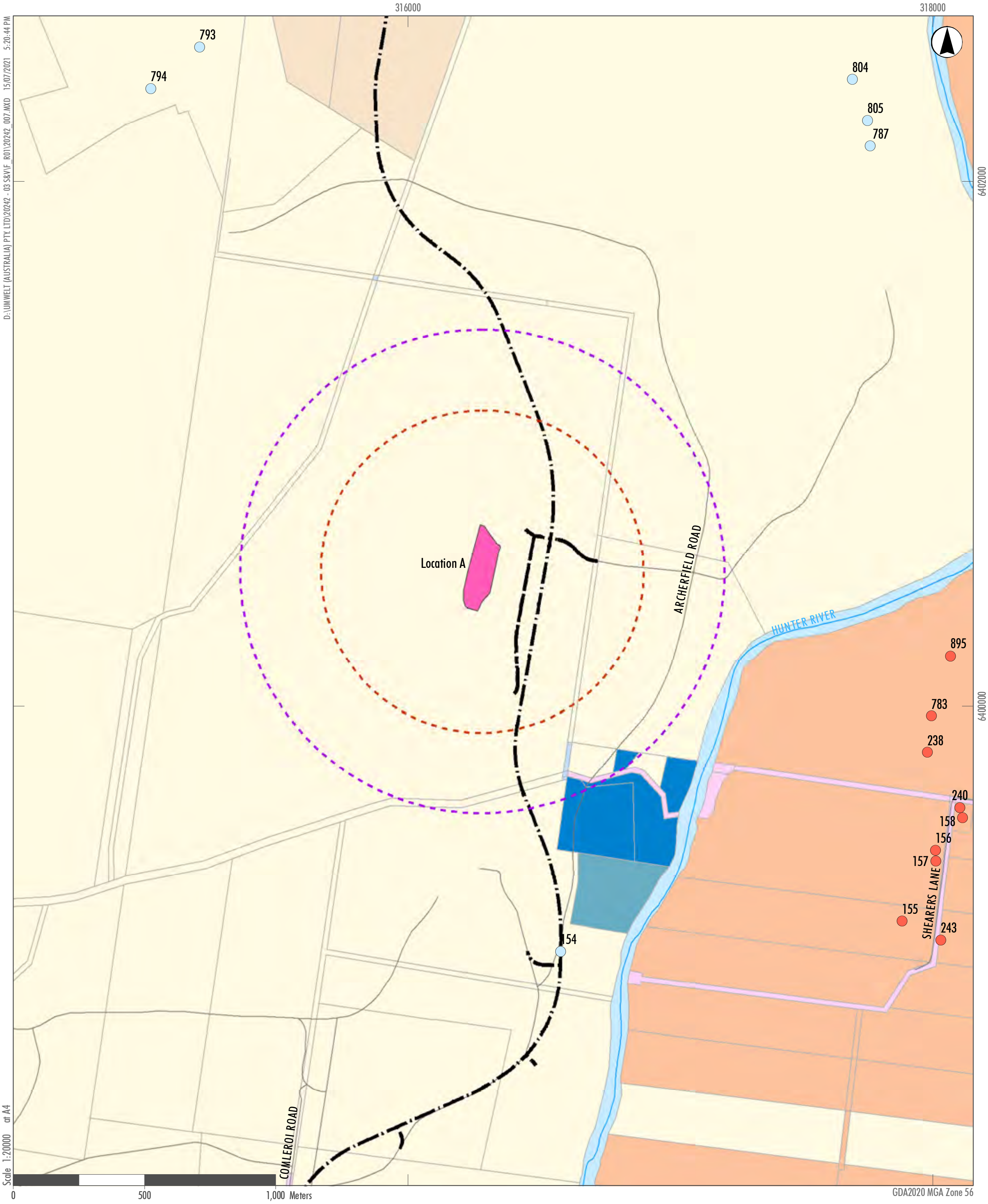
Combined requirements for AN and ANE is estimated to be in the order of 140,000 - 160,000 tpa for the currently approved maximum production rate at HVO of 42Mtpa ROM Coal however may vary slightly depending on the geological conditions and stripping ratios encountered in any given year. The proportion of ANE used on site will vary depending on a range of factors however a higher proportion of ANE will be used in wetter conditions. It is estimated that up to approximately 116,000 tpa of ANE may be required at HVO during wet years when HVO is operating at maximum rates of production.

Currently, HVO sources ANE and AN in a ready-for-use form. ANE supply is generally from Orica Liddell manufacturing facility. AN and other products used with AN in the blast process are transported from the Lower Hunter. While the above reflects current operational arrangements, there are no restrictions under either the HVO South SSD Project Approval PA 06_0261 or DA 450-10-2003 on either the source of ANE material supplied to HVO or the transport routes used for this material.

The current transport route for the delivery of ANE to HVO Operations is from Liddell, where it is transported 55 kilometres (one-way) to HVO, passing through the township of Singleton. The AN used to manufacture the ANE at Liddell is also transported through Singleton Lower Hunter, prior to being used to manufacture the ANE at Liddell. AN (and other ANFO component products) are sourced from the Lower Hunter and are transported to the site via the Hunter Expressway and Golden Highway (Mitchell Line of Road).   While not currently undertaken, ANE material used at HVO could also be sourced from the Lower Hunter which would involve transport to the HVO South via the Golden Highway (Mitchell Line of Road).

ANE and AN is currently delivered to HVO seven days per week and can be received on site 24 hours per day.

These transport arrangements are discussed further in **Section 6.2.2**.



Legend

- Location A (Existing AN and ANE Storage Pad)
- HVO JV Owned Residence
- Privately Owned Residence
- Proposed Lemington Road Realignment (HVO Continuation Project)

Required Separation Distances (in accordance with AEISG Code)

- Protected Works A (546m)
- Protected Works B (846m)

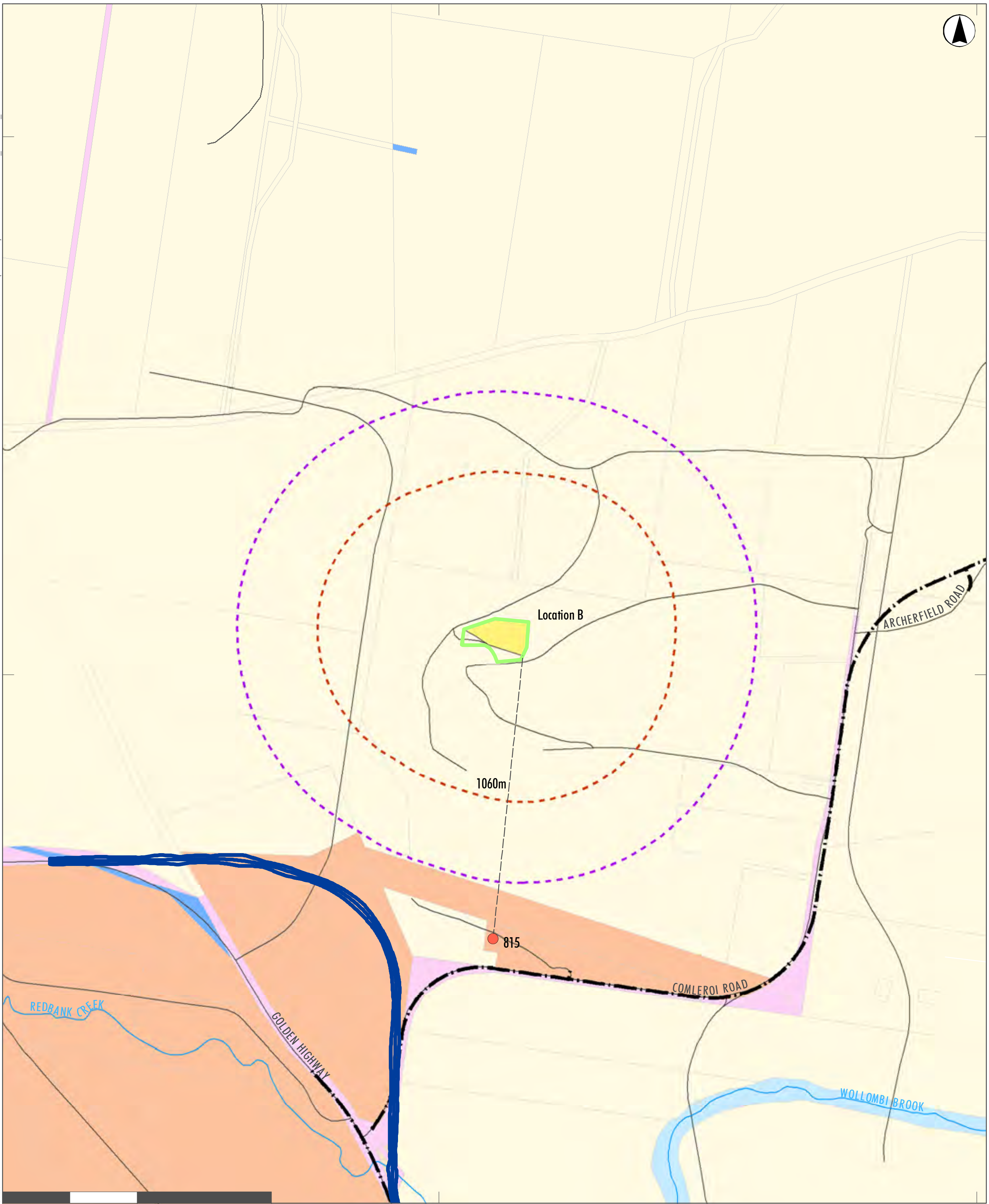
Land Ownership

- Crown Land Managed by Hunter Local Land Services
- Crown Land
- Glencore
- Government Authority
- HVO
- Private
- Road
- Water Features

FIGURE 1.3

Land Use and Ownership Location A

Data source: DFSI (2020)



Legend

Location B (Proposed HVO ANE Plant Assessment)
Location B - Product Storage and Manufacture Area
Proposed Lemington Road Realignment (HVO Continuation Project)
Proposed Golden Highway Realignment
Glider Clubhouse

Required Separation Distances (in accordance with AEISG Code)

Protected Works A (546m)
Protected Works B (846m)

Land Ownership

Crown Land
Glencore
HVO
Private
Road
Water Features

FIGURE 1.4

Land Use and Ownership Location B

1.5 Need for the Proposed Modification

ANE is made up of melted AN granules and is used by mining operations to waterproof explosives in wet conditions, which is a key control in the minimisation of blast plumes during wet conditions, as detailed in **Section 3.2**. HVO are aiming to improve reliability and consistency of ANE sources so that HVO has adequate access to ANE, particularly during and after periods of rain. A security of emulsion supply is critical to maintaining blasting and mining operations and avoiding operational delays at HVO.

The ability to import ANE from other sites would be retained to cover circumstances when the on-site emulsion facility is unavailable due to maintenance needs and/or the onsite facility is unable to meet operational demands.

1.6 Alternatives

The main alternative to the Proposed Modification is the option of not proceeding with the Proposed Modification and continuing to source ANE as per the current methods.

Not proceeding with the Proposed Modification would result in a continuation of the existing ANE manufacturing and supply capacity constraints, with the associated ongoing impacts to the blasting schedules of HVO mining operations. This in-turn results in increased potential for operational inefficiencies and mining delays caused by insufficient quantities of blasted material prepared in time to meet the mining schedule.

HVO has chosen the establishment of a modular ANE facility on site at HVO as the most feasible solution to ensure security of ANE supply. In progressing this proposal, HVO has considered a number of alternative site locations and has chosen two proposed locations at HVO. The key advantages of these sites include:

- there is no need for additional land disturbance beyond the extent of clearing currently approved
- the presence of suitable access roads and infrastructure on site
- suitable distance between the proposed locations and any private residences or public facilities; and
- the proposed locations are close to the mining operations at HVO.

The two locations for the Proposed Modification are further detailed in **Section 3.3**.

The Proposed Modification will not result in any increase in the overall volume of material transported to site via truck for use in blasting. Rather, the Proposed modification will enable raw materials for the production of ANE to be transported to and processed at HVO South for use at HVO and would avoid or reduce the volume of ANE transported on public roads.

2.0 Overview of Existing Operations

HVO South, the subject of the Proposed Modification, was granted Project Approval (PA 06_0261) under the now repealed Part 3A of Section 75J of the *Environmental Planning and Assessment Act 1979* (EPA Act) on 24 March 2009 for the HVO South Coal Project. PA 06_0261 provided for the extraction and continuation of operations until 2030 and has been modified 5 times since grant (further approval history is detailed in **Table 2.1**).

Table 2.1 HVO South Planning Approval History

Approval No.	Issue date	Summary of approved activity
PA 06_0261	24 March 2009	• Extraction of up to 16 Mtpa of ROM Coal per year • Mining operations to 24 March 2030
Modification 1	17 December 2009	• Increase of Lake James storage capacity to 730 ML • Increase of Lake James maximum approved discharge rate to 200 ML/day • Amendment to HVO South approval boundary to incorporate entire footprint of Lake James Dam • Minor administrative amendments
Modification 2	3 February 2012	• Relocate existing Archerfield offset area from within HVO complex • Allow for Archerfield offset area to be combined with additional land to form part of the proposed offset package for Warkworth Extension Project
Modification 3	31 October 2012	• Provide reference to Goulburn River biodiversity offset area • Amendment to Statement of Commitment to remove obligations relating to Archerfield offset area
Modification 4	31 October 2012	• Clarifications of conditions regarding mining-related activities within the biodiversity offset areas which lie within HVO South Project Approval.
Modification 5	28 February 2018	• Progression of mining into additional pits • Amendment to approved maximum overburden emplacement heights • Increase rate of extraction to 20 Mtpa of ROM coal per year • Update to Statement of Commitments to remove commitments and conditions to ensure consistency with approved management plans

At the time the most recent modification (Modification 5) was submitted, it was deemed a transitional Part 3A project and Modification 5 was granted under Section 75W of the EPA Act. These transitional arrangements have since ceased and on 30 November 2018 the HVO South Consent was deemed to be a State significant development (SSD) and further modifications are to be subject to Part 4, Section 4.55 of the EPA Act.

It is noted that at the time of writing, a request for the Secretary's Environmental Assessment Requirements (SEARs) for a new SSD application has been lodged related to the continuation of the life of HVO South from 2030 to 2045, and SEARs for this proposed application have now been received.

3.0 Proposed Modification

The Proposed Modification is seeking approval to manufacture ANE on site for use at HVO. The Proposed Modification will involve the construction and operation of a modular ANE plant within the approved HVO South mine disturbance area.

It is proposed to modify the HVO South Project Approval (PA 06_0261) in accordance with the EP&A Act Section 4.55 (1A). Further details of the proposed approval pathway are provided in **Section 5.2.1**.

3.1 Proposed ANE Plant

HVO will engage a reputable supplier to construct and operate the modular ANE plant within the HVO approved project boundary. The modular ANE plant is a relocatable container-based system with onboard critical controls in place. Plants of this nature are currently in operation in Queensland. The HVO facility will be designed and operated in accordance with the requirements of the *AEISG Code of Practice for Storage and Handling of UN3375,* and Australian Standard (AS) 2187.1-1998 - *Explosives - Storage, transport and use – Storage*.

AEISG and the *SAFEX Good Practice Guide GPG-02* provide classification of certain infrastructure in which people or critical infrastructure may be exposed to blasting effects, should an explosion event occur.

The classification and definition of these exposed sites is provided in **Table 3.1**.

Table 3.1 AEISG Exposed Sites Classification

Exposed Site Classification	Infrastructure
ANE Associated Works	Offices, workshops, stores, ablutions that are directly associated with the operation of the ANE premises.
Protected Works Class A	Public street, road or thoroughfare, railway, navigable waterway, dock, wharf, pier or jetty, marketplace, public recreation and sports ground or other open place where the public is accustomed to assemble open place of work in another occupancy, river-wall, seawall, reservoir, water main (above ground), radio or television transmitter, main electrical substation, private road which is a principal means of access to a church, chapel, college, school, hospital or factory.
Protected Works Class B	Dwelling house, public building, church, chapel, college, school, hospital, theatre cinema or other building where the public is accustomed to assemble, shop, factory, warehouse, store, building in which any person is employed in trade or business, depot for the keeping of flammable or dangerous goods; major dam.

Key components of the modular ANE plant will be relocatable and will include:

- ANE manufacturing container
- high density ammonium nitrate (HDAN) stack and transit bin
- AN solution production tanks
- AN solution melt tanks

- diesel transfer tanks and fill point (bunded)
- thermal oil heating units (bunded) with optional diesel generator for power supply.
- gassing solution manufacture container (bunded)
- ANE product tanks (bunded)
- Shed and concrete hardstand
- Supporting infrastructure will include electricity supply and controls, communications, utilities, staff facilities (relocatable office, lunch-room and toilets), water supply tanks (potable and process water), a workshop igloo, light vehicle parking bay and associated infrastructure and services.

Storage of AN, ANE and Diesel is already approved at HVO and the use of an onsite ANE emulsion facility instead of the use of imported ANE will not exceed the existing storage licence or exceed volumes under the Major Hazard Facility Threshold, as identified by the *Work Health and Safety Regulation 2017*. It is further noted that mines and petroleum sites are exempt from the major hazard facility provisions, in accordance with Chapter 9 of the WHS Regulation (NSW Resources Regulator, 2020).

The proposed modification volumes have been included in the design of the plant layout and meet the minimum distances to receptors as per *AEISG Code of Practice for Storage and Handling of UN3375,* and Australian Standard (AS) 2187.1-1998 - *Explosives - Storage, transport and use – Storage.*

The proposed ANE plant is intended to be the primary source of ANE for the HVO North and HVO South mining operations. However, if unanticipated supply shortages were to arise at the proposed ANE plant, HVO may be required to source ANE from alternative supply points (e.g., the existing Orica facility located at Liddell and situated on land owned by HVO South) in order to continue operations.

The proposed ANE plant would also provide a potential diversification of ANE supply for other mines in the region, as ANE could be distributed to those mines if their regular supply chains were interrupted. However, as noted above, the purpose of the proposed ANE plant is to meet the ANE requirements of the HVO North and HVO South mining operations and any potential supply to other mines would be occasional only, such as in circumstances where they were experiencing critical shortages from their regular ANE suppliers.

The conceptual layout of the modular ANE plant is shown in **Appendix A** and is applicable to both the alternate locations discussed in **Section 3.3**.

Further details of the proposed ANE plant components are provided in **Appendix B**.

3.2 ANE Manufacturing Process

As detailed in **Section 3.4**, it is proposed that the raw AN material is transported to the modular ANE plant at HVO South. It is noted that HVO South already stores AN & ANE and as such, the operation is familiar with the required transport and storage requirements.

The emulsion manufacturing process involves the melting of AN granules. Water used in the melt process is recycled back into the process. Once the high-density AN granules are dissolved, the addition of emulsifier and fuel phase are completed. The formulation is pumped through a static mixer, and once a toothpaste-like consistency is achieved, the emulsion is pumped into storage tanks. Diesel required during the manufacturing process will be supplied from HVO facility.

It is noted that ANEs are not explosives; rather they are classed as a 5.1 Oxidiser (UN 3375), an intermediate for blasting explosives (NTC, 2020) (also referred to as explosives precursors). Oxidisers are not explosives but rather they are materials that may cause or contribute to the combustion of other materials (NTC, 2020).

ANE is mostly used for blasting to ensure that explosives placed in blast holes do not deteriorate due to the presence of water in the blast hole or surrounding strata. This ensures maximum energy efficiency of the blasting and reduces the likelihood of the production of blast fume (Nitrous oxide) subsequently reducing the risk of environmental and community impacts from blast fume.

The Proposed Modification does not propose any change to the existing use of AN in blasts onsite which will continue as per existing operational processes.

3.3 Material volumes

The Proposed Modification involves the processing of raw materials for the manufacture of ANE at HVO South rather than the import of ANE manufactured elsewhere. The manufacturing processes does not involve the production of waste product and, as such, the component materials are of a similar volume and weight to the ANE produced. ANE produced on site will be used at HVO (North and South) and the Proposed Modification does not alter the demand for ANE at HVO relative to existing approved conditions. Accordingly, the Proposed Modification will not result in any change to overall material handling inputs to HVO relative to approved operations.

Based on current approved production rates at HVO (combined production of up to 42Mtpa ROM coal), ANE use at HVO could be up to approximately 116,000 tonnes per annum. This is based on an estimated requirement of approximately 80% ANE use in a very wet year from a total explosive precursor requirement (AN or ANE) of 140 000-160 000 tpa). A similar volume/weight of raw materials would be required to meet this demand if the ANE was produced at the proposed HVO facility with all components used in the process required to be transported to the site via road.

Transfer of ANE manufactured at HVO South to HVO North would be via internal roads, consistent with existing arrangements for both ANE and AN on site.

The storage of AN and ANE on site (i.e. material not actively being used for blasting operations, contained in the reload facility or contained within blast holes awaiting detonation or AN/ANE present within the emulsion facility itself during processing) will not exceed the current licenced storage limit of 240t.

3.4 Proposed Plant Locations

HVO has reviewed a number of site location alternatives within the HVO South mine approved disturbance area for the establishment of the proposed modular ANE plant. The review of alternative locations also considered the availability of suitable site access roads, suitable terrain with minimal earthworks requirements, the progression of future mine plans, and suitable separation distance from private residences, public buildings and infrastructure. The review of potential ANE site locations resulted in the selection of two suitable alternative locations for the proposed ANE plant as shown on **Figure 3.1**.
A description of each alternative location is provided below. HVO only intend to use one location at a time however two options are proposed in anticipation of Lemington Road realignment which is subject of a separate State Significant Development application by HVO. If the decision to relocate the facility from Location A is made, there may be a limited period of time when both facilities are in use during transition from one location to the other.

3.4.1 Location A

Location A is an existing hard-stand area at HVO South operations, which currently includes the existing approved AN and ANE storage and distribution facilities that service the HVO South and HVO North mining operations. Given the existing features at Location A including access road, surface water runoff controls and adequate hard-stand area, this location would facilitate the shortest establishment time for the Proposed Modification.

3.4.2 Location B

Location B has suitable terrain and established access roads and is within the approved Lemington CPP and Infrastructure disturbance footprint as shown in HVO South Mod5 Environmental Assessment. The proposed modular ANE plant at Location B is to be established within the region shown in **Figure 3.1**. It is anticipated that the location will require the establishment of a hardstand area to service the proposed ANE plant.

3.5 Product Transportation

The existing ANE transportation routes are detailed in **Section 1.4.3**, and further assessed in **Section 6.2.2**.

Currently, ANE is generally sourced from Orica Liddell, on land owned by HVO. The ANE supply is transported to HVO via Singleton, ready for use in operations at both HVO South and HVO North.

As part of the Proposed Modification, some of the current raw AN material supply would be diverted from the route to the Orica Liddell facility to HVO South instead. It is proposed that the replenishment of raw AN material required for the manufacture of emulsion will be sourced from suppliers in the Lower Hunter, (currently located in Sandgate and Kooragang Island), and will be transported the 92 km one way via the Hunter Expressway, New England Highway and Golden Highway, bypassing Singleton. These raw material arrangements reflect the current arrangements for AN delivery to HVO.

The volume of ANE produced at the proposed HVO South facility would result in a corresponding reduction of both RAW materials and ANE through Singleton and therefore result in a reduction of daily heavy vehicle movements through Singleton relative to current conditions. The transport of raw material to the site may result in a slight increase in heavy vehicle movements along the Mitchell Line of Road relative to current supply arrangements. As discussed in **Section 1.4.3** there are currently no constraints on the source of ANE material used by HVO under HVO South SSD Project Approval PA 06_0261 or DA 450-10-2003 and ANE could be supplied to HVO from other sources in the Lower Hunter. T

The primary transport route for this material currently would be via the Hunter Expressway and Golden Highway (including the Mitchell Line of Road) however flexibility on supply routes utilised would be retained to cover circumstances where supply from the Lower Hunter is unavailable or restricted. The import of ANE from a Lower Hunter supplier rather than the Orica Liddell facility would involve similar heavy vehicle movements to the primary supply scenario. The Hunter Expressway – Golden Highway Supply route is consistent with current AN transport arrangements. This is discussed further in **Section 6.2.2**.

The majority of material would typically be hauled via B-Double however transport of raw material components by semi-trailer may also occur. The proposed haulage route is approved for B-Double use. There is also potential for the use of A-Double configurations in the future should these be approved for the transport route.

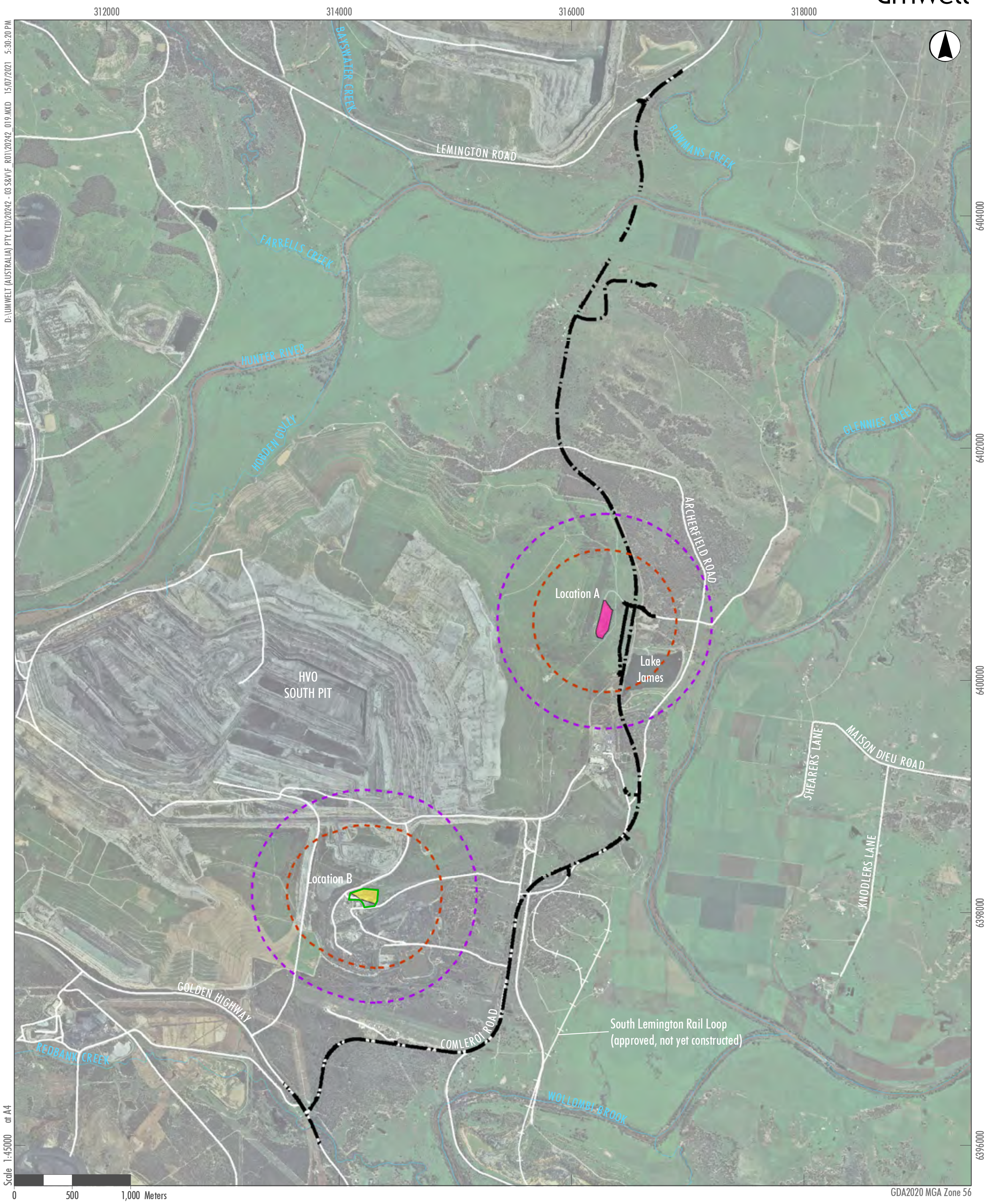
The ability to continue to source ANE from other production facilities would be retained however this would supplement supply from the proposed facility rather than represent an increase in overall material (raw product or manufactured ANE) transported by road.

Trucks supplying material to site would maintain the existing seven day per week/24-hour delivery arrangements.

A comparison of these routes is provided in **Figure 3.2**.

3.6 Workforce Requirements

The operation of the proposed emulsion plant will involve approximately 3 full time equivalent staff members. This additional workforce can be managed within the existing indicative workforce numbers for the HVO complex and is therefore not anticipated to have any material impact on either traffic generation of economic impacts.



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Legend

- Location A (Existing AN and ANE Storage Pad)
- Location B (Proposed HVO ANE Plant Assessment)
- Location B - Product Storage and Manufacture Area
- Proposed Lemington Road Realignment (HVO Continuation Project)

Required Separation Distances (in accordance with AEISG Code)

- Protected Works A (546m)
- Protected Works B (846m)

FIGURE 3.1

Proposed Modification and Required Separation Distances

Image Source: ESRI Base Maps 2020 Data source: HVO 2021

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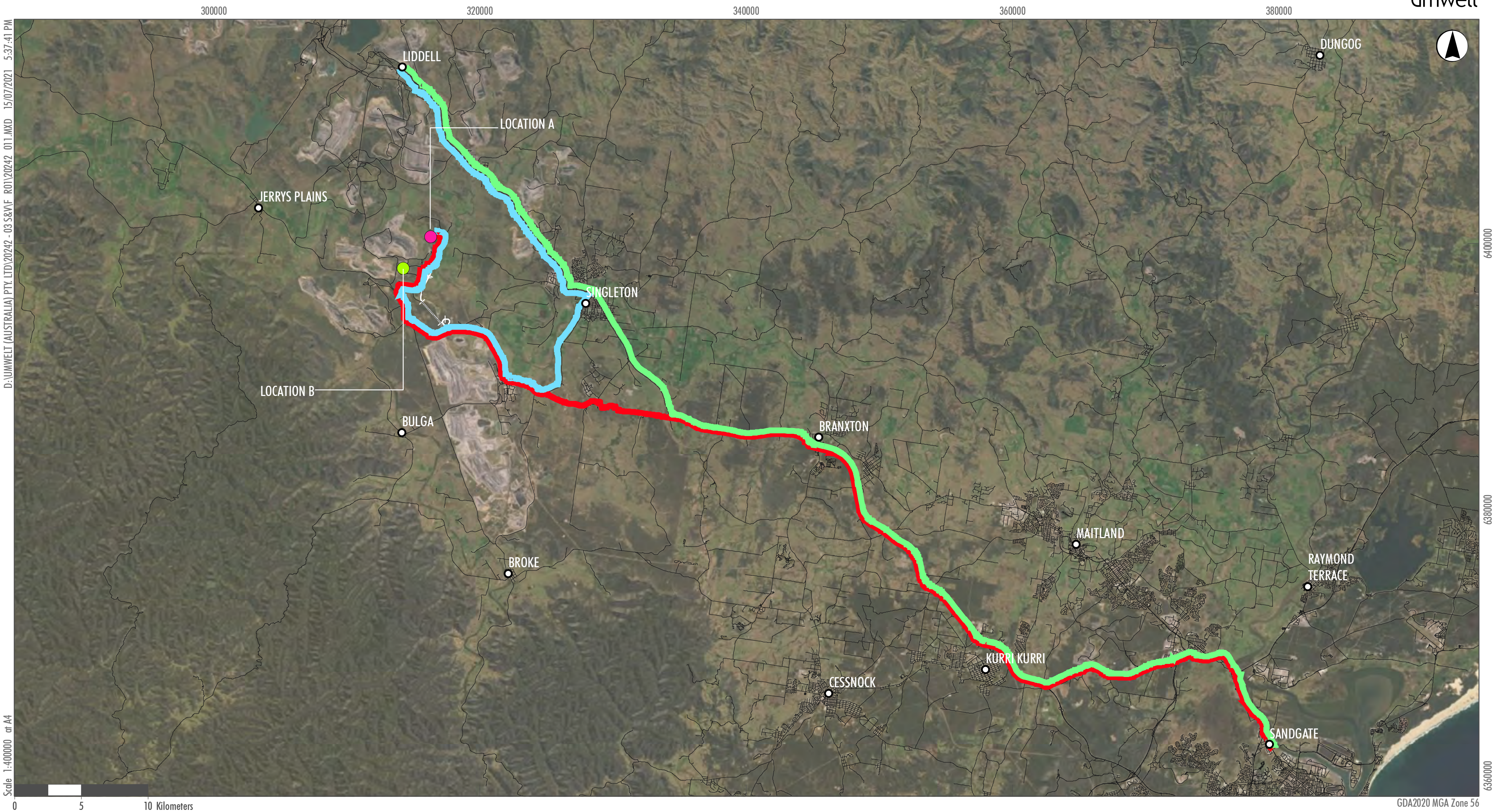


Legend

- Proposed HVO ANE Plant - Location A
- Proposed HVO ANE Plant - Location B

Transport Routes

- Lower Hunter to Liddell - Existing Orica Liddel AN transportation route (~120km)
- Lower Hunter to HVO (~92km one way)
- Liddell to HVO via Singleton (~55km one way)

FIGURE 3.2

Existing and Proposed Transport Routes

Image Source: ESRI Base Imagery 2021 Data source: HVO 2021

4.0 Stakeholder Engagement

4.1 Community Consultation

The HVO Complex operates with an established Community Consultation Committee (CCC). The Proposed Modification was communicated to CCC representatives via a Factsheet on 7 May 2021 and discussed at a CCC meeting on 19 May 2021.

The proposed modification was also communicated to the nearest private landowner located across the Hunter River from Location A and the Hunter Valley Gliding Club which is the nearest privately owned land to Location B. No private properties are located within the proposed Protected Works A or B notification areas for Location A or B.

Feedback received from the consultation primarily related to concerns of risk of impacts to nearby private property due to an explosion at the facility. As discussed in detail in **Section 6.2.5** the design of the proposed new facility reduces the plant layout has been designed in accordance with the quantity distance (QD) requirements of AS 2187.1 and the *Australian Explosives Industry Safety Group* (AEISG) *Code of Practice for Ammonium Nitrate Emulsions* in order to ensure that there is adequate separation between ammonium nitrate, ammonium nitrate emulsion and process equipment (including establishment of mounding). By designing the plant layout and storages this way the plant minimises the quantity of materials that could be involved in an explosive event and would minimise the impact on external infrastructure.

4.2 Government Consultation

The stakeholder engagement process has commenced, with a summary of agency consultation provided in **Table 4.1**.

HVO have confirmed the assessment pathway with DPIE and determined that the modification be sought pursuant to Section 4.55(1A) of the EP&A Act.

Table 4.1 Agency Consultation Undertaken

Agency	Date	Consultation Description
Department of Planning, Industry & Environment (DPIE)	17 December 2020	Presentation was made by HVO to DPIE regarding the nature of the Proposed Modification and its potential environmental interactions.
	21 May 2021	Correspondence provided between HVO and DPIE to confirm the proposed assessment pathway.
Department of Industry, Science, Energy and Resources – Explosives Regulator	10 February 2021	Presentation was made by HVO to the Explosives Sector of the NSW Resources Regulator (the regulatory authority for mining workplaces in the Explosives Act) regarding the nature of the Proposed Modification and its potential environmental interactions. Glencore intends to hold an additional meeting with the Resources Regulator following submission of the modification application.
NSW Environment Protection Authority (EPA)	7 May 2021	Notified of Proposed Modification and provided with a Factsheet, further consultation to be undertaken.

Agency	Date	Consultation Description
Crown Lands (DPIE)	7 May 2021	Notified of Proposed Modification and sought clarification on management accountability for parcels of Crown Land within PWB zone for Location A.
Singleton Council	18 May 2021	Notified of Proposed Modification and provided with a Factsheet.

5.0 Planning Considerations

This section discusses the application of the various Commonwealth and State environmental and planning legislation and policies that are relevant to the Proposed Modification.

5.1 Commonwealth Legislation

The *Environmental Protection and Biodiversity Act 1999* (EPBC Act) is the primary environmental and planning regulatory instrument relevant to the Proposed Modification at the Commonwealth level. The operation of the EPBC Act and its application to the Proposed Modification is discussed at **Section 5.1.1** below.

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, approval from the Commonwealth Minister for Environment is required for any action that may have a significant impact on Matters of National Environmental Significance (MNES).

MNES are identified in the following categories:

- World Heritage Properties
- National Heritage Places
- Wetlands of International Importance (listed under the Ramsar Convention)
- Threatened species and ecological communities
- Migratory species protected under international agreements
- Nuclear actions (including uranium mines)
- The Great Barrier Reef Marine Park
- Commonwealth land, marine areas and reserves
- A water resource, in relation to a coal seam gas development and large coal mining development.

If an 'activity' is likely to have a significant impact on a MNES then it may be a 'controlled action' and require approval from the Commonwealth Minister for the Environment. To obtain approval from the Minister, a proposed action must be referred. The purpose of a referral is to enable the Minister to decide whether the proposed action will need assessment and approval under the EPBC Act.

The Proposed Modification relates to the construction and operation of a modular ANE plant within the currently approved HVO mine.

As detailed in **Section 3.3**, both Locations A and B are located within areas which have previously been approved for disturbance for mining and related activities. No additional land disturbance is required, and the Proposed Modification presents no impact or threat to any MNES. Therefore, a referral under the EPBC Act is not considered necessary for this modification application.

5.1.2 Native Title Act 1993

The *Native Title Act 1993* provides for determinations of native title in Australia. The main objects of the Act are:

- to provide for the recognition and protection of native title
- to establish ways in which future dealings affecting native title may proceed and to set standards for those dealings
- to establish a mechanism for determining claims to native title
- to provide for, or permit that validation of past acts, and immediate period acts, invalidated because of the existence of native title.

The Proposed Modification relates to the construction and operation of a modular ANE plant within the HVO mine, to be located on freehold title owned by HVO. As the area is freehold land owned by HVO, Native Title has therefore been extinguished and there is no further assessment required under the *Native Title Act 1993*.

5.2 New South Wales Legislation

5.2.1 Environmental Planning and Assessment Act 1979

On 30 November 2018 the HVO South Consent was gazetted as a state significant development (SSD) and further modifications are to be subject to Part 4, Section 4.55 of the EPA Act.

It is proposed to modify PA 06_0261 in accordance with the EPA Act Part 4, Section 4.55 (1A). Modifications sought under Section 4.55 (1A) must be substantially the same development for which the original consent was granted and must result in minimal impacts. The Proposed Modification to PA 06_0261 is considered to be suitable for assessment under Section 4.55 (1A) as:

- The overall nature and scale of the currently approved mining development will remain unchanged.
- The overall nature of the development as originally approved remains unchanged. All other aspects of the operation i.e. the annual production rates, types of products, hours of operation, life of mine, mining method, coal transportation and coal processing remain unchanged by the Proposed Modification.
- Minimal additional employees will be required to operate the Proposed Modular ANE Plant, which are largely able to be sourced from those required to manage the existing facility.
- ANE product, proposed to be manufactured in the modular facility, is currently stored at the HVO South mine and is used in the HVO North and South mining operations as an integral component of the currently approved mine blasting process.
- The Proposed Modification will not change the nature, size or frequency of mine blasting and will not increase blasting impacts.
- The Proposed Modification has potential to reduce the requirement for transportation of ANE to site by truck on the public road network.
- ANE is used for blasting to ensure that explosives placed in blast holes do not deteriorate due to the presence of water in the blast hole or surrounding strata. This ensures maximum energy efficiency of

the blasting and reduces the likelihood of the production of blast fume (Nitrous oxide) subsequently reducing the risk of environmental and community impacts from blast fume.

- The storage and use of ANE is an integral part of the currently approved mining process at HVO. The production of ANE on-site will improve supply reliability and consistency for its operations. Accordingly, the Proposed Modification does not change the nature of the currently approved mining operations.

This Statement of Environmental Effects addresses the requirements of Section 4.55 (1A) as relevant to the Proposed Modification and provides an assessment of potential environmental impacts in **Section 6.0**.

In addition, the EP&A Act Section 4.55 (3) requires the consent authority to take into consideration relevant matters referred to in Section 4.15 (1). The development, in its Modified form, would continue to be permitted under the provisions of relevant environmental planning instruments currently applying to the approved operations.

5.2.1.1 Proposed Consent Condition Changes

In order to manufacture emulsion, it is recommended that the description of approved activities prescribed by PA 06_0261 will require modification. Condition 28 of Schedule 3 of PA 06_0261 relating to Hazards requires:

> *28. The Proponent must ensure that the storage, handling, and transport of:*
>
> *(a) dangerous goods is done in accordance with the relevant Australian Standards, particularly AS1940 and AS1596, and the Dangerous Goods Code; and*
>
> *(b) explosives are managed in accordance with the requirements of DRG.*
>
> Condition 28 will require modification to include the manufacturing of dangerous goods. Suggested wording could be:
>
> *28. The Proponent must ensure that the <u>manufacture</u>, storage, handling, and transport of:*
>
> *(a) dangerous goods is done in accordance with the relevant Australian Standards, particularly AS1940 and AS1596, and the Dangerous Goods Code; and*
>
> *(b) explosives are managed in accordance with the requirements of DRG* (now Department of Planning, Industry and Environment)*.*

5.2.2 Protection of the Environment Operations Act 1997

HVO South currently holds an Environmental Protection Licence (EPL 640) under the *Protection of the Environment Operations Act 1997* (POEO Act) to store dangerous goods, which permits storage of AN & ANE to the north east of the HVO South mining area.

Condition O1 of Schedule 4 of EPL 640 provides for the competent carrying out of licensed activities including:

> "*the processing, handling, movement and storage of materials and substances used to carry out the activity*".

An Environment Protection Licence (EPL) is required for the carrying out of 'scheduled activities' listed under Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act). Clause 8 of Schedule 1 declares certain 'chemical production' activities to be scheduled activities including:

"***dangerous goods production***, *meaning the commercial production, blending, recovering or using of, or research into, dangerous goods (other than toxic substances, explosives or radioactive substances)".*

The proposed production of ANE would constitute the commercial production of dangerous goods. The relevant criterion for this activity is the "*capacity to produce, blend, recover or use more than 1,000 tonnes of dangerous goods per year*".

In this regard it is proposed that the existing licence would be varied to include "*dangerous goods production*" as a scheduled activity to allow for the manufacturing of ANE under EPL 640.

It is noted that storage requirements proposed as part of the Proposed Modification will not exceed the allowable storage volumes under the Major Hazard Facility Threshold, as identified by the *Work Health and Safety Regulation 2017*.

5.2.3 Explosives Act 2003

The *Explosives Act 2003* is regulated by SafeWork NSW (or the Secretary of the Department of Planning, Industry and Environment for certain mining workplace requirements).

For its existing storage facility, HVO currently holds a licence to Store Explosives and/or Security Sensitive Dangerous Substances (SafeWork NSW, 2016), which details the type of storage facility, identifies specific explosives and maximum storage capacity associated with the existing facility.

Should the Proposed Modification to PA 06_0261 be approved to permit the manufacture of ANE at HVO South, the regulatory authority will be required to review the SEE and relevant specialist studies as well as the proposed construction and operation plans that will be prepared.

Should the Explosives Regulator be satisfied with the documentation, the existing licence will be updated or re-issued as required, to include manufacturing of ANE at the HVO South facility.

5.2.3.1 Summary of other State Legislation

Table 5.1 discusses the application of other NSW legislation to the Proposed Modification.

Table 5.1 Applicability of NSW legislation

Legislation	Key Requirements	Relevance to the Proposed Modification
Water Management Act 2000	The overall objective of the *Water Management Act 2000* (WM Act) is the sustainable and integrated management of the State's water (DLWC 2001). Water sharing plans are the main tool through which the WM Act achieves its objective.	Water for the modular ANE plant will be sourced from existing HVO water licences. As no extraction of groundwater or surface water is proposed by this modification, no approval is required under this legislation for the Proposed Modification.

Legislation	Key Requirements	Relevance to the Proposed Modification
Mining Act 1992	The *Mining Act 1992* does not permit an activity, for which development consent is required, to be carried out without the consent being obtained in accordance with the EP&A Act.	Both Proposed Locations A and B are within an existing lease granted under the *Mining Act 1992*- Mining Lease 1634. Should the Proposed Modification be approved under the EP&A Act, no further compliance with the Mining Act is required
Heritage Act 1977	Approval is required from the Heritage Council of NSW to disturb or excavate land where this will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed.	No changes to currently approved operations (including approved heritage impacts) are proposed as part of the Proposed Modification. Therefore, no approval is required under this legislation.
National Parks and Wildlife Act 1974	Approval is required from the Biodiversity Conservation Division of DPIE to destroy, deface or damage; or cause or permit the destruction of or damage to an Aboriginal object or Aboriginal Place.	No changes to currently approved operations (including biodiversity impacts) are proposed as part of the Proposed Modification. Therefore, no approval is required under this legislation.
Roads Act 1993	Development that affects a public road, Crown road, highway, main road, freeway or tollway requires approval from the NSW Roads and Maritime Services (RMS) or the local Council under this Act.	The Proposed Modification will not directly affect a public road, Crown road, highway, main road, freeway or tollway other than those already approved by existing operations. Approval is therefore not required under this legislation.
Biodiversity Conservation Act 2016	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. Under the EP&A Act, impacts on threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) are required to be assessed.	No additional clearing or impacts to threatened species are associated with the Proposed Modification. Therefore, no approval is required under this legislation.
Crown Lands Act 1989	Under both the Crown Lands Act 1989 and the Crown Lands (Continued Tenures) Act 1989, no Crown land can be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised.	Two parcels of Crown Land reserved R28453 for Camping are located within the PWB zone and HVO would include these in the emergency evacuation plan. HVO will consult with Hunter Local Land Services in relation to this interaction with the Crown Land camping reserves.

Legislation	Key Requirements	Relevance to the Proposed Modification
Work Health and Safety Regulation 2017	AN and ANE storage volumes of the Proposed Modification, considered cumulatively along with the existing approved AN and ANE storages, are under the Major Hazard Facility Threshold for these materials	The Proposed Modification is not considered a Major Hazard Facility. HVO would liaise with the appropriate authorities to receive approval for the Proposed Modular ANE plant. refer to **Section 5.2.3**.

5.2.4 Environmental Planning Instruments

5.2.4.1 Singleton Local Environmental Plan 2013

The Proposed Modification (at both Location A or B) is contained within the HVO South Approval Boundary which is wholly within the Singleton Local Government Area (LGA). The Singleton Local Environmental Plan 2013 (Singleton LEP) regulates the permissibility of local development within the Singleton LGA. The key features of the Proposed Modification (refer to **Section 6.0**) are all located on land zoned RU1 – Primary Production under the Singleton LEP.

The objectives of the RU1 zone are as follows:

a) to encourage sustainable primary industry production by maintaining and enhancing the natural resource base

b) to encourage diversity in primary industry enterprises and systems appropriate for the area

c) to minimise the fragmentation and alienation of resource land; and

d) to minimise conflict between land uses within this zone and land uses within adjoining zones.

Open cut mining is permissible with development consent in the RU1 zone. Agriculture is also permissible in the RU1 zone. The land zoning of the areas around the Proposed Modification is shown in **Figure 5.1**.

5.2.4.2 State Environmental Planning Policies

The following State Environmental Planning Policies (SEPP) are relevant to the consideration of the Proposed Modification.

State Environmental Planning Policy (State and Regional Development) 2011

The State and Regional Development State Environmental Planning Policy (SRD SEPP) identifies development to which the SSD assessment and determination process under Part 4 of the EP&A Act applies. The Proposed Modification is for the purpose of coal mining and is SSD as defined by the provisions of the SRD SEPP and requires development consent under Part 4 of the EP&A Act.

The Minister for Planning and Public Spaces is the consent authority for the Proposed Modification, except in the case of political donations having been made. However, this is not applicable to this Proposed Modification as no political donations have been made by the Proponent.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP)

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. The Mining SEPP contains provisions related to the consideration of the impacts from proposed mining projects on agricultural impacts. The Mining SEPP also includes mandatory requirements to consider a range of environmental impacts as well as land use conflict issues.

Clause 7 of the Mining SEPP provides that mining may be carried out, with development consent, on land where development for the purposes of agriculture or industry may be carried out. Agriculture is also permitted in the RU1 Zone. While there is no direct conflict between permissibility under the Mining SEPP and the Singleton LEP, the operation of Part 3 of the EP&A Act and clause 5 of the Mining SEPP provides that State Environmental Planning Policies prevail over LEPs to the extent of any inconsistency.

State Environmental Planning Policy (Koala Habitat Protection) 2020

State Environmental Planning Policy (Koala Habitat Protection) 2020 applies to the extent that in Local Government Areas (LGAs) listed in the SEPP, a Council is restricted from granting development consent for proposals on land identified as core koala habitat without the preparation of a plan of management.

Singleton LGA is listed in Schedule 1 of SEPP 44 as being land to which the policy applies. The Proposed Modification does not involve any clearing of vegetation and as such it would have no impact on koala habitat.

State Environmental Planning Policy 33 (Hazardous and Offensive Development)

Clause 13 of the *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33) requires that in determining an application to carry out development for the purposes of a potentially hazardous industry, the consent authority must consider:

- current guidelines published by the Department of Planning relating to hazardous or offensive development, and
- whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and
- in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and
- any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and
- any likely future use of the land surrounding the development.

In accordance with Clause 12 of SEPP 33, a Preliminary Hazard Analysis has been prepared with regard to the current legislation and guidelines published by DPIE. The assessment is summarised in **Section 6.2.5** and attached at **Appendix B**.

State Environmental Planning Policy 55 (Remediation of Land)

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) 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.

The Proposed Modification does not propose to alter the project footprint or land use as the proposed plant will be within the footprint of approved disturbance area at HVO South mine, and there is no record of contaminated land within the two locations.

5.2.5 Relevant Strategic Policies

5.2.5.1 Upper Hunter Strategic Regional Land Use Plan

The *Upper Hunter Strategic Regional Land Use Plan 2012* (NSW Government, 2012) (UHRLUP) is a sub-regional land use strategy that applies to the Local Government Areas withing the Upper Hunter Region, which includes the Singleton LGA. It is a 20-year plan that outlines a range of key challenges facing the Upper Hunter Region, including competing land uses. The UHRLUP identifies high quality agricultural land (BSAL) that may be impacted by resource developments.

Given that there is no change to the existing operations other than addition of the ability to manufacture ANE as well as store it (which is currently approved), the Proposed Modification will align with the UHRLUP as it will not involve disturbance of any land outside that currently approved.

5.2.5.2 Singleton Local Strategic Planning Statement 2041

The *Singleton Local Strategic Planning Statement 2041* (Singleton Council, 2020) (SLSPS) is a local land use strategy for the Singleton LGA which guides land use policies and principles.

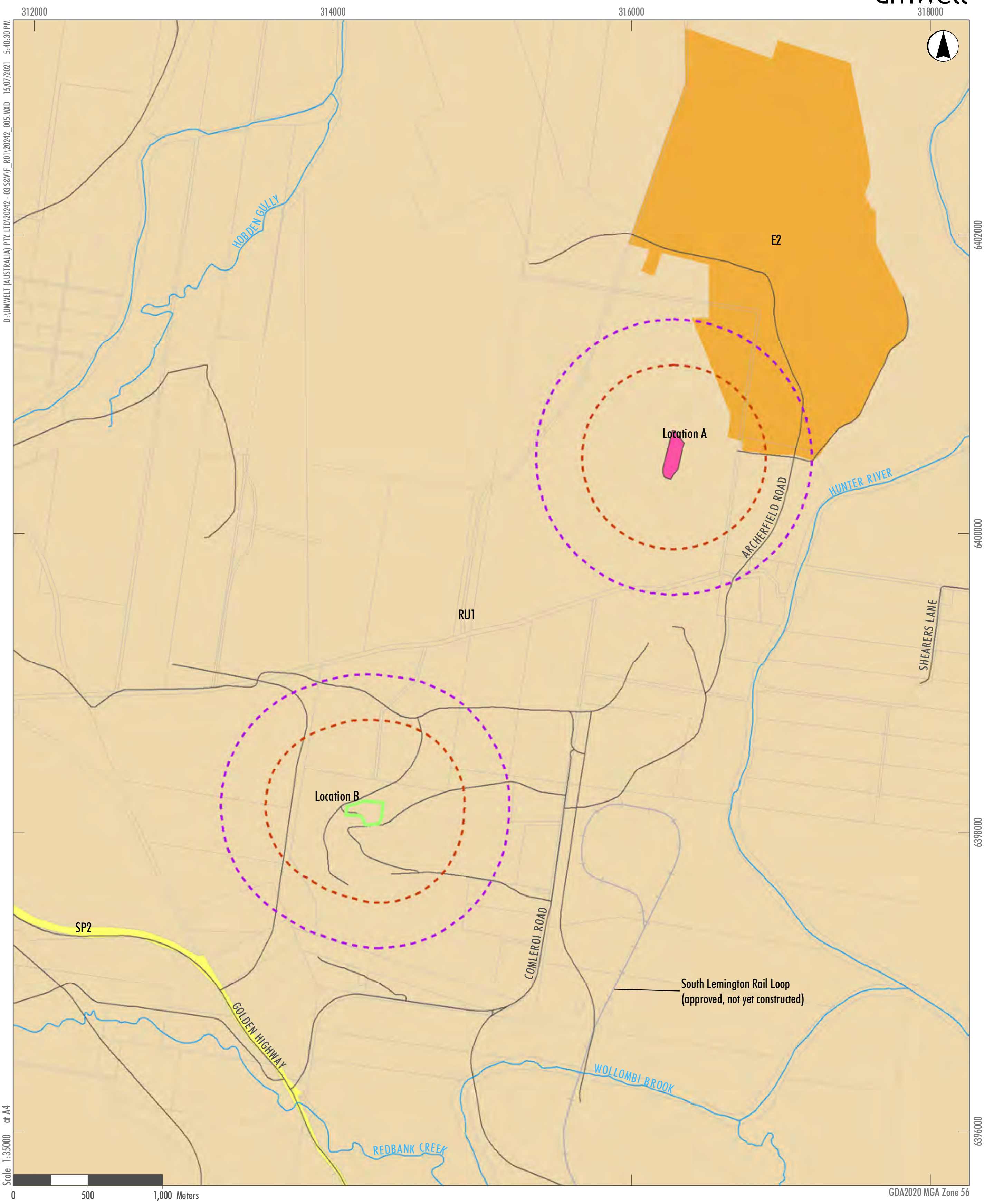
The SLSPS aims to provide clear direction for Singleton Council and NSW Government agencies to guide decisions relating to future land use of land within the Singleton LGA and provides a policy framework to facilitate future opportunities.

The SLSPS recognises coal mining as significant land use and economic driver of the Singleton LGA for the foreseeable future and the Proposed Modification is aligned with the SLSPS as it aims to continue to support economic development in the Singleton LGA by supporting HVO operations.

5.2.5.3 NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (AIP) defines the regime for the protection and management of water take and activities which may interfere with NSW's water resources. It sets out the requirements for attaining water licences for aquifer interference activities and assessment of potential impacts on water assets.

Open-cut mining is an aquifer interference activity; however the Proposed Modification will not result in any changes to the currently approved operations and aquifer impact. Process water used in the operation of the proposed modular ANE plant will be sourced from existing water licences.



Legend

Location B (Proposed HVO ANE Plant Assessment)

Location A (Existing AN and ANE Storage Pad)

Required Separation Distances (in accordance with AEISG Code)

Protected Works A (546m)

Protected Works B (846m)

Land Zoning

E2 Environmental Conservation

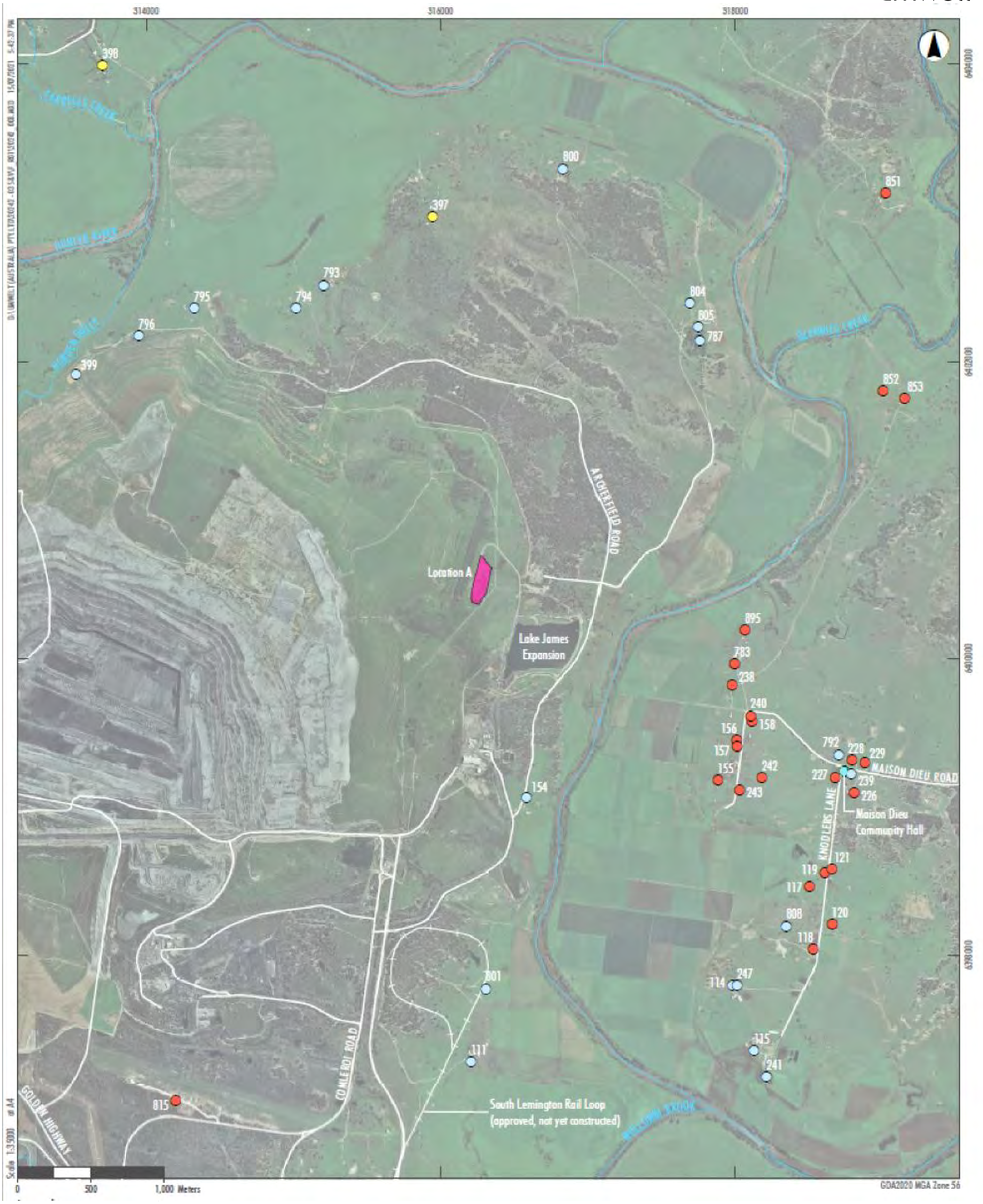
RU1 Primary Production

SP2 Infrastructure

FIGURE 5.1

Land Zoning

Image Source: Data source: NSW Department of Planning (July 2016)



Legend

Location A (Existing AN and ANE Storage Pad)

- Glencore Owned
- HVO JV Owned
- Privately Owned

FIGURE 5.2

Nearest Receptors Location A

Image Source: HVO FEB 2020 Data source: HVO 2021

Legend

- Location B (Proposed HVO ANE Plant Assessment)
- Location B - Product Storage and Manufacture Area
- Glencore Owned
- HVO JV Owned Residence
- Privately Owned Residence
- Hunter Valley Glider Club airstrip

Required Separation Distances (in accordance with AEISG Code)

- Protected Works A (546m)
- Protected Works B (846m)

FIGURE 5.3

Nearest Receptors Location B

Data source: DFSI (2020)

6.0 Environmental Assessment

6.1 Preliminary Environmental Assessment

Umwelt has reviewed key aspects of the Proposed Modification to identify potential impacts that could result from the Proposed Modification.

As noted in **Section 3.5**, the scale of the proposed modular plant and the quantities of stored material will not reach the material storage thresholds in order for the Proposed Modification to be considered a Major Hazard Facility according to the *NSW Work Health and Safety Regulation 2017*.

As detailed in **Section 1.1**, no aspects of HVO South approved operations will change as a result of the Proposed Modification with the exception of the inclusion of the manufacturing of ANE. Key potential issues were identified and reviewed through a preliminary environmental risk and review analysis to determine if any issues may require further assessment. **Table 6.1** identifies the environmental and social issues relevant to the Proposed Modification and identifies and assesses the potential for further evaluation of these issues as part of this SEE.

Table 6.1 Preliminary Environmental Assessment Considerations

Aspect	Review Analysis	Was Further Assessment Required?	Reference to Further Assessment
Groundwater	No changes to operational depths, potential for interaction with groundwater or potential exposure of aquifers will occur as a result of the Proposed Modification.	No	N/A
Surface Water	It is anticipated that there will be no change to existing risks associated with the Proposed Modification.	Yes	Refer to **Section 6.2.1**.
Ecology	The Proposed Modification will not require additional surface disturbance, as both Locations A and B are located within the approved disturbance area for the HVO South operations and on land that is previously disturbed. As there will be no potential for changes to groundwater interaction, there will be no impact to groundwater-dependent ecosystems. The existing approved Biodiversity Management Plan will continue to apply.	No	N/A
Aboriginal Cultural Heritage	The Proposed Modification does not involve any additional land disturbance and will not result in any change to the currently approved area of disturbance associated with the Project. The existing controls stipulated in the Project's Aboriginal Heritage Management Plan will continue to apply.	No	N/A

Aspect	Review Analysis	Was Further Assessment Required?	Reference to Further Assessment
Historic Heritage	The Proposed Modification does not involve any additional land disturbance and will not result in any change to the currently approved area of disturbance associated with the Project. The Proposed Modification will not impact any historic heritage items or places.	No	N/A
Traffic and Transport	The Proposed Modification will involve changes to AN and ANE transport routes from those currently utilised. The proposed transportation of AN has potential to reduce traffic movements through Singleton via the public road network. The proposed modification will not result in any change to heavy vehicle movements relative to what is approved.	Yes	Refer to **Section 6.2.2**
Noise (Operations)	The Proposed Modification will introduce an additional minor noise source to the HVO complex. There are not proposed to be any changes to currently approved operational noise levels and it is anticipated that there will not be any significant noise impacts from the proposed ANE manufacturing. The existing approved noise controls for HVO South will continue to apply, including monitoring programs, for HVO South will continue to apply in accordance with the current Noise Management Plan.	Yes	Refer to **Section 6.2.4**
Noise (Traffic)	The Proposed Modification does not result in an increase in road traffic (including heavy vehicle movements) relative to existing approved operations. The Proposed Modification will reduce heavy vehicle movements through Singleton which will have a small positive impact on traffic noise within Singleton.	No	N/A
Air Quality	There are only minor emissions expected from the construction and operation of the plant. Construction of the plant has potential to generate dust particulate as result of the movement of machinery. Should HVO require use of a diesel generator to power the thermic fluid heating plant there is potential to emit low levels of carbon monoxide (CO), nitrogen dioxide (NO_2) and particulate matter (as PM_{10}) as exhaust gas. These are well below background levels and below levels known to produce odour.	Yes	Refer to **Section 6.2.3**.

Aspect	Review Analysis	Was Further Assessment Required?	Reference to Further Assessment
Visual	Both Locations A and B are not located in a highly exposed location. Location A will be visible from Maison Dieu, however it is anticipated that the use of any proposed fixed lighting and infrastructure would be equivalent to the current AN storage facility. Location B is located adjacent to an existing pit, with limited visibility by public, and is already subject to visual management and mitigation measures. It is anticipated that the use of any fixed lighting will not exceed currently approved offsite lighting impacts and will be installed and operated in order to minimise potential fugitive light emissions. As such, there are not anticipated to be any changes regarding visual impacts from those already experienced by existing and approved operations. Lighting for the Proposed Modification will be designed and installed in accordance with relevant Australian Standards and will minimise direct light spillage from the site. Sheds will be coloured to minimise visual contrast, where visible from offsite.	No	N/A
Bushfire	There will be no change to the bushfire risk as a result of the Proposed Modification as the modular ANE plant is proposed to be located within the footprint of the existing AN storage facility. There will not be any additional asset protection requirements as a result of the Proposed Modification.	No	N/A
Waste	The Proposed Modification would not require any change to the existing waste management practices of HVO South Operations. Any waste created during construction would be appropriately disposed of at a licensed facility by suitably qualified waste disposal contractors. General waste generated by the proposed employee facilities will be removed from site using the existing licenced waste contractors, including segregated waste bins and pump-out sewage tanks.	No	N/A
Chemicals, hazardous substances and dangerous goods	The Proposed Modification will require changes to the storage, handling and manufacturing of chemicals and dangerous goods.	Yes	Refer to **Section 6.2.5**.
Greenhouse Gas and Energy	There are no changes proposed to coal extraction or approved mining operations at HVO South. The Proposed Modification is also not expected to result in a significant increase in energy usage. It is anticipated that the ANE facility will only require a relatively minor quantity of diesel fuel as part of its operation.	Yes	Refer to **Section 6.2.6**
Social	The Proposed Modification is not predicted to result in any additional social impacts for the local community. As outlined in **Section 4.1**, community consultation	No	N/A

Aspect	Review Analysis	Was Further Assessment Required?	Reference to Further Assessment
	will be undertaken at the time of submission with local residents and through the HVO Community Consultative Committee, to provide transparency regarding the project design and timing. The proposed ANE facility will employ minimal additional operators, and it is anticipated that operator numbers will be similar to those already engaged to operate the existing ANE facility.		
Economic	The Proposed Modification would support continuity and improved efficiency of operations at the HVO mine sites and will not result in any change the approved annual production tonnages at HVO South. No negative economic impacts are anticipated as part of the Proposed Modification. As noted above, the proposed ANE facility will employ a similar number of persons to that of the existing facility, who will be trained through the facility operator.	No	N/A
Rehabilitation and Landscape Management	Use of Location A would require no change to existing disturbance areas. Use of Location B is also on previously disturbed land, however a portion of this has been rehabilitated and may require re-disturbance to locate the facility. If required, this would not exceed the currently approved disturbance area in the Mining Operations Plan or Project Approval. There will be no change to landscape management program.	No	N/A

6.2 Environmental Assessment

The following sections provide further environmental assessment of potential impacts identified in the preliminary environmental assessment in **Table 6.1**.

6.2.1 Surface Water

Neither proposed ANE plant location A or B will require any additional disturbance outside of the currently approved areas. Surface water runoff during construction and operation of the Proposed Modification will be contained with the existing approved mine water management system at HVO South.

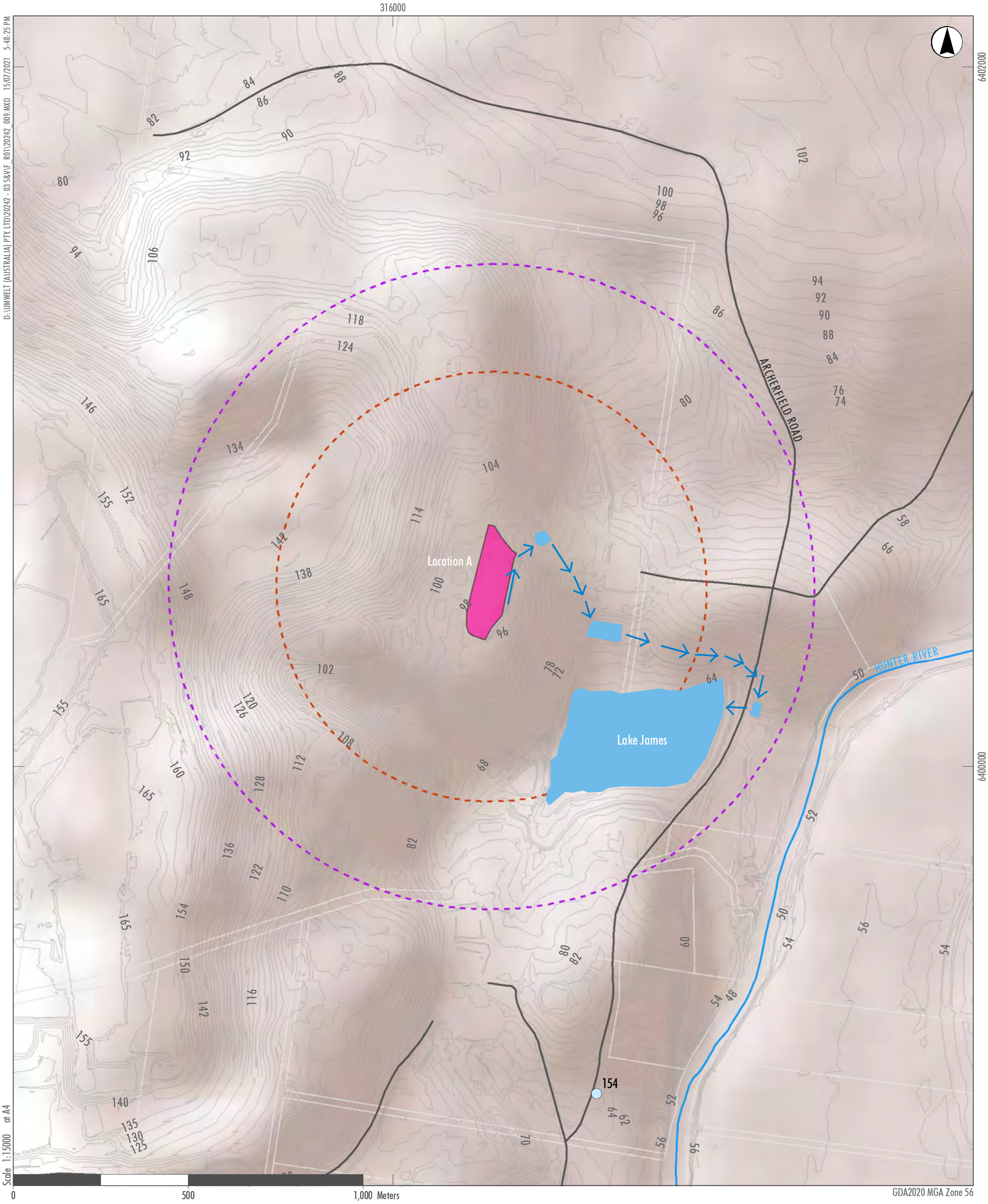
Location A is an existing hard-stand area which includes the currently approved AN and ANE storage and transfer facilities. This area currently has a surface water drainage system that ensures that surface water runoff from the site is directed through three dams before being pumped to the main HVO South mine water storage dam (known as Lake James). Mine water stored in Lake James can also be pumped to other mine water storages on site which enables re-use for coal processing and dust suppression purposes. The existing hopper and emulsion landing area is bunded with drainage to a sump contained within the compound, which is pumped out by a licenced waste contractor when required.

Location B will require the establishment of a hardstand area and facilities similar to that in place at Location A. Location B would be located within the catchment of the currently approved mine water management system which includes capture, storage and reuse of runoff water from disturbed areas and mining affected areas. This includes a section of rehabilitation catchment which drains water to sediment Dam 36S, which is required to be pumped back into the mine water system. The primary control in the event of a spill at Location A or B is immediate clean-up of AN or ANE spillage, and due to the small scale of the proposed plant area compared to the approved disturbance area, there will not be any significant changes to the surface water quantity reporting to the existing approved mine water management system.

The Preliminary Environmental Assessment (**Section 6.1**) identified potential for minor changes to the WMP associated with surface water quality impacts as a consequence of AN, ANE, diesel or chemical spills should this occur at the proposed ANE plant. In order to mitigate this risk, the proposed ANE facilities will include appropriate bunding to chemical and fuel storages, designed in accordance with the relevant Australian Standards and the codes of practice as detailed in **Section 6.2.4**. These design requirements not only provide for secure separation of oxidisers and fuels in storage, but also ensure that the components are suitably redirected to not become combined in the event of a spill. Additional controls in place will include spill response kits including spill containment and clean-up equipment. In addition, as described above, stormwater runoff from both the proposed ANE plant locations A and B is contained within the approved Water Management System at HVO South.

Management of surface water at HVO South is undertaken in accordance with the approved Hunter Valley Operations Water Management Plan (WMP). Should the Proposed Modification be approved, HVO’s approved environmental management plans and monitoring programmes, including the WMP, would be reviewed and, if necessary, revised to incorporate the Modification at Location B (as Location A already included withing approved WMP).

An overview of the topography and existing surface water drainage system at the proposed locations of the ANE facility is provided in **Figure 6.1** and **Figure 6.2**.



Legend

- Location A (Existing AN and ANE Storage Pad)
- Water Flow Path
- Drainage Dam

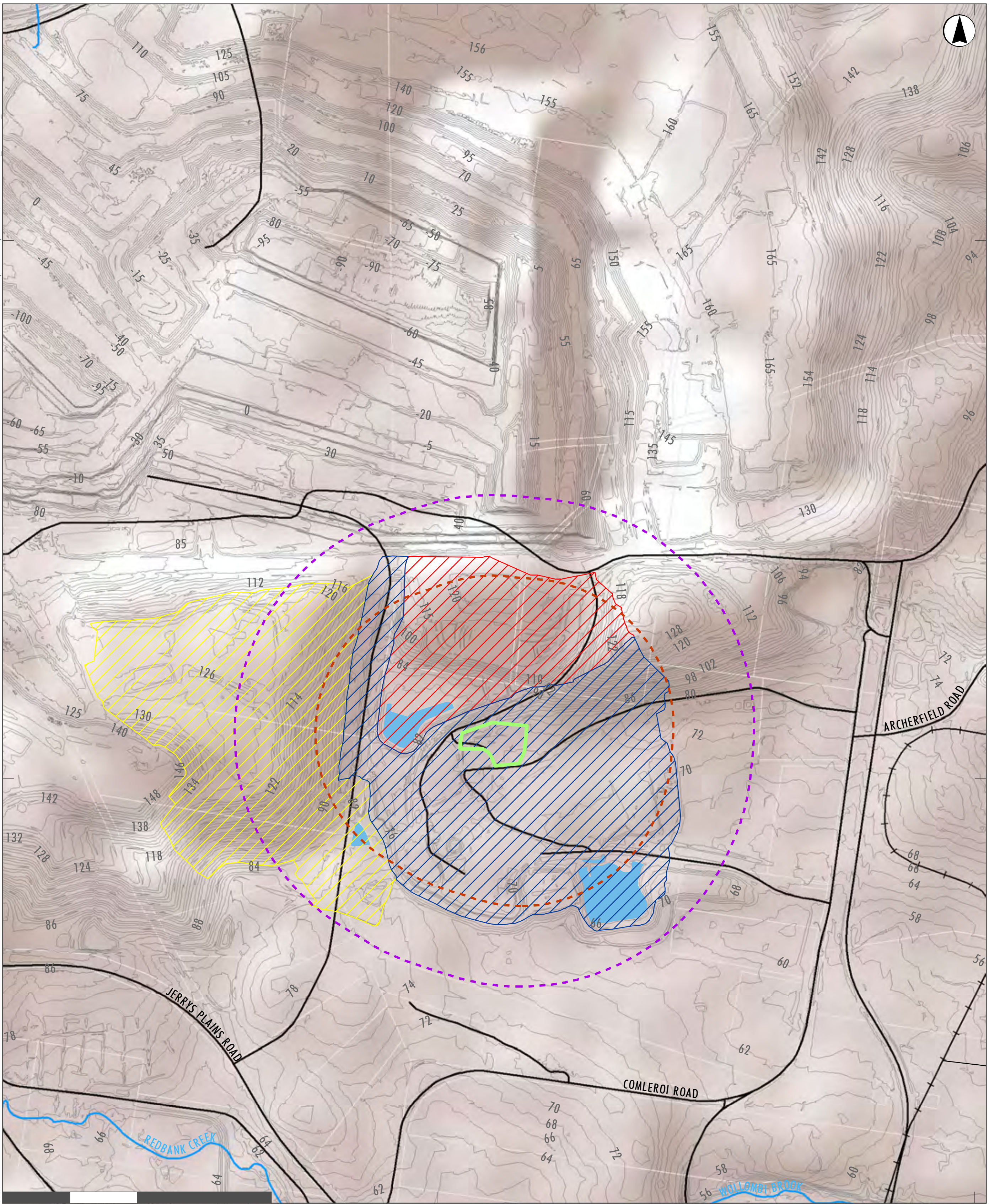
Required Separation Distances (in accordance with AEISG Code)

- Protected Works B
- Protected Works A
- HVO JV Owned

FIGURE 6.1

Surface Water Topography and Drainage Location A

Image Source: ESRI Base Maps 2020 Data source: HVO 2021



Legend

- Location B (Proposed HVO ANE Plant Assessment)
- Drainage Dam

Required Separation Distances (in accordance with AEISG Code)

- Protected Works A (546m)
- Protected Works B (846m)

Catchment Areas

- Dam 18s Catchment
- Dam 19s Catchment
- Dam 36s Catchment

FIGURE 6.2

Surface Water Topography and Drainage Location B

Image Source: ESRI Base Maps 2020 Data source: HVO 2021

6.2.2 Traffic and Transport

6.2.2.1 Existing ANE Transport to HVO

Currently, ANE in a ready-for-use form is transported by truck to HVO along public roads via Singleton from the Orica Liddell manufacturing facility.

AN is currently transported to site from suppliers in the Lower Hunter via the Hunter Expressway and Golden Highway.

The Project does not involve any increase in the overall volume of AN/ANE related material to HVO South relative to existing approved operations. The Proposed Modification has potential to reduce these ANE transport-associated truck movements through the township of Singleton, as manufacturing will be completed onsite at HVO South, and subsequently the manufactured ANE product will be transported on-site to HVO North. An indicative assessment has considered a scenario where HVO receives approximately 700 heavy vehicle (predominately B-double) deliveries of ANE to site per year, transported from the existing Orica Liddell manufacturing facility to the HVO site via Singleton per year. Under a high ANE use scenario (full production of 42Mtpa ROM coal at HVO and wet weather conditions) it is estimated that the volume of ANE imported to site under this scenario as 116,000 tonnes which would require approximately 2800 laden B-Double truck movements between these facilities and through Singleton.

As discussed in **Section 3.3**, it is proposed that the supply of (Ammonium Nitrate Solution) ANSOL raw material, which is currently delivered to Liddell via Singleton, will be replaced by sourcing High Density AN (HDAN) and diesel for use in the manufacturing of ANE at the HVO South site. The transport route for these raw material products would be similar to that used for existing AN and diesel products transported to HVO.

Due to the storage location at HVO South, the use of HDAN will result in a reduction heavy vehicle movements via public road networks through Singleton. In the event that additional product is required (particularly during periods of frequent or heavy rain), HVO may require additional sources of ANE which will be transported via the current practice from other suppliers using either a similar haulage route to the existing ANE supply route or the Lower Hunter supply route.

A comparison of the existing and proposed AN and ANE transport routes is provided in **Figure 3.2**. The difference in heavy vehicle numbers and transport distances required to service the ANE plant at Location A or Location B is considered to be negligible.

Appendix C includes a qualitative assessment of the proposed changes to transport arrangements associated with the Proposed Modification. The Proposed modification is not considered to result in any increase in heavy vehicle movements relative to existing approved transport arrangements under the existing HVO South Consent (PA 06_0261). The potential increase in heavy vehicle movements along the Mitchell Line of Road is considered to be negligible relative to existing conditions (i.e. allowing for the change in haulage arrangements proposed) and would not result in a material change in level of service at any intersections).

The Proposed Modification could result in a reduction of between 4 and 16 heavy vehicle movements per day (depending on HVO ANE requirements) through Singleton.

6.2.2.2 Lemington Road Realignment

The HVO Continuation Project is a State Significant Development application (SSD-11826621) for which the Scoping Report was lodged with DPIE in December 2020, with HVO as the applicant. As part of the HVO Continuation Project, it is proposed to realign the existing Lemington Road to the east of the mining boundary. The realignment will allow Lemington Road to retain its function for road users as a connection between New England and Golden Highways. The location of the proposed realignment is subject to further project design and assessment purposes, however it is currently proposed to be relocated to approximately 170 metres to the east of the proposed Location A. The currently proposed realignment of Lemington Road is shown on **Figure 1.2**.

It is anticipated that, should the HVO Continuation Project be approved including the realignment of Lemington Road, there may be a requirement to relocate the proposed modular ANE plant to Location B. As detailed in **Section 3.1**, the proposed ANE plant is modular in nature, which allows it to be relocated if required. Any implications of these changes to Lemington Road on the proposed transport arrangements for AN and other products used in the preparation of ANFO or ANE production (and ANE if required) will be considered as part of the HVO Continuation Project.

6.2.3 Air Quality

Jacobs were engaged to undertake an Air Quality Impact Assessment (refer to **Appendix D**) and assess the potential air quality issues as a result of the Proposed Modification. The potential air quality issues were identified through:

- a review of the proposed activities relating to the Proposed Modification, with consideration of:
    - the types of emissions to air occurring during both the construction and operational phases of the Proposed Modification
    - the machinery and activities which may generate dust and emissions
    - proximity of these emission sources to sensitive receptors.

The key air quality parameters were identified to be emissions (dust) resulting from machinery used for construction works, and emissions (CO, NO_2 and PM_{10}) in exhaust gas if a diesel generator is used to supply power to the thermic fluid heating units during operation. It is more likely that HVO will use power from nearby electrical infrastructure in which case there will be no exhaust emissions.

The assessment took into account the existing environment (elevation, extraordinary events or extreme climatic conditions, meteorological conditions and ambient air quality conditions) and analysis of 7 years of available meteorological data from a location classified as being representative of conditions around the HVO South area (Jacobs, 2021). The data was utilised to determine common wind speed and direction, seasonal variations and patterns and it was determined that:

- there is evidence of deterioration in air quality conditions in the last 2-3 years, heavily influenced by drought, dust storms and bushfires
- 7 years of data may be representative of the longer-term conditions, as the wind patterns in the area do not vary significantly from year to year.

The predicted emissions of the Proposed Modification were assessed in terms of the ability to comply with the air quality criteria set by the EPA's "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (EPA, 2016). The criteria relate to the total (cumulative) concentration of pollutants in the air. One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to the Proposed Modification contributions in order to assess the potential cumulative impacts (Jacobs, 2021).

The potential significance and impacts of construction dust are not able to be realistically quantified during modelling, and therefore has been determined from a qualitative review, taking into consideration the intensity, scale, location and duration of the Proposed Modification. As material handling quantities are expected to be higher in the operational phase than in the construction phase, air quality impacts during construction are expected to be lower than during operations (Jacobs, 2021). The identified sources of potential dust likely to be generated during construction are:

- site preparation works
- delivery of machinery, plant, equipment and building materials
- construction of buildings
- installation and commissioning of plant and equipment.

Although it was determined that the nature, scale and duration and proximity to sensitive areas mean the air quality impacts are not expected to arise during construction, it was recommended that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum (Jacobs, 2021). These methods include will include those detailed in the existing Air Quality & Greenhouse Gas Management Plan.

Operational emissions were calculated using a computer-based air dispersion model to predict ground-level concentrations from the Proposed Modification emissions. A conservative approach was used to over-state potential impacts (by assuming the plant would be releasing emissions continuously for 24 hours per day) and the model predictions were aligned with the EPA air quality criteria and contour plots to show the spatial distribution of model predictions (Jacobs, 2021). The results in **Table 6.2** from the Air Quality Assessment (Jacobs, 2021) at **Appendix D** are based on maximum potential impacts, by adding maximum background levels to maximum predicted project increments to represent a conservative approach. As the exact positioning is yet to be determined for Location B, the Assessment Location shown in **Figure 3.1** was assumed for the purposes of modelling of potential impacts. This is considered representative of the proposed area for Location B.

Table 6.2 Predicted Ground Level Pollutant Concentrations

Year	Due to ANE Plant at Location A	Due to ANE Plant at Location B	Background	Cumulative	EPA Criterion
Predicted maximum 1-hour average CO (mg/m³)					
Maison Dieu nearest properties	0.0002	0.600006	3.3	3.300	30
Predicted maximum 8-hour average CO (mg/m³)					
Maison Dieu nearest properties	0.0002	0.00001	3	3.000	10
Predicted maximum 1-hour average NO2 (µg/m³)					
Maison Dieu nearest properties	1.1	0.2525	74	75.1	246
Predicted annual average NO2 (µg/m³)					
Maison Dieu nearest properties	0.01	0.40004	16	16.0	62
Predicted maximum 24-hour average PM10 (µg/m³)					
Maison Dieu nearest properties	0.01	0.0017	64	64.0	50
Predicted annual average PM10 (µg/m³)					
Maison Dieu nearest properties	0.001	0.00006	23	18.0	25

These results determined that:

- Maximum CO concentrations resulting from the Proposed Modification, including background levels, would be very low and would not exceed the relevant EPA assessment criteria at any location, including at the nearest sensitive receptors (Jacobs, 2021).

- Maximum 1-hour average NO_2 concentrations from the operation of the plant at the nearest property were assessed to be 1.1 ug/m^3 compared with a background concentration of 74 ug/m^3. Maximum plant and background emissions would not exceed the EPA's respective criterion. The highest annual average NO_2 concentrations would also be below the EPA's annual average criterion. Based on these results, NO_2 concentrations are expected to comply with EPA criteria at all locations, including at sensitive receptor locations (Jacobs, 2021).

- Above certain concentrations, NO_2 does have a characteristic pungent odour. The World Health Organisation (WHO) reports an odour threshold for NO_2 between 100 µg/m^3 and 410 µg/m^3. The modelling shows that the NO_2 concentrations due to the plant would be well below the odour threshold reported by the WHO at the nearest sensitive receptors. It has therefore been inferred that the project would not lead to adverse odour impacts.

- Predicted maximum 24-hour average PM_{10} concentrations due to the proposed plant would be no more than 0.01 µg/m^3 at the nearest receptor. However, as a result of existing background sources, cumulative levels may exceed criteria. As detailed in **Appendix D**, background PM_{10} concentrations at Maison Dieu have historically exceeded 50 µg/m^3 from time-to-time, with air quality deterioration from 2017 to 2019 being heavily influenced by drought, dust storms and bushfires (Jacobs, 2021). The predicted maximum 24-hour average PM10 contribution from the Proposed Modification at the Maison Dieu locality is only 0.01µg/m^3 at the nearest receptor.

- The next highest monitored 24-hour average PM_{10} concentration was 48 µg/m^3 and combining this result with the maximum modelled contribution from the project (1 µg/m^3) demonstrates that the project would not cause exceedances of the EPA's 50 µg/m^3 criterion. Similarly, compliance is predicted for annual average PM_{10} concentrations where the highest cumulative concentration of 18.2 µg/m^3 is below the 25 µg/m^3 criterion (Jacobs, 2021).

The air quality assessment determined that the Proposed Modification is a small plant in terms of emissions to air and potential impacts, which was reflected in the modelling which showed that the Proposed Modification emissions would not cause exceedances of EPA ambient air quality assessment criteria.

6.2.4 Noise

Under the HVO South Consent, operations must be undertaken in a manner which ensures the noise criteria specified in Condition 2 of Schedule 3 of the HVO South Consent. Activities at HVO South are managed in accordance with the Hunter Valley Operations Noise Management Plan (HVO 2019) which includes the implementation of a performance based noise management system. Realtime noise monitoring is used to inform active operations and, where necessary, adjust operations to ensure that relevant noise criteria are being met.

The Proposed Modification involves the introduction of additional noise sources at HVO in the form of two modular process plants and the potential for diesel generators. Sample noise data provided suggests a nominal combined sound power level for the major components of the conceptual process plant (including the emulsion rig, two boilers and generator) in the order of 113 dBA. The conceptual design indicates that the majority of the modular process plant is located with enclosures of a shipping container and/or within a sheet metal clad shed. On this basis, a nominal noise reduction of 5 dBA may be achieved through these enclosures and therefore applied as a reduction to the sound power levels for the process plant to 108 dBA[1]. Concurrent operation of the two modules would provide a combined sound power level of 111 dBA.

Based on this sample data an indicative noise assessment has been undertaken to understand the potential noise emissions from the proposed ANE plant. The CONCAWE noise prediction algorithms have been used to calculate the potential noise levels at the nearest sensitive receivers. The distance to the nearest sensitive receiver to Location A is located in Shearers Lane in Maison Dieu and is approximately 2km to the east of the project site. Allowing for a source to receiver wind conditions of 3 m/s results in a predicted noise level of 33 dBA at Maison Dieu. Under the current consent for HVO South the applicable noise limit at this location during all periods is 41 dBA. The predicted noise levels from the ANE plant are 8 dBA below this noise limit based on this simplified assessment are likely to over predict likely impacts at this location when terrain and other conditions are taken into account.

Due to the nature of the ANE emulsion production processes, there are limited opportunities to reduce noise impacts from this plant while it is operating. However, the relatively low sound power levels of the proposed emulsion plant and predicted noise levels at the nearest property relative to the applicable criteria means that the addition of this plant to the operations is unlikely to make a material impact on overall noise levels at any residence. Additionally, the continued implementation of current performance based noise management practices at HVO enables other mobile noise sources to be managed to reduce overall noise impacts from the operations should real time monitoring indicate potential for exceedances of noise criteria at any properties.

Therefore the ANE plant is most likely to have a negligible influence on the total noise emissions from the mine.

[1] While trucks movements are associated with the operation of the facility, the Proposed Modification does not result in any change to the number of truck movements that may occur at HVO associated with AN and ANE. Accordingly, noise associated with truck movements servicing the new facilities is not considered to be an incremental noise source relative to existing approved operations.

6.2.5 Hazards and Dangerous Goods

A Process and Risk Report was prepared for the Proposed Modification by Greenice Pty Ltd (Greenice, 2021). The report is provided in **Appendix B** and details the process and materials associated with the proposed modular ANE plant and identifies the requirements to identify potential incidents and risk that apply to the Proposed Modification. **Appendix B** provides a Preliminary Hazard Analysis In accordance with Clause 12 of SEPP 33 including the Systematic Risk Assessment process for the Proposed Modification, which incorporates:

- preparation of a high-level risk assessment, based on hazard identification and learnings from global explosives incidents
- review of existing Hazard Studies for similar facilities by Glencore, in partnership with the technology vendor, to ensure all available knowledge is used in the final design of the modular ANE plant, control systems and operating processes
- the Explosives Hazard Study process to ensure the final design and layout of the modular ANE plant meets Australian standards and market needs
- conducting of a Broad-Brush Risk Assessment to ensure all major risks are identified and managed in the day-to-day operation of the facility
- identification of hazard scenarios, based around the potential for uncontrolled heating of ANE.

The plant layout has been designed in accordance with the quantity distance (QD) requirements of AS 2187.1 and the *Australian Explosives Industry Safety Group* (AEISG) *Code of Practice for Ammonium Nitrate Emulsions* in order to ensure that there is adequate separation between ammonium nitrate, ammonium nitrate emulsion and process equipment (including establishment of mounding). By designing the plant layout and storages this way the plant minimises the quantity of materials that could be involved in an explosive event and would minimise the impact on HVO mine operations and external public infrastructure.

The proposed modular ANE plant will be equipped with suitable critical safety controls including pump safety systems, process temperature control, Programmable Logic Controllers, and Emergency Stops.
A Safety Management System will be developed for the modular ANE plant, which will contain all policies, standards, processes and procedures for its safe and efficient operation, as described in **Appendix B**.

The Quantitative Risk Assessment process detailed in **Appendix B** will be followed to suitably consider the prescribed hazard scenarios. The QRA will involve:

- determination of the TNT equivalence of AN and ANE involved
- determination of Net Explosives Quantity based on quantities of AN and ANE
- calculation of distance to the Maximum Allowable Overpressures (MAO) for the various exposed sites. An exposed site is defined as an infrastructure or building where people may be exposed to blast effects or critical public infrastructure. Should the distance be found to be greater than or equal to the MAO then an adequate buffer zone is in place between the modular ANE plant and the exposed site, then the risk assessment process is complete.

The consideration of exposed sites in relation to potential explosive sites was completed as part of the Process and Risk Report (refer to **Appendix B**), are classified in accordance with the *SAFEX Good Practice Guide GPG-02* as shown in **Table 6.3** below. Each classification of infrastructure is assigned a required separation distance from the potential explosive site to ensure adequate buffer zones are in place in the event of an explosive incident (Greenice, 2021).

Table 6.3 Exposed Site Classifications

Classification	Infrastructure type	Required Separation Distance
Protected Works A (PWA)	• Public street, road or thoroughfare, railway, navigable waterway, dock, wharf, pier or jetty, marketplace, public recreation and sports ground or other open place where the public is accustomed to assemble • Open place of work in another occupancy, river-wall, seawall, reservoir, water main (above ground), radio or television transmitter, main electrical substation • Private road which is a principal means of access to a church, chapel, college, school, hospital or factory.	564 m
Protected Works B (PWB)	• Dwelling house, public building, church, chapel, college, school, hospital, theatre, cinema or other building or structure where the public is accustomed to assembling • Shop, factory, warehouse, store, building in which any person is employed in any trade or business, depot for the keeping of flammable or dangerous goods • Major dam	846 m
	• Mine infrastructure[1]	380 m
Vulnerable Facility	• Multistorey buildings, e.g. above 4 storeys • Large glass fronted buildings of high population • Health care facilities, childcare facilities, schools • Public buildings or structures of major historical value • Major traffic terminals, e.g. railway stations, airports • Major public utilities, e.g. gas, water, electricity works.	1,623 m

[1] Note: A reduction in the PWB separation distance is allowed by the AEISG code for PWB mine infrastructure, as a warning explosive scenario with credible evacuation plan will be in place for HVO South.

Locations A and B have been assessed in relation to the exposure risk to existing mine operations and external public infrastructure. As discussed in **Section 6.2.3**, the exact positioning is yet to be determined for Location B. Therefore, the required separation distances in **Table 6.3** have conservatively been applied to the boundary of the Location B polygon to represent potential impacts from any placement of the modular ANE plant within Location B.

Based on the quantities of materials proposed to be processed and stored on site, the facility meets the quantity distance (QD) requirements of AS 2187.1 and the *Australian Explosives Industry Safety Group* (AEISG) *Code of Practice for Ammonium Nitrate Emulsions* (ANE). This means that there is an adequate buffer zone between the plant and exposed sites on the mine and external public infrastructure likes roads, rail lines and houses for both locations.

The separation distance analysis detailed in **Appendix B** demonstrates that there are no Vulnerable Facilities within the required separation distance from the proposed modular ANE plant, and in all cases, exposed sites (both PWA and PWB) are located outside of the required separation distances (Greenice, 2021).

It is noted that all dwellings are located outside of the prescribed PWB separation distances (refer to **Figure 1.3** and Figure 1.4). However, it is proposed that Archerfield Road (a private road owned by HVO and used for mine owned property access,) will be included in an emergency evacuation plan to be prepared by HVO.

As discussed in **Section 6.2.2.2**, the HVO Continuation Project (SSD- 11826621) proposes to realign Lemington Road to the south east of its existing road location. As Lemington Road is a public road, it is classified as PWA (see **Table 6.3**) and its proposed location as part of the realignment may require it to be located within the required PWA separation distance.

Should the Continuation Project be approved, the modular ANE plant may be relocated to Location B prior to the commissioning of the Lemington Road realignment. As detailed in **Section 3.1**, the proposed ANE plant is modular in nature, which allows it to be readily relocated if required. The facility will be designed and constructed in accordance with the AN-specific storage and bunding requirements as identified in the *Storage and Handling of UN3375* (AEISG, 2018) Code of Practice.

Hazards and risk relating to the operation of the modular ANE plant are typical for this type of facility, and provided that the standard explosives industry control measures are put in place, it is considered that the overall risk can be reduced so far as is reasonably practicable. Safety Management System will be developed for the HVO modular ANE plant which will describe all policies, standards, processes and procedures for the safe and efficient operation of the facility. The design will incorporate Australian requirements from systems developed by the technology vendor and HVO.

6.2.6 Greenhouse Gas and Energy

A greenhouse Gas and Energy Assessment (GHGEA) was prepared for the Proposed Modification and is contained in **Appendix E**. The scope of the GHGEA included calculation of Scope 1, 2 and 3 greenhouse gas emissions for the Proposed Modification and calculating energy use for the Proposed Modification, and the framework is based on the methodologies and emission factors contained in the National Greenhouse Accounts (NGA) Factors 2020 (DISER 2020) (the NGA Factors). All assumptions and data exclusions are detailed in **Appendix E**.

Scope 1 emissions (direct emissions over which the Proponent has a high level of control, e.g. fuel) and Scope 2 emissions (emissions from the generation of purchased electricity consumed by the Proposed Modification), were calculated based on the methodologies and emission factors contained in the NGA Factors (DISER 2020).

Scope 3 emissions (indirect emissions that are a consequence of the activities of the Proposed Modification, including emissions generated upstream of the Proposed Modification by providers of energy, materials and transport) associated with product transport were calculated based on emission factors contained in the *National GHG Inventory: Analysis of Recent Trends and GHG Indicators* (AGO 2007).

In calculating Scope 1 emissions, it was determined that all construction related activities will be outsourced to third party contractors. The Proposed Modification's construction related activities will not generate direct Scope 1 emissions for the Proponent.

The construction of the Proposed Modification is likely to generate Scope 3 (indirect) emissions from the following sources:

- On-site energy use by contractors (diesel used during site preparation and module assembly).
- Transport energy use by contractors (diesel used during the delivery of modular equipment).

- Embedded emissions in construction materials (foundations and hard stand areas).
- Embedded emissions in modular equipment.

Embedded emissions in modular equipment is likely to be the primary source of Scope 3 emissions (based on capital value), however, these emissions are very difficult to estimate with any degree of certainty.

The net impact of the Proposed Modification is assessed by comparing current operations with proposed operations. The following sections estimate greenhouse gas emissions associated with existing ANE consumption and the Proposed Modification.

As detailed in **Appendix E**, the results of the GHGEA indicate that the Proposed Modification:

- Is expected to increase the proponent's net Scope 1 emissions by approximately 14 t CO_2-e. Scope 1 emissions will be generated by diesel combustion.
- Is expected to increase the proponent's net Scope 2 emissions (generated by electricity generators in NSW) by approximately 314 t CO_2-e.
- Is expected to potentially reduce potentially reduce the proponent's net Scope 3 emissions (for which the primary source of which are material use and transport) by up to approximately 514 t CO_2-e.
- Is forecast to require approximately 1,600 GJ per annum from diesel and grid electricity, and to consume approximately 100 GJ per annum in feedstock diesel. While this use of feedstock diesel will increase energy consumption, it will not generate greenhouse gas emissions.

The GHGEA (refer to **Appendix E**) determined that the Proposed Modification largely redistributes the source of Scope 3 emissions from Orica Liddell, to feedstock suppliers in Newcastle, and subsequently the Proposed Modification has the potential to reduce Scope 3 emissions by up to approximately -514 t CO2-e per annum through transport-related efficiencies.

Given the minor nature of predicted impacts to emissions, it is considered that HVO's existing AQGGMP management measures and monitoring program are sufficient and will not change in response to the Proposed Modification.

7.0 Management and Mitigation Measures

PA 06_0261 is subject to detailed conditions regulating the management measure required for the approved Project. These include requirements for a range of environmental management plans (EMPs) which provide detail on the management of key environmental issues. These EMPs, which are integrated across HVO North and South, provide the necessary controls for the potential impacts associated with the Proposed Modification.

As the Proposed Modification represents a relatively minor change to the existing approved operations, the ongoing implementation of the existing EMPs and monitoring programs are considered sufficient to effectively manage site operations.

As detailed in **Appendix D**, results from the Air Quality emissions modelling demonstrated that the Proposed Modification is a small operation in terms of emissions to air and potential impacts. In addition, the modelling showed that the Proposed Modification would not cause exceedances of EPA ambient air quality assessment criteria. HVO has in place an Air Quality & Greenhouse Gas Management Plan (AQGGMP) both approved HVO Operations, which provides procedures required to ensure compliance with conditions of the approvals relating to potential air quality and greenhouse gas impacts. It is considered that the established AQGGMP management measures and monitoring program are sufficient and will not change in response to the Proposed Modification due to the minor nature of predicted impacts of the Proposed Modification. Currently, ANE used at HVO South is typically manufactured at an existing location in Liddell on land owned by HVO.

The existing performance based noise management system at HVO operates to ensure that noise criteria at nearby private receivers is not exceeded. Conservative calculations of predicted noise impacts from the Proposed Modification indicates noise impacts from the facility are well below applicable criteria at the nearest private residence. The operation of the proposed facility is considered unlikely to have any material impact on the management of cumulative noise impacts at HVO South.

The Proposed Modification does not result in any increase of overall heavy vehicle movements to HVO South relative to existing approved conditions but will result in a reduction in heavy vehicle movements of AN and ANE through Singleton. Further opportunities to reduce heavy vehicle movements through the use of A-Doubles will be progressed where reasonable and feasible and appropriate transport authorisations exist.

As detailed in **Appendix B**, a Safety Management System will be developed for the HVO modular ANE plant which will describe all policies, standards, processes and procedures for the safe and efficient operation of the facility. The design will incorporate Australian requirements from systems developed by the technology vendor and HVO.

The appropriate community consultation, safe operating procedures and processes outlined in **Appendix B** will also be in place to ensure that the overall risk can be reduced so far as is reasonably practicable.

As detailed in **Appendix E**, the results of the GHGEA indicate that there the nature of predicted impacts to emissions as a result of the Proposed Modification is minor, and it is considered that HVO’s existing AQGGMP management measures and monitoring program are sufficient and will not change in response to the Proposed Modification.

8.0 Justification and Conclusion

8.1 Environmental Impacts

The potential environmental and socio-economic impacts of the Proposed Modification have been identified through an environmental assessment process involving:

- assessment of the site characteristics
- an environmental risk screening analysis
- preparation of relevant technical assessments including a Preliminary Hazard Analysis
- consultation with relevant government agency.

The purpose of the Proposed Modification is to allow for manufacture of ANE onsite. No other aspects of the currently approved operations at HVO South will change as a result of the Proposed Modification.

8.2 Suitability of the Site

The Proposed Modification is located in an area with a long history of open cut coal mining. Both Locations A and B are within the HVO South approved disturbance area and are considered suitable for the construction and operation of the modular ANE plant, as:

- Location A currently includes approved storage and handling facilities for AN and ANE.
- Both Locations A and B provide adequate separation distances between potential explosion and exposed sites for private residences, public places and existing infrastructure (as detailed in **Section 6.2.5**).
- As discussed in **Section 6.2.2.2**, should the future realignment of Lemington Road be approved, Location A would not have adequate separation distances and the modular ANE plant would be relocated to Location B.
- Both Locations A and B are suitably for supply to HVO Operations, providing efficient transportation of raw AN and delivery of ANE.

8.3 Ecologically Sustainable Development

The EP&A Act aims to encourage ecologically sustainable development (ESD) within NSW. As outlined in **Section 5.0**, the Proposed Modification requires approval from the Minister under Section 4.55(1A) of the EP&A Act. As such, the Minister needs to be satisfied that the project is consistent with the principles of ESD. This section provides an assessment of the Proposed Modification in relation to these principles.

To justify the Proposed Modification with regard to the ecologically sustainable development principles, the benefits of the Proposed Modification in an environmental and socio-economic context should outweigh any negative impacts. The principles, as outlined in Section 6 of the *Protection of the Environment Administration Act 1991* encompass the following:

- the precautionary principle
- inter-generational equity

- conservation of biological diversity and ecological integrity
- improved valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

8.4 The Precautionary Principle

The EP&A Regulation defines the precautionary principle as:

… if there are threats of serious or irreversible 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:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

(ii) an assessment of the risk-weighted consequences of various options

In order to achieve a level of scientific certainty in relation to potential impacts associated with the Proposed Modification, this SEE has undertaken an extensive evaluation of all the key components of the project. Detailed assessment of all key issues and necessary management procedures has been conducted and is comprehensively documented in this SEE.

The assessment process has involved a detailed study of the existing environment and the use of scientific modelling to assess and determine potential impacts as a result of the Proposed Modification (refer to **Section 6.0**). To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

Consistent with the precautionary principle, a Preliminary Hazard Analysis of the proposed ANE facilities and associated product handling has been undertaken (refer to **Appendix B**) with appropriate setbacks from sensitive receivers implemented to minimise risks in accordance with established risk based standards.

Additionally, the Proposed Modification will also reduce truck movements through Singleton, including the number of trucks carrying AN and ANE. This change reduces impacts (including potentially irreversible impacts) on the Singleton area.

The decision-making process for the design, impact assessment and development of management processes has been transparent in the following respects:

- Private landholders located closest to the proposed development and the Community Consultative Committee were consulted during SEE preparation (refer to **Section 4.1**). This enables comment and discussion regarding potential environmental impacts and proposed environmental management procedures.
- HVO has implemented a comprehensive Environmental Management System (EMS), and related EMPs, that seek to implement best practice management. As the Proposed Modification represents a relatively minor change to the existing approved operations, the ongoing implementation of the existing EMS and associated EMPs are considered sufficient to effectively manage site operations.

- As required by the relevant conditions of the HVO North and South approvals, the EMS will be reviewed within three months of the submission of a modification to the conditions of consent. If any significant modifications to the EMS are required as an outcome of the review, a revised EMS will incorporate changes associated with the Proposed Modification and will be submitted to DPIE for approval.

8.4.1 Intergenerational Equity

The EP&A Regulation defines the intergenerational equity principle as:

> *… that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations*

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, biodiversity and productivity.

The objective of the Proposed Modification is to allow for an efficient recovery of the resource in a manner that achieves the best practical safety, environmental, social and economic outcomes while aiming to minimise any associated environmental impacts. The Proposed Modification would stabilise and diversify the supply of ANE in order to support operations and prevent delays to operational schedules in the Hunter Valley.

The management measures discussed in **Section 7.0** have been considered to be sufficient in minimising the impact on the environment to the greatest extent reasonably possible and would continue to be implemented when the proposed modular ANE plant is in operation.

In addition to the Proposed Modification objectives, a range of environmental management measures discussed in **Section 7.0** have been developed and evaluated to minimise the impact on the environment to the greatest extent reasonably possible.

The management of environmental issues as outlined in this SEE will maintain the health, diversity and productivity of the environment for future generations.

8.4.2 Conservation and Biological Diversity

The EP&A Regulation identifies that:

> *… that the conservation of biological diversity and ecological integrity should be a fundamental consideration…*

In the decision-making process, the conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Proposed Modification and measures to ameliorate adverse impacts were described in the latest Environmental Assessment. The Proposed Modification to manufacture ANE and increase ANE storage capacity is not envisaged to cause any additional impact on biodiversity.

8.4.3 Valuation of Pricing Resources

The EP&A Regulation defines the valuation of pricing resources as:

> *… that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

HVO Operations has intrinsically valued the environmental resources by designing the Proposed Modification to avoid and minimise potential environmental impacts as much as possible, for example, selecting a location that was already approved for surface disturbance, includes suitable supporting infrastructure and would not require an increase to the disturbance footprint.

8.5 Conclusion

The Proposed Modification has been designed with due consideration of the environmental and social values of the existing environment and community, and potential impacts of the proposed changes have been carefully assessed and determined to be within acceptable limits.

AN and ANE is currently stored and used on site as an integral component of the approved mine blasting processes. The Proposed Modification is to allow for manufacture of ANE on site. No other aspects of the currently approved operations at HVO South will change as a result of the Proposed Modification. As a result, the ongoing operations at HVO South will remain substantially the same as the currently approved operations.

The Proposed Modification will be located within the already approved disturbance area and within the existing surface water management system for the HVO South mine.

The Process and Risk Report, including Preliminary Hazard Analysis identified that there are no exposed private residences or other Protected Works A or B within the prescribed separation distances from both of the proposed plant locations.

HVO has a range of well-established, approved and effective measures to minimise and manage impacts associated with the Proposed Modification. This SEE has assessed potential environmental impacts from the construction and operation of the Proposed Modification and found those potential impacts to be minimal. It is anticipated that the Proposed Modification can proceed within the approved limits and controls currently in place to manage and mitigate environmental impacts applicable to the site, in accordance with PA 06 0261 and relevant environmental standards over the anticipated life of the HVO South project.

The implementation of existing EMS and EMPs outlined in **Section 7.0** are considered adequate to ensure that any risks or air quality impacts associated with the modular ANE plant can be effectively controlled and will be considered reasonably practicable.

The Proposed Modification has potential to result in changes to heavy vehicle movements currently undertaken for the transportation of AN and ANE via public road networks and will reduce the number of truck movements through singleton. The proposed changes are however consistent with existing approved transport arrangements and there is no proposed increase in the number of heavy vehicle movements associated with the Proposed Modification.

The manufacturing of ANE at HVO South will facilitate improved reliability of supply and diversification of ANE sources with minimal environmental impact and allow operations to continue to progress in an efficient and timely manner.

9.0 References

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APPENDIX A

Conceptual Plant Layout

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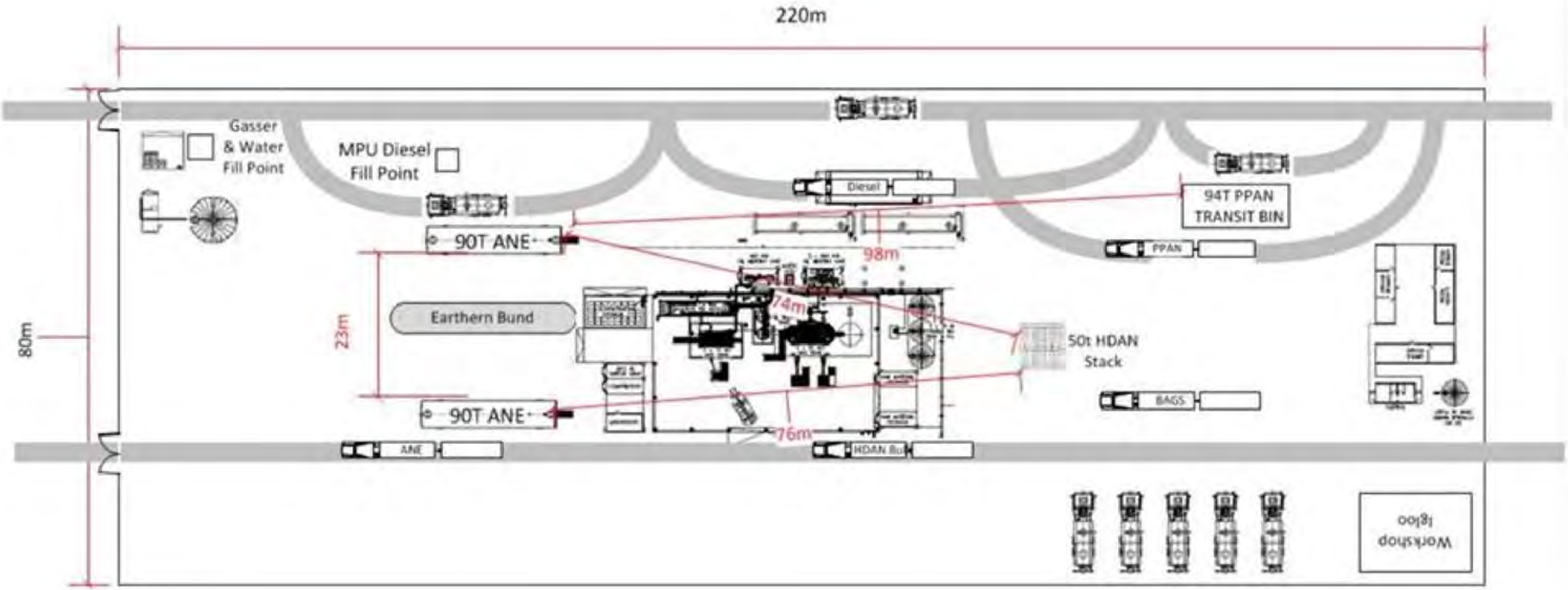


APPENDIX A

Conceptual Modual ANE Plant Layout

APPENDIX B

Process and Risk Report

HVO Coal Assets Pty Ltd

Process and Risk Report

Proposed Modular Ammonium Nitrate Emulsion (ANE) Manufacturing Facility

Hunter Valley Operations (HVO) NSW

Version 6.2

12 July 2021

Prepared by:
Michael du Plessis

Greenice Pty Ltd

Approved by:
Andrew Rose
HVO Coal Assets, Australia

Disclaimer
In conducting the process and risk review I have relied solely on information regarding the manufacturing and storage facility and locations on the HVO site provided by HVO Coal Assets (the *Client*) and the technology vendor. I have assumed the information provided by the Client and technology vendor is correct and accurately reflects the design, specifications, and location of the proposed ANE manufacturing facility. I have not sought to independently verify the information provided by the Client and technology vendor.

This report only considers information provided to me up to the date of this report and so its findings may be affected by new information.

Document History

Version No.	Date	Description	Approved by
1	½/21	Initial draft for comment	
2	10/2/21	For internal review	Andrew Rose
3	5/3/21	For further internal review	Andrew Rose
4	29/3/21	New plant layout	Andrew Rose
5	30/4/21	Revised plant layout	Andrew Rose
6	09/07/21	Revised Plant Layout (Shed)	Andrew Rose
6.1	12/07/21	Minor revision separation distances	Andrew Rose
6.1	12/07/21	Final review of separation distances	Andrew Rose

Executive Summary

Two locations for the proposed ammonium nitrate emulsion manufacturing facility have been assessed. Location A would be constructed within the footprint of the existing bulk explosives depot and reload facility on the HVO mine site. Location B would be constructed on a new site close to the South Pit on the site of an existing mine shed. The plant design and layout will be identical for both Locations A and B.

The plant will be of a modular design and is based on standard technology that has been licenced elsewhere in Australian and overseas. The technology has been operated successfully by the technology vendor without incident in Australia since 2015. Appropriate safety control systems and procedures have been incorporated into the plant design in accordance with international explosives industry best practice and Australian Standards.

The key hazards and risks scenarios for the plant have been identified and appropriate explosives industry control measures will be put in place to ensure that the overall risk can be reduced so far as is reasonably practicable (SFARP)

The quantities of Schedule 15 Chemicals stored on the site (ammonium nitrate and ammonium nitrate emulsion) are less than the Major Hazard Facility (MHF) threshold. The facility is therefore not a Major Hazard Facility under the NSW Work Health and Safety Regulation 2017.

Locations A and B has been assessed in relation to the exposure risk to existing mine operations and external public infrastructure. Based on the quantities of materials to be processed and stored on site, the facility meets the quantity distance (QD) requirements of AS 2187.1 and the Australian Explosives Industry Safety Group (AEISG) Code of Practice for Ammonium Nitrate Emulsions (ANE). This means that there is an adequate buffer zone between the plant and exposed sites on the mine and external public infrastructure likes roads, rail lines and houses for both locations.

Table of Contents

1. INTRODUCTION

HVO Coal Assets (HVO) are planning to construct an ammonium nitrate emulsion manufacturing facility on the Hunter Valley Operations (HVO) mine site. This report has been prepared in support of a development application for the facility to be submitted to NSW Planning. The report covers the following aspects in support the development application:

- Location of the facility and the proximity to existing mine operations and external public infrastructure,
- Manufacturing technology to be used in the plant,
- The materials that will be stored and used on the site,
- The properties and hazards of the materials to be manufactured, processed, and stored on site,
- Manufacturing and storage hazards and critical control measures, and
- Compliance with Australian standards, codes of practice and guidelines.

2. STANDARDS, POLICIES, GUIDELINES AND CODES OF PRACTICE

The risk assessment and hazard analysis approach for this facility follows the integrated approach in the NSW Planning Guidelines and policies, Australian Standards, and explosive industry guidelines. These are listed below:

- NSW DPIE Major Projects. Key Guidance. Hazards and Risks. Assessment of chemical, biological, and chemical hazards and risks.
- NSW State Planning Policy No 33 – Hazardous and Offensive Development
- NSW Planning Guidelines for risk assessment, hazard analysis and risk criteria:
  - Assessment Guideline. Multilevel Risk Assessment, 2011
  - Hazardous Industry Planning Advisory Paper no 4. Risk Criteria for land Use Safety Planning, 2011.
  - Hazardous Industry Planning Advisory Paper No 6. Hazard Analysis, 2011
- NSW Work Health and Safety Regulation 2017 (Major Hazard Facilities)
- Code of Practice - *Storage and Handling of UN3375, Edition 5 July 2018*, published by the Australian Explosives Industry Safety Group (AEISG)
- AS 2187.1 - 1998 Explosives - Storage, transport and use – Storage.
- Hazards in Emulsion Explosives Manufacture and Handling by Andy Begg, SAFEX Topical Papers Series Paper no. 05/2008.
- Good Practice Guide: Storage of Solid Technical grade Ammonium Nitrate by the International Working Group on Ammonium Nitrate. SAFEX Good Practice Guide Series GPG 02.

The following statutory guidelines and instruments have been reviewed and are not applicable to the risk and hazard assessment for an ammonium nitrate emulsion manufacturing and storage facility.

- Dangerous goods (Road and Rail and Transport) Act 2008
- Environmental Hazardous Chemicals Act 1985
- Australian Dangerous Goods Code (ADG Code)

3. FACILITY OVERVIEW

3.1 Site Location, Surrounding Land Uses and Layout

Two options for the location of the ANE plant are under consideration:

- **Location A -** The ANE plant will be located on the site of an existing licensed bulk explosives depot and reload facility.
- **Location B –** The ANE plant will be located on a new site, adjacent to the HVO South Pit on the site of an existing mine shed.

Both sites are located on the HVO mine site. The mine is in a rural area surrounded by farms and scattered houses. There is no major public infrastructure or residential areas close to the mine.

Appendix 1 shows lists of mine infrastructure sites and the location of the infrastructure in the surrounding area for Locations A and B.

Appendix 2 shows the proposed layout for the ANE manufacturing facility. The plant layout will be identical for both site locations.

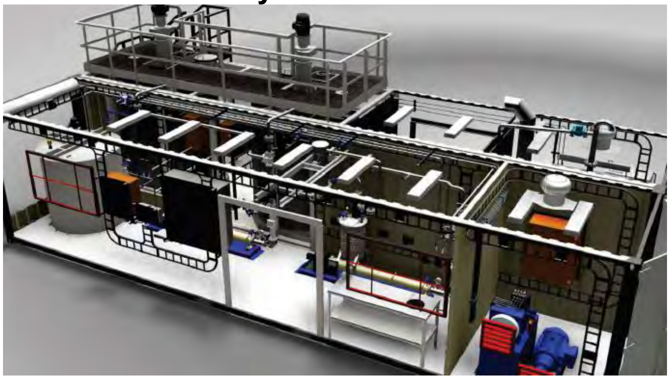
3.2 Process Description

The proposed modular Ammonium Nitrate Emulsion (ANE) manufacturing plant will be located on the HVO mine lease. ANE is not an explosive and is classed as a 5.1 Oxidiser (UN3375). The modular ANE processing unit will be in two 40-foot shipping containers located side by side on a concrete pad. The manufacturing process will be based on proven ANE manufacturing technology widely used in Australia and around the world. Figures 1 and 2 show a typical concept for a modular ANE plant.

In additional to the ANE processing unit, the plant will also include tanks for storage of finished ANE, ammonium storage pad and bin, gasser solution storage tanks and other ancillary services.

Figure 1: Concept of Modular ANE Process Unit

Figure 2: Schematic Layout of Modular ANE Process Unit



The process steps for manufacturing ANE are:

- Deliver and store of high density ammonium nitrate (HDAN),
- Dissolve HDAN prills in water (oxidiser solution),
- Mix emulsifier and fuels (fuel blend),
- Pump the oxidiser solution and fuel blend through a static mixer to create ANE, and
- Pump the ANE into storage tanks.

3.2.1 Delivery and Storage of Ammonium Nitrate

High density ammonium nitrate prill (HDAN) is delivered to the site, in "bulka" bags (normally of nominal weight 1.25t or 1.2t, depending on source), by road truck. On arrival, the materials are offloaded and stored on a dedicated storage pad adjacent to the ANE manufacturing unit. Porous prilled ammonium nitrate (PPAN) will also be delivered to the site and stored in a transit bin. The PPAN is not used in the manufacture of ANE. It will be loaded into bins on the Mobile Processing Unit (MPU) for use in ANE blends on the mine site as per current licenced practice.

3.2.2 Preparation of the Oxidiser Solution (ANSOL)

A supersaturated aqueous solution of ammonium nitrate, urea and / or calcium nitrate (dependant on the product being manufactured) along with trace elements; thiourea, acetic or citric acid and sodium acetate, is prepared to meet specifications for pH and fudge point (crystallisation temperature and hence concentration). The ammonium nitrate solution (ANSOL) is prepared and stored in dedicated oxidiser tanks. The tanks are fitted with agitators and stainless steel heating coils. Tanks will have both digital and analogue temperature indicators. Heat is provided through a closed circuit steam heating loop or pipes containing thermal oil known as a heat transfer fluid (HTF) which acts as the heat transfer medium.

ANSOL preparation begins with the addition of a predetermined amount of water to the solution tanks using a flow meter (as specified on the product batch sheet). The water is heated above a temperature of 60°C (56°C is the approximate temperature at which the final solution, at its desired concentration, will crystallise if allowed to cool, the "fudge point") at which point the agitators are started.

HDAN in the form of a small bead, or prill, contained in bulk bags, is lifted using a forklift above hopper of the feed auger for the solution tank and emptied. The feed auger transfers the ammonium nitrate from the hopper into the solution tank holding the set amount of water. The solution is then heated to a temperature of above 80°C but less than 90°C.

Due to the endothermic reaction (absorption of energy) that occurs between the AN and water when it is dissolving, the solution cools. Heat is repeatedly applied through the coils to ensure the solution is held above the 56°C fudge point required. HDAN is progressively added in this manner until the specified amount has been added as per the solution batch sheet. Urea or calcium nitrate is then added using the same process as required, depending on formulation.

Acetic acid is then transferred from a 1,000lt IBC pod through a dosing pump into the solution tank. Thiourea and sodium acetate are weighed into transfer containers and manually added to the solution via the transfer auger.

The solution is then heated and mixed using the agitators for a set period of time as prescribed on the specific product batch sheet. A sample of the solution is then collected for quality control / quality assurance (QA/QC). The quality test entails testing for pH and fudge point. Corrections to pH are made by adding sodium acetate (if too low) or acetic acid (if too high). Corrections to fudge point are made by the addition of water (if fudge point is too low) or (if fudge point is too high).

3.2.3 Preparation of Fuel Oil Blend

A mixture of diesel fuel and a proprietary surfactant (emulsifier) component are prepared in fuel oil blend tanks to meet specifications for viscosity. The predetermined amount of diesel fuel is transferred from bulk storage and added to the fuel oil blend tank using a transfer pump and flow meter. Surfactant is transferred from 1,000lt IBC pods and added to the fuel oil blend tank using a transfer pump and flow meter. The two components are mixed using tank agitators for a prescribed period of time prior to conducting quality control tests. The fuel oil blend quality test consists of testing the viscosity (level of resistance to flow) using an ISO Cup. Corrections to viscosity are made by ether adding diesel fuel (if viscosity is too high) or surfactant (if viscosity is too low).

3.2.4 Emulsion Manufacture

ANSOL is blended with the fuel blend to form the ammonium nitrate emulsion (ANE). The process will start with the formation of a pre-emulsion. This will be achieved by introducing the fuel blend and the ANSOL at pre-set flow rates to a mixing device called a ‘stir pot’. The stir pot contains a rotating agitator which imparts a vigorous mixing action to blend the two products into a pre-emulsion. The stir pot is open to atmosphere and therefore mixing occurs at ambient pressure.

The pre-emulsion is then transferred from the stir pot through a progressive cavity (PC) pump and refined by further blending through a static mixer. The static mixer creates a refining action that reduces the size of the droplets and increases the consistency of size distribution. The PC pump discharge housing is fitted with both a high and low pressure sensor and a high temperature sensor. These sensors are both hard wired to trip amplifiers and interface relays. This ensures that the pump is automatically shut down in the event of over pressure and or overheating from deadheading of the pump or a blockage. There is also a mechanical failsafe device in the form of a bursting disc that is independent of any interlock or other safety device.

A sample of the ANE is collected for quality testing at regular intervals. This final quality test involves establishing the viscosity of the ANE using a viscometer. Corrections to the viscosity are made by changing the process flow and homogeniser settings. A quality test is also conducted on the final product to measure product density using an ISO cup and scales. Any density test result outside of the specified range would prompt the plant operator to stop production and investigate.

3.2.5 Storage and Load Out of ANE

After manufacture, ANE is transferred through a progressive cavity (PC) pump into two 70 t horizontal storage silos, pending despatch in Mobile Processing Units (MPU) to blast holes on site. The PC pump discharge housing is fitted with both a high and low pressure sensor and a high temperature sensor. These sensors are both hard wired to trip amplifiers and interface relays.

This ensures that the pump is automatically shut down in the event of over pressure and or overheating from deadheading of the pump or a blockage. There will be a mechanical failsafe device in the form of a bursting disc that is independent of any interlock or other safety device.

Transfer of ANE from the silos the MPU is achieved using a gear pump with nitrile rubber impellers (Napco pump). This pump is fitted with temperature and pressures sensors as well as two bursting discs, one on each side of the pump. A 5 minute "Dead Man" switch is also incorporated to ensure that the pump will trip if the "Dead Man" button is not pressed by the pump operator every 5 minutes.

3.2.6 Preparation of Gassing Solution

Gassing solution is an aqueous solution of sodium nitrite. It is mixed with ANE directly prior to delivery down the blast hole to sensitise the emulsion product. (Note: This process only occurs on the mine site immediately prior to delivery by a Mobile Processing Unit).

Gassing solution is manufactured in 1,000 kg batches by adding water to a mixing tank via a flow meter. The required amount of sodium nitrite is then manually added to the water through an opening in the mixing tank. The solution is then mixed using an agitator for 1 hr. The solution is tested to meet specification for density using a hydrometer. On meeting specification, the solution is then transferred to 1,000 kg IBC's for delivery to the mine site.

4. HAZARDOUS MATERIAL PROPERTIES

4.1 Ammonium Nitrate (Oxidizing Agent Class 5.1 UN1942)

Ammonium nitrate prill (AN) is a white solid oxidiser (Class 5.1), which under certain conditions can thermally decompose generating some toxic gases (NOx) and, when heated under strong confinement, may decompose violently. AN is a strong oxidising agent that will sustain combustion as it produces oxygen as one of its decomposition products.

AN prill occurs in two forms – porous prill (PPAN) which is designed to absorb fuel oil in the manufacture of ANFO and dense prill (HDAN) that is generally used to manufacture AN solution. AN prill is hydroscopic and therefore small amounts of additives are added as a prill coating to reduce the chance of consignments of AN forming into lumps. These anti-caking agents need to be carefully controlled to ensure that they do not sensitise the AN (i.e. effectively adding a fuel) that can increase the sensitivity of AN to heat. This control is performed at the source factory and every incoming shipment is accompanied by a Certificate of Analysis / Conformance.

For decomposition to occur, the temperature of the AN must be increased well above its melting point of 169°C. Decomposition proceeds with both endothermic reactions and exothermic reactions occurring simultaneously. In the decomposition process, the solid material is converted into a gas. If the AN is not confined, the decomposition can achieve a steady state temperature of approximately 292°C at one bar pressure. This is a self-sustaining decomposition that will generate mainly NOx and ammonia fumes.

However, in certain extreme circumstances the reaction may run away when the heat generated exceeds the heat lost. This is difficult to achieve due to both the low decomposition rates of pure AN and the endothermic reaction effect when the material is unconfined. For a runaway reaction to occur the material has to be strongly confined which allows the exothermic reaction effect to dominate and the pressure builds up accelerating the reaction. On the HVO plant there will be pressure relief valves on tanks and temperature gauges linked to the PLC control system to ensure that overheating or overpressure cannot occur.

Another hazard is the sensitising contamination of solid AN either in manufacturing or in storage (e.g. by mixing with sensitising materials) which in some circumstances can lead to an increase in the risk of decomposition / explosion. Typical contaminants are organic compounds such as spilled fuel oil, acids and other oxidising agents. On the HVO plant there will be strict protocols to ensure that incompatible materials are stored separately.

AN prill is classified as a Security Sensitivity Ammonium Nitrate (SSAN).

4.2 Ammonium Nitrate Emulsion - ANE (Oxidizing Agent Class 5.1 UN3375)

ANE is a viscous fluid containing ANSOL, fuel oil and emulsifiers. Under certain conditions ANE may thermally decompose generating some toxic gasses (NOx). ANEs are not flammable, and do not burn at the range of pressures experienced in manufacture, storage, and handling.

ANE is a Division 5.1 oxidiser. The ANE manufactured at the proposed HVO facility are not classed as explosives. The formulations have successfully passed the UN Series 8 tests (a, b, c and d) that allow these mixtures to be classified as a non-explosive pre-cursor and transported as such. ANE to be manufactured at the HVO facility are classified as UN 3375, a 5.1 Oxidising Agent.

The main hazard associated with ANE is decomposition due to excessive heating and/or contamination which can cause accelerating decomposition to the point where explosion or detonation can occur, especially if the decomposing gases are sufficiently confined (e.g. in an inadequately vented storage tank, pump, process vessel etc.).

In processing of ANE the main hazards occur in pumping. It is essential that the ANE is not allowed to overheat in the pumping process through deadheading or dry running of the pump. For this reason, the international explosives industry has developed guidelines for pumping ANE. These guidelines and pump standards will be implemented at the HVO facility

Sensitivity to accidental decomposition/detonation is increased by the presence of energetic sensitising materials or chemical contaminants. ANE is insensitive to friction, impact, and sparks.

ANE is a poor conductor of heat and contains a high water content, which acts as a heat sink in the event of the material being heated in a fire. ANE is very difficult to heat due to the high water content.

ANE is classified as a Security Sensitivity Ammonium Nitrate (SSAN).

4.3 Ammonium Nitrate Solution - ANSOL (Oxidizing Agent Class 5.1)

Hot concentrated ammonium nitrate solutions (>60%) are Division 5.1 oxidising agents and are a hot clear liquid routinely found at temperatures up to 130°C in factory environments. Burns from oxidiser solutions are very severe as they are both thermal and chemical burns. High concentration ANSOL (above 80%) can thermally decompose under certain conditions such as change in pH or water content. Some of the gaseous products of ANSOL decomposition are toxic (various NOx gases).

At the HVO facility, the maximum temperature of the ANSOL manufactured will be 90°C and the target concentration is approximately 75%.

Certain contaminants and incompatible chemicals can catalyse the decomposition of ANSOL. Contaminants that may increase the risk of decomposition include acids, chlorides, organics, alkali metals, and nitrites.

ANSOL does not burn but, as an oxidising agent, it will support fire, even in the absence of an external source of oxygen. ANSOL is insensitive to friction, impact, and sparks.

ANSOL is not classified as a Security Sensitivity Ammonium Nitrate (SSAN).

5. SCHEDULE OF CHEMICALS AND RAW MATERIALS

5.1 Schedule 15 Chemicals

Table 1 shows the Schedule 15 chemicals that will be stored on site. All the Schedule 15 chemicals are below the Major Hazard Facility (MHF) threshold levels. The facility is therefor not a Major Hazard Facility under the NSW Work Health and Safety Regulation 2017

Table 1: Inventory of Schedule 15 Chemicals

Material	UN No.	DG Class	Threshold (t)	Quantity Stored (t)	% Threshold	Type of Storage
Porous Prilled AN and High Density AN (PPAN & HDAN)[1]	1942	5.1	2,500	200	8	PPAN 100 t transit bin HDAN 100t bagged stack
Ammonium Nitrate Emulsion (ANE)	3375	5.1	200	140	70	2 x 70t tanks
Diesel oil		C1 Combustible Liquid	50,000	70	<1	Self-bunded trans tank in a concrete bund

Note 1 - Existing storage license for AN is 115 t. Proposal to increase by 30 t.

Table 2: Other Raw Materials to be Used and Stored on Site

Material	Type	Quantity	Type of storage (TBC)
Diesel oil	C1 Combustible Liquid	74,000L	Self-bunded trans tank in a concrete bund
Surfactant	Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code)	40,000L	1,000lt IBC stored in a concrete bund
Sodium Nitrite	Class 5.1 PGIII UN1500	5,000kg	25kg Bags on pallets stored in a Designated Storage Container
Gassing Solution	Class 5.1 PGII UN3099	10,000L	1,000L IBC stored in a designated concrete bund
Thiourea	Class 9 Miscellaneous Dangerous Goods PGIII UN3077	5,000kg	25kg Bags on pallets stored in a Designated Storage Container
Acetic Acid	Class 8 PGII UN2790	5,000kg	1,000L IBC stored concrete floor bund within the manufacturing shed
Sodium Acetate	Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code)	5,000kg	25kg Bags on pallets stored in a Designated Storage Container
Urea	Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code)	20,000kg	1t bulka bags stored on earthen pad under tarpaulins.
ANSOL	Class 5.1 PGIII UN2426	80,000lt	2 x 30,00lt Tanks 2 x 10,000lt Tanks

6. HAZARD AND RISK ASSESSMENT APPROACH

6.1 Hazard and Incident Identification

This section describes the risk and hazard analysis approach that HVO proposes to use to assess hazards and risks. This is an integrated process for safety assurance that follows the guidance in the NSW Assessment Guideline, Multi-level Risk Assessment (2011). The risk assessment and hazard analysis approach will also be compliant with the guidelines and recommendations in NSW HIPAP 4 and 6.

The risk assessment and hazard analysis process for the HVO facility will include the following elements:

6.1.1 High Level risk Assessment

HVO is planning to engage an experienced and reputable explosives manufacturer (technology vendor) to design and build the ANE manufacturing facility. The initial risk assessment will be based on vendor's experience in designing and building modular, containerised ANE plants of the type to be built on the HVO site. The plant design will be based on a proven plant design used in Australia and around the world. The outcome of the risk assessment process will provide the broad design and operating principles for the HVO facility.

HVO will ensure that learnings from explosives incidents that have happened all over the world are incorporated in the initial high level risk assessment for the HVO plant.

The chosen technology vendor will have extensive engineering and technical resources with deep experience in hazard identification and risk assessment. HVO will ensure that these resources are actively involved in the initial risk assessment process and participate in ongoing risk assessments conducted internally and facilitated by external consultants.

6.1.2 Detailed Review of Existing Risk Assessments

This detailed risk assessment process will be built on the outcomes generated by the high level risk assessment. In this phase, HVO, in partnership with the technology vendor, will conduct a rigorous review of the Hazard Studies for similar facilities around the world and this detailed knowledge was used in the final design of the HVO facility, the control systems and the operating processes implemented in the plant. These hazard studies were all conducted using cross functional teams from HVO, technology vendor and external consultants.

6.1.3 HVO Specific Hazard Studies

Although the emulsion production module is based on a standard containerised design, there are specific requirements implanted in the final plant design and layout to meet Australian standards and market needs. The HVO facility will therefore be subjected a detailed Explosives Hazard Study process. This was originally developed by ICI (UK) and has been widely implemented across the explosives industry worldwide. The HVO process will be conducted by a multi-disciplinary team including HVO, the technology vendor, and external experts.

6.1.4 Broad Brush Risk Assessment

Upon commissioning of the facility, a broad-brush risk assessment will be conducted to assess the operational requirements and to ensure that all major risks have been identified and managed in the day to day operation of the facility. The broad-brush risk assessment would cover the following key areas:

- Personnel Management
- Safety & Health
- SSAN Store & Load Out Operations
- Manufacture ANE
- Security
- Environment
- Emergency Management
- Laboratory use

6.2 Identification of Key risks

Based on a review of containerised ANE plants, HVO has identified the key risks that are likely to apply to the HVO facility.

International experience shows that uncontrolled heating of ammonium nitrate and ammonium nitrate mixtures can result in explosions and is a key risk in the manufacture of ANE. The main causes of uncontrolled heating arise from:

- ANE pumps overheating,
- Fires under ANE storage tanks,
- Ammonium nitrate emulsion mixtures being overheated and allowed to dry out,
- Contamination of solid ammonium nitrate causing a run–away decomposition, and
- Fires near ammonium nitrate storage areas.

In line with international guidelines, key risks are framed around the potential for uncontrolled heating of ANE and solid ammonium nitrate and the control measures to avoid overheating. There is a considerable body of knowledge from HAZOP studies and risk assessments conducted on containerised ANE plants. Table 3 shows key risk scenarios and control measures that would be implemented in the HVO plant. Hazard studies and risk assessments will be conducted on all manufacturing and operational elements in the HVO plant to ensure that critical controls are adequate and that risks have been reduced so as far as is reasonably practicable (SFARP).

Table 3: Key Risk Scenarios for the HVO Facility

Operational Element	Process Description	Hazards	Consequence	Controls
ANE Manufacture - emulsion pumping	High pressure pumping of ANE thorough static mixers	PC pump over pressure/ overheating	Explosion of ANE in process	High pressure & temp trips on PC pumps
ANSOL Mixing	Transfer of AN prill via auger and dissolving of AN in water	Overheating	Fire	Control systems & trips on heating circuit and boilers
AN Delivery	Loading AN to storage from truck	Truck/Auger fire	Fire	Accredited DG contractor Maintenance procedures

AN Storage	Bulk storage of HDAN bulka bags in 130t stack and 95t PPAN in transit bin	Truck or bushfire Contamination with incompatible materials	Explosion of AN storage	Accredited DG contractor Separation of incompatible materials
ANE Storage	Storage of finished ANE in two 90t tanks prior to loading on tanker	Fire under tank	Explosion of ANE storage	Plant design ensures fuels cannot pool under ANE tanks
ANE Load Out	Pumping of ANE from tanks to road tanker for transport to mine	Pump over pressure/overheating	Explosion of ANE storage	Pump temp trips Bursting disk

6.3 Critical Controls

In line with international explosives industry best practices and specific knowledge from the technology vendor, the following critical control system will be implemented at the HVO facility:

6.3.1 Pump Safety Systems

The highest risk element of ANE manufacture involves the high pressure of ANE in mixers and static mixers. The international explosives industry has adopted pump standards that define the required pump specification and the types of safety systems that need to be installed to ensure safe operation of ANE and ANSOL pumps. The pump standard to be implemented at the HVO facility will be in accordance with The Australian Explosives Industry and Safety Group (AEISG): *Code of Practice Ammonium Nitrate Emulsions, Suspensions or Gels - ANEs (UN3375), Edition 5, 2018* which specifies requirements for pumps used for ANE.

Pump safety systems are a critical control in the manufacture of ANE. The key requirement is that the pump should have a pump protection system to detect and prevent dead-heading (high pressure), dry operation (low flow) and or high temperature.

6.3.2 Process Temperature Control

Steam boilers or thermal oil heaters will used for heating of the ANSOL tanks. A PLC system will control the heating process to ensure that the ANSOL temperature does not exceed 90 C.

In addition to heating sensors, the ANSOL tanks will have independent analogue temperature indicators that allow operators to monitor temperature during the manufacturing process.

Any fault or failure in the temperature control resulting in elevated solution temperature could be identified by the operator using the independent temperature gauges.

The steam boilers or thermal oil heating system will be commercial units with full safety monitoring systems and trips linked to the plant PLC control system.

6.3.3 Programmable Logic Controller (PLC)

The ANE manufacturing plant will be operated using a single Programmable Logic Controller (PLC). It will consist of an engineered set of hardware and software controls which are used to manage ANSOL and fuel blend preparation as well as ANE manufacture. This means that a minimal level of operator manual input is required to operate these processes.

There will be up to three Human Machine Interface (HMI) control panels for the PLC . One is in the ANSOL makeup area and two in the area where the emulsion is formed. ANSOL and fuel blend preparation along with the ANE manufacture process can be controlled by any one of these screens.

The PLC system is linked to a hardwired trip system to ensure that once a process is up and running and an operational problem occurs, the system will revert to a "Safe State" (i.e. manufacturing stops and all upstream systems are placed into recirculation or stopped) to avoid adverse safety, health and environmental (SH&E) consequences).

The processes within the manufacturing plant managed by the PLC system are:

- Pumping of ANSOL, fuel blend and pre-emulsion,
- ANSOL mixing and heating,
- Fuel blend preparation,
- Blending and refinement of emulsion,
- Control of the flow and quantities of raw ingredients,
- Displays of temperature, high and low pressure, and level sensors, and
- Display of alarms when triggered by hard wire trip system.

Operator intervention will be required to open and close valves to tanks and to load AN via the auger into the ANSOL tank. The PLC monitors these operations and alarms are triggered if a change in pre-set conditions occur.

The process parameters controlled by the PLC system cannot be changed by operators or any other personnel. Any changes to the PLC program can only be changed by an authorised control engineer from technology vendor’s engineering team under the auspices of the Management of Change procedure for the HVO facility.

The critical trips such as temperature and pressure sensors will be linked to the PLC but operate independently of the PLC system. In the event of a fault, the trips will send an alarm to the PLC control panel and stop all upstream & downstream process’ independently (see below).

6.3.4 Programmable Logic Controller (PLC) – ANE Load Out

There will be a standalone PLC control system with control panel at the ANE load out area that manages the pumping of ANE from the two 90 t tanks to a delivery tanker. This PLC monitors temperatures and pressures in the transfer pump and has a 5 minute time-out that needs to be reset.

The system is designed to shut down if any of the temperature, pressure and level trips are faulty or fail. Operators cannot bypass the system or any of the trips and operate it in a manual mode.

Any changes to the PLC program can only be changed under the auspices of the Site Management of Change procedure.

6.3.5 High Level Protection on ANSOL Tanks

The ANSOL tanks will use high level switches that are wired to the PLC. The high level switch identifies when the ANSOL tank is at 90% and isolates the water addition valve and, if in Transfer mode, the ANSOL Transfer pump.

6.3.6 Emergency Stops

Emergency stop buttons will be provided in locations throughout the plant. Emergency stop buttons cut power to the manufacturing and transfer operations, effectively stopping all mixing, heating, pumping, or blending activities which may be the source of any unwanted high temperature or high pressure.

Each individual piece of equipment has an individual E-Stop fitted. There will be additional Emergency Shutdown E-Stops throughout the facility that shut down the entire manufacturing process (aside from the water pump as it is required to utilise fire hose reels).

6.3.7 Emergency Response Plan

The Emergency Response Plan is designed to mitigate the consequence of a major incident occurring on the manufacturing facility site. Reduction of consequences is achieved through evacuation. A critical element of the Emergency Response Plan is to have a credible evacuation plan that will ensure that there will be a high likelihood that within 45 minutes of the evacuation being initiated there is no person within a Protected Class B (PWB) distance from the plant. This means the plant Emergency Response Plan will be fully integrated with HVO mine site emergency procedures and systems like alarms and emergency communications.

6.3.8 Housekeeping

Site procedures require a high standard of housekeeping to ensure that incompatible materials are separated and stored appropriately. Housekeeping inspections will be conducted weekly. Waste management procedures will prevent the build-up of waste on site.

6.3.9 Operator Presence and Competency

Manufacturing and transfer activities undertaken at the HVO site are continually manned, i.e. operators are present at all times. In particular:

- Competent operators will always present within the ANE manufacturing area during the manufacturing process.
- Competent operators will always present during the ANSOL manufacturing and transfer processes,
- Competent operators will always present during ANE load out to delivery tankers,
- Competent delivery driver will always be present during filling of diesel storage tank, and
- Competent operator will be present during delivery of bulk AN.

Operational control measures for manual tasks and operation of the PLC system will be for operators to follow operating instructions. A comprehensive set of operational instructions for the plant and site operations will be developed. A training needs analysis will be developed for each operator and training in the required operational procedures conducted. Records of the training needs analysis, copies of procedures and training assessments will be held for each operator.

6.3.10 Site Security

The ANE production and storage facility will be fenced with locked gates to ensure the security of Security Sensitive Ammonium Nitrate (SSAN) stored on the site. Suitable security monitoring systems like cameras and alarms will be installed. Site security will be integrated with the HVO mine security and communications system.

7. SAFETY MANAGEMENT SYSTEM

A comprehensive Safety Management System (SMS) will be developed for the HVO facility. This document will describe all the policies, standards, processes, and procedures for the safe and efficient operation of HVO facility. This system will be specifically developed for Australian requirements from systems developed by the technology vendor and HVO.

Table 4 below shows how the requirements of the SMS may be addressed by policy and procedure documents. Each of these elements will be a defined process with reference to procedures and forms in supporting management systems.

Table 4: Typical SMS Elements and Links to other Systems and Procedures

SMS Requirement	How Addressed
Leadership, management, accountability, and commitment	• Health & Safety Policy • Accountability & Responsibility • Responsibility Matrix • Management Review • Delegation of SHE Responsibilities
Hazard and risk management	• Risk management • Engineering Design and Risk Analysis • Hazard Reporting
Information and documentation	• Integrated Management System
Design and construction	• Basis of Safety • Engineering Design and Risk Analysis
Incident management	• Incident Management • Incident Investigation and Reporting • Incident Reporting Matrix
Management of change	• Change Management • Clearance Certificate & Permit to Work
Contractor management	• Subcontractor Management
Emergency preparedness and response	• Incident and Emergency Procedures
Purchasing	• Purchasing
Asset Integrity	• Scheduled Maintenance • Defect Management
Systems of work	• Systems of work
Personnel	• Training/Competent People • Training Needs Analysis • Communication& Consultation • Site Authorisations
Monitoring, auditing, review, and improvement	• Continual Improvement • Performance Standards & Metrics • Inspections and Audits • Objectives and Targets
Health and fitness for work	• Occupational Health
Environment and waste management	• Care for the Environment

8. RISK ASSESSMENT AND CONSEQUENCE ALALYSIS

8.1.2 Risk Scenarios

The risk scenarios that will be considered are:

Explosion of ANE during manufacturing (30 kg in process)

The continuous ANE manufacturing process proposed for the HVO facility minimises the amount of in-process ANE in the system (in pumps, pipes and mixers). It is estimated that the amount of in-process ANE during production will be approximately 30kg. In the scenario it is assumed that explosion of in-process ANE would occur *without warning*. This is the worst case scenario. In practice, prior warming would be provided by the control systems on the plant linked to the PLC control system and alarms.

Explosion of AN storage as a result of fire (100 t of AN)

It is unlikely that an entire storage would explode, however, for the sake of completeness this has been considered as a criterion for consequence analysis. In the scenario it is assumed that explosion of the AN storage would occur *with warning*.

Explosion of ANE storage as a result of fire (2x 70 t of ANE tanks separated by earth mound)

The industry reference case is the incident at Porgera (PNG), where burning fuel engulfed tanks storing ANE that eventually exploded. The HVO facility will be designed such that ANE storage and fuel are separated and that even a fuel spill from the manufacturing rig cannot flow or be directed to the ANE storage tanks. The two ANE storage tanks are separated by 20m with an earth mound in between which is designed to stop any propagation between ANE tanks. The explosion of one 70 t tanks (ie total of 70 t) has been considered as a criterion for consequence analysis. In the scenario it is assumed that explosion of a single ANE storage tank would occur *with warning*.

8.1.3 Risk Assessment Process

The risk assessment process will follow the standard explosives industry process recommended in SAFEX Good Practice Guide GPG-02. The process steps are:

- Determine the TNT Equivalence of materials involved (AN and ANE)
- Based on the quantities of materials, determine the Net Explosives Quantity (NEQ) for AN and ANE
- Calculate the distance to the Maximum Allowable Overpressures for the various exposed locations and buildings. If the distance is equal or greater than the distance to the Maximum Allowable Overpressures, then an adequate buffer zone exists between the location of the potential explosive event and the exposed site then there is no need to continue the risk assessment process.

8.1.4 Risk Assessment Assumptions

The separation distance between the AN and ANE storages will be 46 m with an earth mound in between ANE tank and AN transit bin. This meets the requirements of AS2187.1. Therefore, it is assumed that should explosion of an AN store or ANE store occur, there would be no knock-on effect leading to sympathetic explosion of the other stores. There are therefore three potential explosive sites (PES) :

- PES1: AN storage with a NEQ of 32 t,

- PES2: ANE storage with a NEQ 56 t (2x 70 t ANE tanks separated by 20m with an earth mound in between each tank. 1x 70 t ANE tank included in NEQ calculation). This separation distance meets the requirement of AS2187.1 so that the two ANE tanks can be considered as separate storages.
- PES3: In-process ANE with NEQ of 0.024 t

In the case of the explosion of ANE in-process, the separation distance from the mounded ANE storage tanks and the mounded AN stores will be adequate to prevent sympathetic explosion of AN and ANE stores. The layout of the plant has been designed such that a safe, minimum separation will be achieved.

PES2 (explosion of ANE storage) has the highest NEQ and will be used to confirm that external separation distances are adequate.

Table 5. Potential Explosives Site (PES) Aggregate Quantities

PES	Material	TNT Equivalence	Quantity (t)	NEQ (t)	Total NEQ (t)
1	**HDAN Store**	0.32	100	32	32
	PPAN - Store	0.32	100	32	32
2	**ANE - Store**	0.8	70	56	56
3	**ANE - in process**	0.8	0.03	0.024	0.024

8.1.5 Séparation Distances (Quantity Distances – QD)

An exposed site (ES) is defined in the SAFEX Good Practice Guide GPG-02 and the Australian Explosives Industry Safety Group (AEISG) Code of Practice for Ammonium Nitrate Emulsions (ANE) as infrastructure or a building where people may be exposed to blast effects, or critical public infrastructure like railway lines, powerlines etc that may be damaged by blast effects.

Exposed sites are classified as Protected Works A, B or as a Vulnerable Facility. ANE Associated Works are offices, workshops, stores, ablutions, that are directly associated with the operation of the ANE premises.

Protected Works Class A include the following:

- Public street, road or thoroughfare, railway, navigable waterway, dock, wharf, pier or jetty, marketplace, public recreation and sports ground or other open place where the public is accustomed to assemble,
- Open place of work in another occupancy, river-wall, seawall, reservoir, water main (above ground), radio or television transmitter, main electrical substation, and
- Private road which is a principal means of access to a church, chapel, college, school, hospital, or factory.

Protected Works Class B include the following:

- Dwelling house, public building, church, chapel, college, school, hospital, theatre, cinema or other building or structure where the public is accustomed to assembling,
- Shop, factory, warehouse, store, building in which any person is employed in any trade or business, depot for the keeping of flammable or dangerous goods, and
- Major dam

Vulnerable Facility includes, but is not restricted to, the following:

- Multistorey buildings, e.g. above 4 storeys,
- Large glass fronted buildings of high population,
- Health care facilities, childcare facilities, schools,
- Public buildings or structures of major historical value,
- Major traffic terminals, e.g. railway stations, airports, and
- Major public utilities, e.g. gas, water, electricity works.

Appendix 1 show lists of exposed sites, infrastructure and the location of the plant and surrounding infrastructure for Locations A and B.

Tables 6 and 7 show the required and actual separation distances from the plant for Locations A and B for PES2 and 3. The required separation distances for ANE Associated Works and Protected Works A and B are taken from the AEISG ANE Code which references AS2187.1. An evacuation process will be incorporated the Emergency Plan for the plant and this will be integrated into the mine emergency plan and communications system.

8.1.6 Quantity – Distance Table for Location A

Table 6 shows the required and actual separation distances for the exposed sites from the potential explosion sites PES 2 and 3 for Location A. There are no Vulnerable Facilities within exclusion zone. In all cases, the exposed sites are located further away from the PES with the highest NEQ (ANE storage) than the required separation distances in the AESIG ANE Code and AS 2187.1. Therefore, no further risk analysis is required. Since the separation distance for the ANE storage meets the requirements of the standards, the separation distance for the AN stores also complies.

In the case of HVO mining facilities classed as Protected Works B, the AEISG code states that for *with warning scenarios*, no minimum separation distance is required if there is a credible evacuation plan in place and the mine operators are involved in the relevant emergency response procedures and plans. To ensure that this applies on the HVO site, the mine operators will be fully integrated into the emergency plan for the ANE facility.

Table 6. Required and Actual Separation Distances between Potential Explosive and Exposed Sites 2 and 3 for Location A.

Type	ES	PES	Distance from Plant (m)		
			Required	Actual	Met?
ANE Associated Works	ANE storages	ANE in-process	5 mounded	>5	Y
	AN storages		5 mounded	46	Y
	Plant Lunchroom, toilet		<18	>18	Y
Protected Works Class A (PWA)	Public Transmission Line	ANE Store	564	1,415	Y
	South Lemington Rail Loop			2,368	Y
	Hunter River			1,033	Y

Protected Works Class B (PWB)	Nearest House	ANE Store	846	1,490	Y
	Hunter Valley Gliding Club Runway & Clubhouse		846	3,828	Y
Vulnerable Facility	Nil	ANE Store	1,623	>2,237	Y

8.1.7 Quantity – Distance Table for Location B.

Table 7 shows the required and actual separation distances for the exposed sites from the potential explosion sites PES 2 and 3 for Location B. There are no Vulnerable Facilities within exclusion zone. In all cases, the exposed sites are located further away from the PES with the highest NEQ (ANE storage) than the required separation distances in the AESIG ANE Code and AS 2187.1. Therefore, no further risk analysis is required. Since the separation distance for the ANE storage meets the requirements of the standards, the separation distance for the AN stores also complies.

In the case of HVO mining facilities classed as Protected Works B, the AEISG code states that for *with warning scenarios*, no minimum separation distance is required if there is a credible evacuation plan in place and the mine operators are involved in the relevant emergency response procedures and plans. To ensure that this applies on the HVO site, the mine operators will be fully integrated into the emergency plan for the ANE facility.

Table 7. Required and Actual Separation Distances between Potential Explosive and Exposed Sites 2 and 3 for Location B.

Type	ES	PES	Distance from Plant (m)		
			Required	Actual	Met?
ANE Associated Works	ANE storages	ANE in-process	5 mounded	46	Y
	AN Storage		5 mounded	46	Y
	Plant Lunchroom, toilet		<18	>18	Y
Protected Works Class A (PWA)	Archerfield Rd & Comleroi Rd intersection	ANE stores	564	1,545	Y
	Hunter River			2,398	Y
Protected Works Class B (PWB)	Nearest House – Comleroi Road	ANE stores	846	2,082	Y
	Hunter Valley Gliding Club Runway and Clubhouse			848	Y
Vulnerable Facilities	None	ANE stores	1,623	>2,000	Y

8.1.8 Consequence Analysis

In compliance with the requirements of NSW HIPAP 6, the consequence of the explosion of AN and ANE has been assessed. The consequence analysis is based on the acceptable explosion overpressure at the exposed sites to minimise injuries to people and damage to infrastructure. The maximum allowable overpressures are taken from NSW HIPAP 4. This is the recognised standard to ensure an acceptable safety level in relation to the overpressures if a high consequence explosion of AN and ANE occurs.

Table 8. Maximum Allowable Overpressure for Exposed Sites (NSW HPIP 4)

Type of Infrastructure/Facility	Maximum Allowable Overpressure
Associated Works	21 kPa
Protected Works Class A	14 kPa
Protected Works Class B	7 kPa

For both Locations A and B, the overpressure at the external exposed sites will be lower than the maximum allowable overpressure pressure because the exposed sites are further away than what is required in the AESIG ANE Code and AS2187.1. The level of risk for both Options A and B is tolerable and meets the acceptable risk criteria in HIPAP 4.

9. CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this review applying to both Location A and B are as follows:

1. The plant is not a Major Hazard Facility under the NSW Work Health and Safety Regulation 2017.

2. The proposed ANE manufacturing facility is based on standard, proven ANE manufacturing technology that has been licensed elsewhere in Australia and overseas. No major incidents have been reported. Appropriate safety control systems and procedures have been incorporated into the plant design in accordance with international explosives industry best practice and the AEISG ANE Code with specific reference to use of earth mounds outlined in section 6.1 of the Code.

3. The key hazards and risks scenarios for the plant have been identified and appropriate explosives industry control measures will be put in place to ensure that the overall risk can be reduced so far as is reasonably practicable (SFARP)

4. There are adequate separation distances between the ANE manufacturing process and the mounded AN and ANE storages and the lunchroom on the plant.

5. The operators of the HVO mine will be fully integrated into the emergency plans and procedures for the ANE plant. This meets the requirements of the AEISG ANE code for *with warning* explosive materials (AN and ANE). In this case no minimum separation distance is required and proposed separation distances are acceptable. A credible evacuation plan will be developed and incorporated into the Emergency Plan for the plant. Evacuation plans will be integrated into the mine's emergency plan and communication system.

6. There are adequate buffer zones between the plant and external public infrastructure in accordance with the AEISG ANE Code and AS2187.1

7. A comprehensive Safety Management System will be developed for the HVO facility.

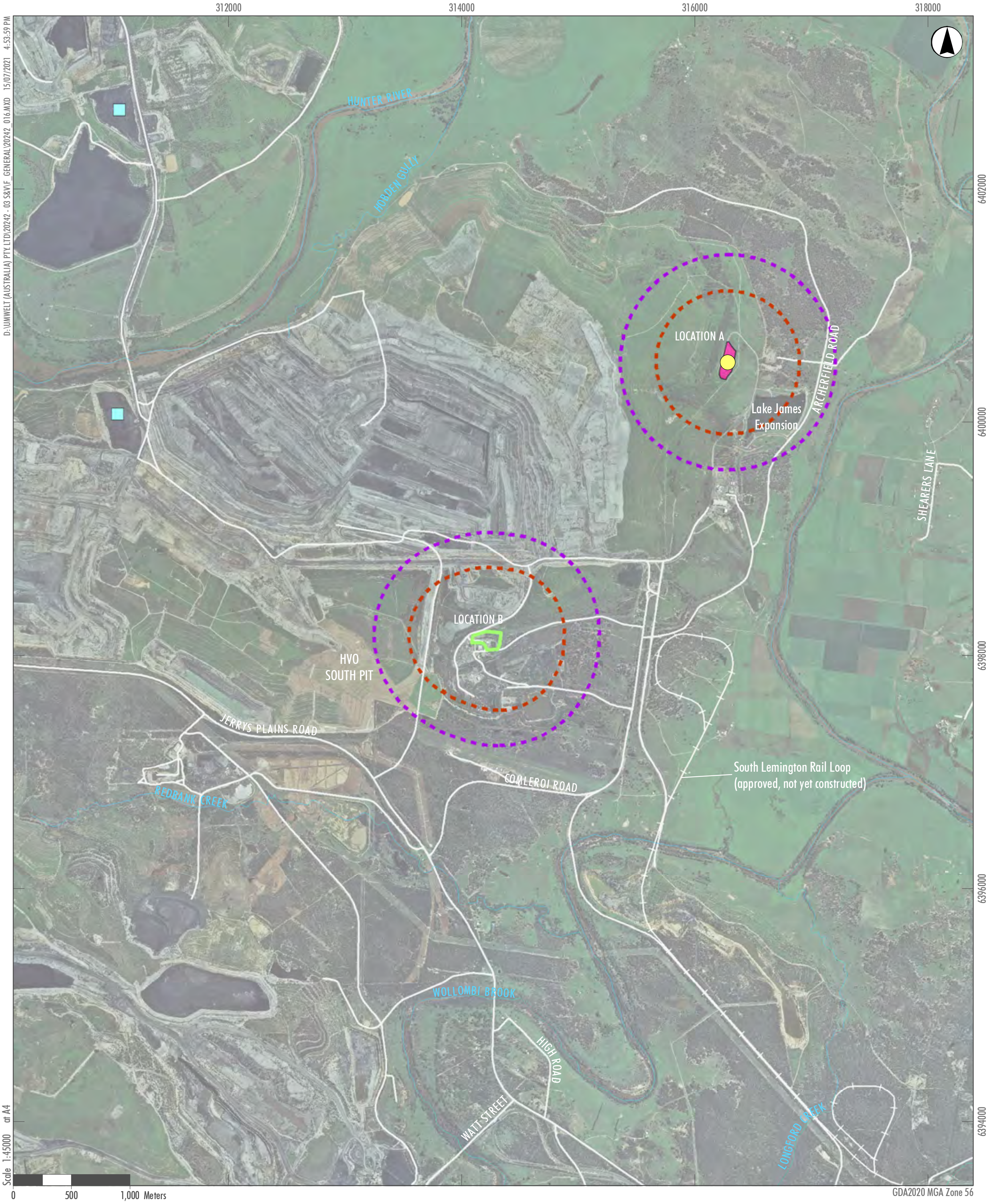
APPENDIX 1: PROPOSED LOCATIONS OF ANE PLANT

Location A – Separation Distances

Infrastructure type	Identification	Distance from Plant (m)	Type
Utilities (HVO)	Transmission Line	90	Mine infrastructure - not ES
Utilities (HVO)	Transmission Tower	2,516	Mine infrastructure - not ES
Utilities (Public)	Transmission Line	1,415	PWA
Dwelling	Receptor ID 795	2,685	PWB
Dwelling	Receptor ID 794	2,226	PWB
Dwelling	Receptor ID 793	2,263	PWB
Dwelling	Receptor ID 397	2,472	PWB
Dwelling	Receptor ID 804	2,336	PWB
Dwelling	Receptor ID 805	2,249	PWB
Dwelling	Receptor ID 787	2,184	PWB
Dwelling	Receptor ID 895	1,812	PWB
Dwelling	Receptor ID 783	1,798	PWB
Dwelling	Receptor ID 238	1,832	PWB
Dwelling	Receptor ID 240	2,036	PWB
Dwelling	Receptor ID 158	2,060	PWB
Dwelling	Receptor ID 156	2,031	PWB
Dwelling	Receptor ID 157	2,054	PWB
Dwelling	Receptor ID 155	2,087	PWB
Dwelling	Receptor ID 242	2,314	PWB
Dwelling	Receptor ID 792	2,687	PWB
Dwelling	Receptor ID 243	2,247	PWB
Dwelling	Receptor ID 154	1,490	PWB
Mine Infrastructure Area	HVO South Mine Infrastructure Area	890	Evacuation plan
Mine Access Road	Archerfield Road	786	Mine infrastructure - not ES
Public Facility	Hunter Valley Gliding Club	3,828	PWB
Waterway	Hunter River	1,033	PWB
Reservoir	Lake James Extension (Proposed as Part of HVO South Continuation Project)	419	Mine infrastructure - not ES

Location B – Separation Distances

Infrastructure type	Identification	Distance from Plant (m)	Type
Utilities (HVO)	Transmission Line	15 (11kv) 139 (66kv)	Mine infrastructure - not ES
Utilities (HVO)	Transmission Tower	15 (11kv) 139 (66kv)	Mine infrastructure - not ES
Utilities (Public)	AusGrid SUB5700	404	Mine infrastructure - not ES
Utilities (Public)	TransGrid Transmission Line – UYWJV Proposed Easement	1267	PWA
Mine Infrastructure Area	HVO South Pit	339	Mine infrastructure - not ES
Public Road	Archerfield Road and Comleroi Road intersection	1545	PWB
Public Facility	Hunter Valley Gliding Club Boundary	848	PWB
Waterway	Hunter River	2398	PWB
Reservoir	Lake James Extension (Proposed as Part of HVO South Continuation Project) Southern Spillway	2803	Mine infrastructure - not ES
House	Nearest House – Comleroi Road	2082	PWB



Legend

- Proposed HVO ANE Plant Assessment Location A
- Proposed HVO ANE Plant Assessment Location B
- Existing AN and ANE Storage Pad
- Coal Stockpile Area

Required Separation Distances (in accordance with AEISG Code)

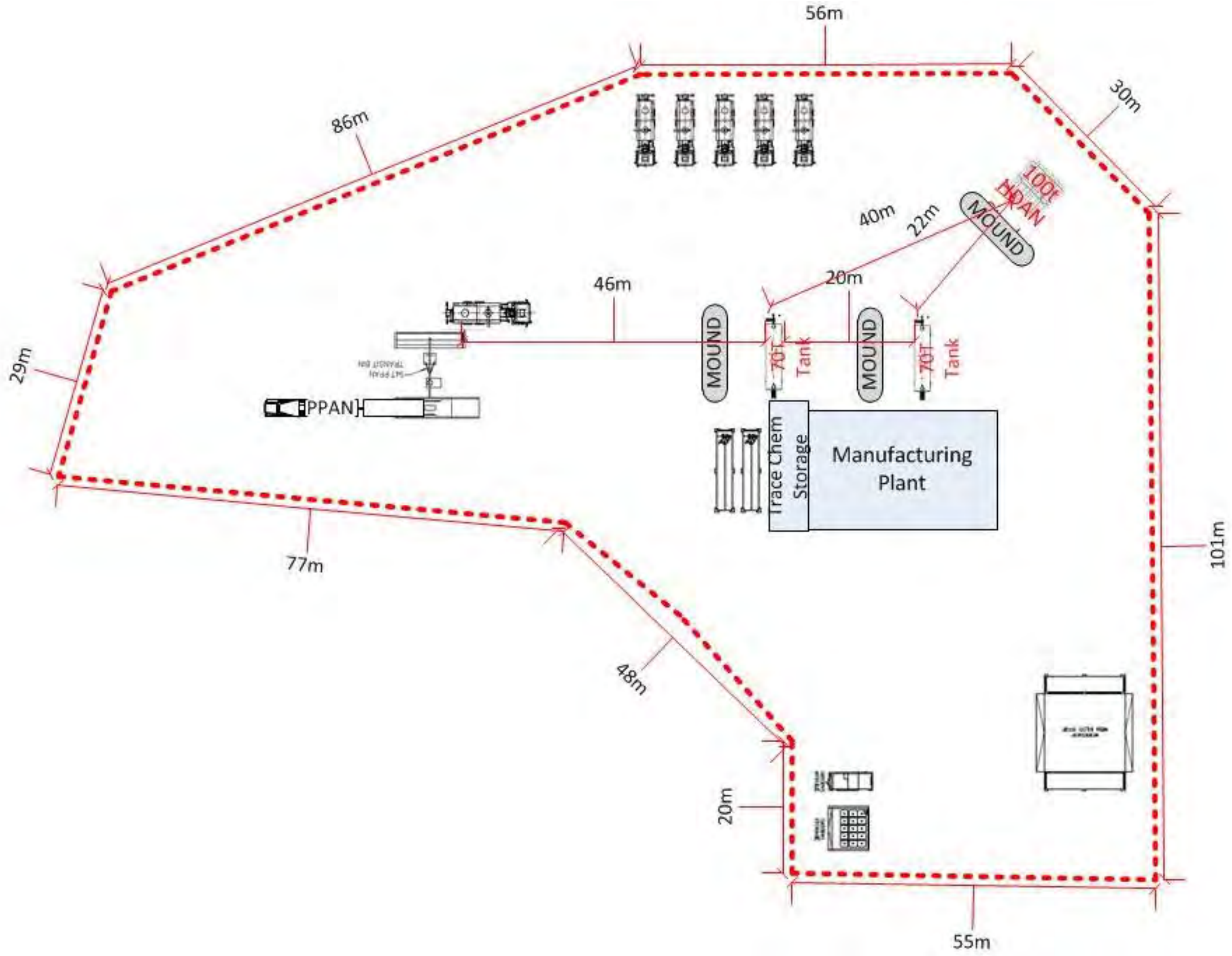
- Protected Works A (546m)
- Protected Works B (846m)

FIGURE 1

Proposed Modification

Image Source: ESRI Base Maps 2020 Data source: HVO 2021

APPENDIX 2: PROPOSED PLANT LAYOUT



APPENDIX C

Traffic Assessment

Memorandum

14 July 2021

To	Hunter Valley Operations		
Copy to	Kirsty Davis, Daniel Sullivan, Andrew Speechly and Paul Youman		
From	Mark Leigh-Lucas	Tel	+61 2 92397141
Subject	Proposed Ammonium Nitrate Emulsion Plant: Traffic Assessment	Job no.	12554303

1 Introduction

1.1 Background

GHD have been commissioned by Hunter Valley Operations (HVO) to undertake a Traffic Assessment for the proposed Ammonium Nitrate Emulsion (ANE) Plant at the HVO.

HVO is an open cut coal mining complex that is located approximately 25 kilometres north-west of Singleton. The mine operates across two sites, HVO South and HVO North, which are separated by the Hunter River, and operate as a single complex.

HVO is seeking to lodge an application for the development of a ANE manufacturing plant within the HVO South mine site.

ANE is typically used in blasting, by reducing deterioration in explosive material associated with the presence of water in blast holes. HVO is currently seeking to improve the reliability of the access to ANE, to support required blasting activity, particularly during and after periods of precipitation.

Two suitable sites for the ANE plant have been identified within HVO south (Location A and Location B), as displayed in **Figure 1-1**. The two potential locations were identified, accounting for a number of factors, including access, terrain and separation from public buildings/infrastructure. It is only intended to use one location at a time.

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Memorandum

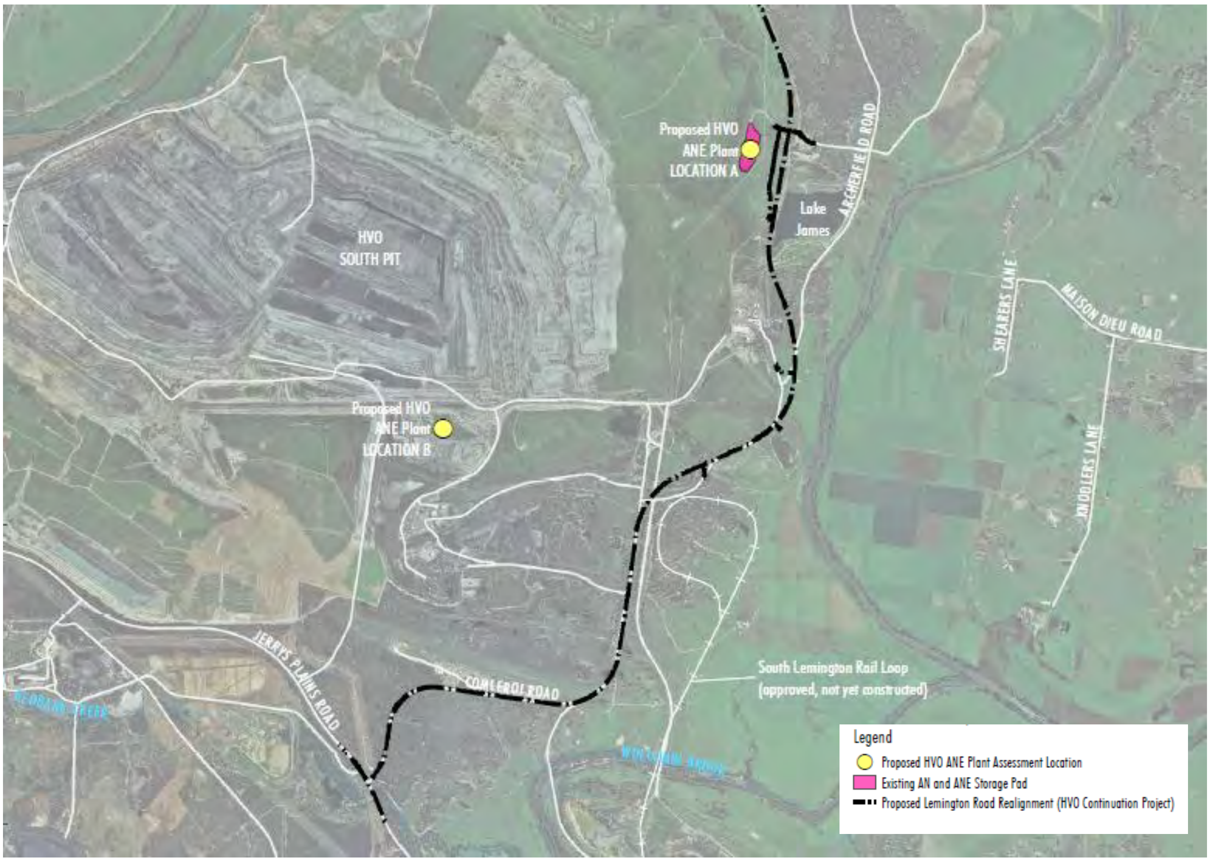

Figure 1-1 ANE Plant Locations

Source: Proposed Modular Ammonium Nitrate Emulsion Plant Statement of Environmental Effects

1.2 Assumptions and Limitations

The study limitations and key assumptions applicable to this study include:

- Traffic data was obtained from TfNSW count stations. No traffic surveys were undertaken.
- Information on the proposed traffic volumes associated with the ANE plant was provided by the Client.

1.3 Disclaimer

This report: has been prepared by GHD for Hunter Valley Operations and may only be used and relied on for the purpose agreed between GHD and Hunter Valley Operations as set out in report.

GHD otherwise disclaims responsibility to any person other than Hunter Valley Operations arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2 Current Arrangements and Approved Operations

HVO currently use both AN (prill) and ANE for blasting operations.

ANE is mostly used for blasting to ensure that explosives placed in blast holes do not deteriorate due to the presence of water in the blast hole or surrounding strata. The use of ANE (as opposed to AN) is a key control in the minimisation of blast plumes during wet conditions. AN is generally used in most other blasting conditions.

Combined requirements for AN and ANE is estimated to be in the order of 140,000-160,000 tpa for the currently approved maximum production rate at HVO of 42 Mtpa ROM Coal however may vary slightly depending on the geological conditions and stripping ratios encountered in any given year. The proportion of ANE used on site will vary depending on a range of factors however a higher proportion of ANE will be used in wetter conditions. It is estimated that up to approximately 116,000 tpa of ANE may be required at HVO during wet years when HVO is operating at maximum rates of production, noting:

- Currently, HVO sources ANE and AN in a ready-for-use form. Based on current operating and production arrangements at HVO, approximately 31,000 tonnes of ANE per annum are received from the Orica Liddell facility.
- HVO currently receives approximately 700 heavy vehicle deliveries of ANE a year from the Orica Liddell facility using trucks up to the size of a B-Double with a 42-tonne payload.
- ANE is transported to the site seven days per week and is approved to occur 24 hours per day.
- Due to the nature of ANE handling and use at the site, ANE deliveries are typically staggered over the day, with multiple deliveries during a short period unlikely.

Under the current arrangement, Ammonium Nitrate Solution (ANSOL) is transported from Kooragang Island to the Orica Liddell manufacturing facility (green route in **Figure 3-1**), a distance of approximately 120 kilometres, where it is converted to ANE. Subsequently, the ANE is transported from Orica Liddell, 55 kilometres to a designated storage facility located at the HVO South (blue route in **Figure 3-1**).

Both of these journeys require trucks to drive through the township of Singleton.

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AN (and other products used with AN as Ammonium Nitrate Fuel Oil (ANFO) in the blast process) is currently sourced from the Lower Hunter and is transported to the site via the Hunter Expressway and Golden Highway (Mitchell Line of Road). This route (approximately 92 kilometres) is shown in red in **Figure 3-1**.

While the above reflects current operational arrangements, there are no restrictions under either the HVO South SSD Project Approval PA 06_0261 or DA 450-10-2003 on either the source of ANE material supplied to HVO or the haulage routes used for this material. While not currently undertaken, ANE material used at HVO could also be sourced from the Lower Hunter which would involve transport to the HVO South via the Golden Highway (Mitchell Line of Road) (red route in **Figure 3-1**).

ANE and AN is currently delivered to HVO seven days per week and can be received on site 24 hours per day.

3 Proposed Assumptions use in Assessment

The assessment of potential traffic impacts associated with the proposed installation and use of ANE plant at HVO South is based on the following assumptions.

The replenishment of raw AN material required for the manufacture of emulsion at HVO South will be sourced from suppliers in the Lower Hunter, (currently located in Sandgate and Kooragang Island), and will be transported the 92 km one way via the Hunter Expressway, New England Highway and Golden Highway (red route in **Figure 3-1**).These raw AN arrangements reflect the current arrangements for AN delivery to HVO.

The volume of ANE produced at the proposed HVO South facility would result in a corresponding reduction of both RAW materials and ANE through Singleton and therefore result in a reduction of daily heavy vehicle movements through Singleton relative to current conditions. The transport of raw material to the site may result in a slight increase in heavy vehicle movements along the Mitchell Line of Road relative to current supply arrangements.

As discussed in Section 2, there is currently no constraints on the source of ANE material used by HVO under HVO South SSD Project Approval PA 06_0261 or DA 450-10-2003 and ANE could be supplied to HVO from other sources in the Lower Hunter. The transport route for material supplied to HVO South from the Lower Hunter would be via the Hunter Expressway and Golden Highway (including the Mitchell Line of Road). Accordingly, the import of ANE from a Lower Hunter supplier rather than the Orica Liddell facility would involve similar heavy vehicle movements to this supply scenario for AN and other associated products.

The proposed haulage route for raw materials to be used by the proposed facility would likely utilise the Hunter Expressway – Golden Highway Supply route consistent with current AN haulage arrangements.

The majority of material would be hauled via B-Double however, transport of raw material components by semi-trailer may also occur. The haulage route from the Lower Hunter to HVO South

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via the Mitchell Line of Road is approved for B-Double use. There is also potential for the use of A-Double configurations in the future should these be approved for the haulage route.

The ability to continue to source ANE from other production facilities would be retained however this would supplement supply from the proposed facility rather than represent an increase in overall material (raw product or manufactured ANE) hauled by road.

Trucks supplying material to site would maintain the existing seven day per week/24 hour delivery arrangements.

Subsequent to the construction of the ANE plant, the AN material would be transported directly to the HVO.

The route would bypass the Singleton, reducing congestion and improving the general amenity of the township.

Additionally, the provision of an ANE plant at the HVO would reduce the distances trucks are required to travel, with corresponding environmental benefits.

The current and proposed vehicle routes are displayed in **Figure 3-1**.

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Memorandum

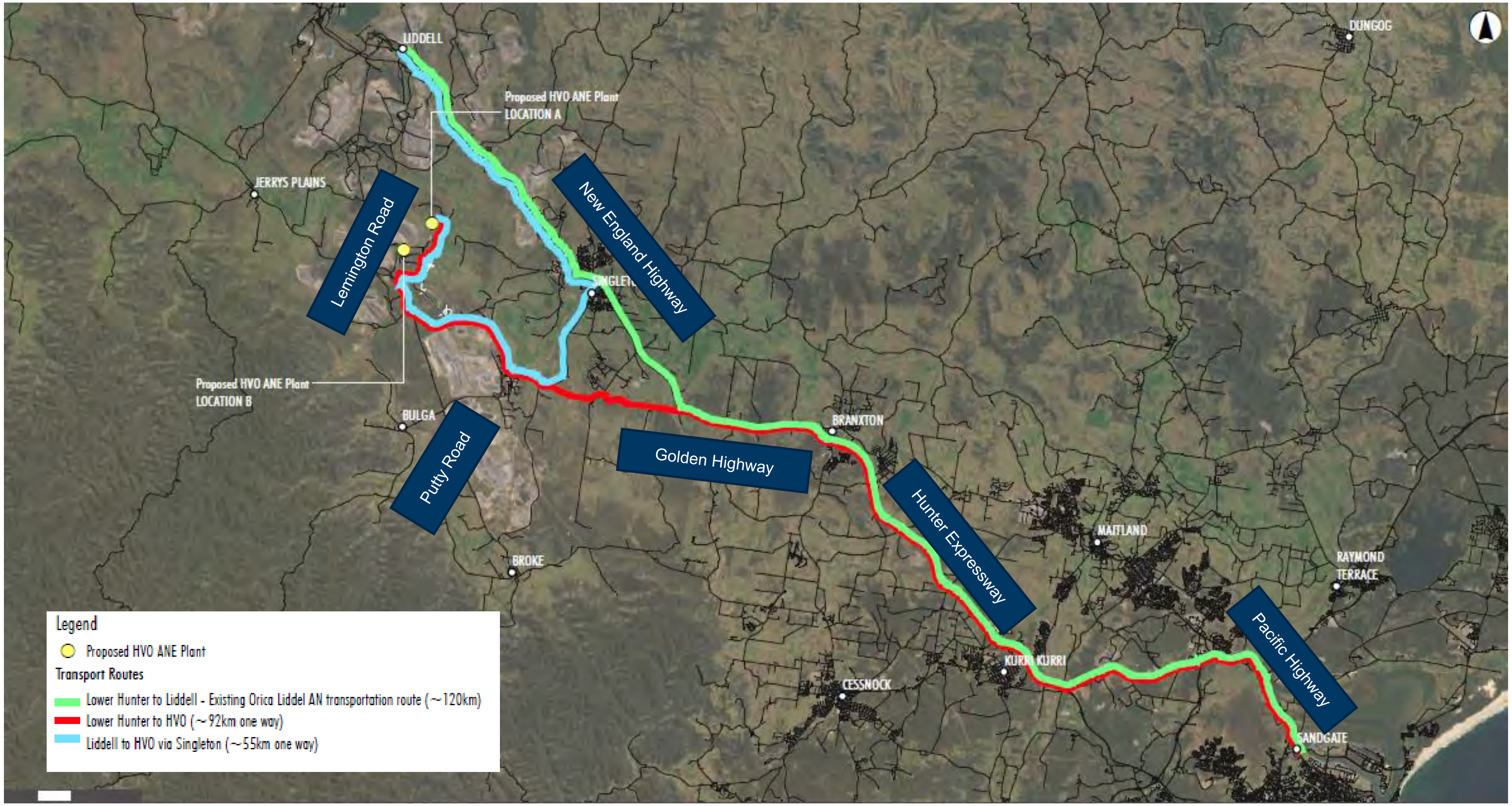

Figure 3-1 Existing and Proposed AN/ANE Transport Routes

Source: Proposed Modular Ammonium Nitrate Emulsion Plant SEE

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4 Road Upgrades

The NSW Government has committed to upgrading the New England Highway between Belford and the Golden Highway to:

- Widen the New England Highway to provide a divided to with two lanes in each direction between Belford and the Golden Highway.
- Replace the existing right turn movement from the Golden Highway onto the New England Highway with a flyover.
- Provide a roundabout at the intersection of the Golden Highway with New England Highway.

The upgrades are expected to be completed in 2024 and will improve travel times and safety for vehicles accessing/egressing the HVO site from Kooragang Island.

5 Impact Assessment

As stated previously, up to approximately 116,000 tpa of ANE may be required at HVO during wet years when HVO is operating at maximum rates of production. Supply the equivalent amount of raw material to HVO directly from the Lower Hunter would not result in any change to traffic conditions relative to approved operations as the existing approvals do not contain any restrictions on haulage routes for AN and ANE material.

The Proposed sourcing of raw material for AN production from the lower hunter and manufacturing ANE at HVO South will however result is a change in transport arrangement relative to existing operations.

HVO currently receives approximately 700 truck deliveries of ANE to the site per year from Orica Liddell. Assuming that B-doubles, with a payload of 42 tonnes undertake these deliveries to the proposed HVO Plant, maximum ANE requirements at HVO would require approximately 2,800 truck movements per year from the Orica Liddell facility to HVO South and a corresponding volume of raw material between the Lower Hunter to the Orica Liddell facility to manufacture this ANE.

Deliveries of ANE to the HVO occur 365 days a year, and on average, the existing 700 deliveries to HVO from Orica Liddell represent approximately two inbound movements each day. At full production in a wet year, the estimated 2,800 truck movements correspond to approximately eight movements per day (inbound).

Accordingly, production of ANE at HVO South with raw material being provided to HVO South via the Hunter Express Way – Golden Highway route would result in between two and eight fewer ANE laden truck movements through Singleton and a corresponding reduction in raw material movements through Singleton.

These additional two to eight laden vehicle movements per day along the Golden Highway (Mitchell Line of Road) relative to existing supply arrangements are minor in relation to traffic operation and fall within typical daily fluctuations in traffic volumes on this route routes.

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TfNSW provides count stations at the following locations in proximity to the subject site:

- New England Highway, approximately four kilometers north of Singleton (Station Id 6153).
- The Golden Highway, approximately three kilometers west of Sandy Hollow (Station Id 6164).

The 2021 traffic data for the New England Highway count station is displayed in **Figure 5-1**.

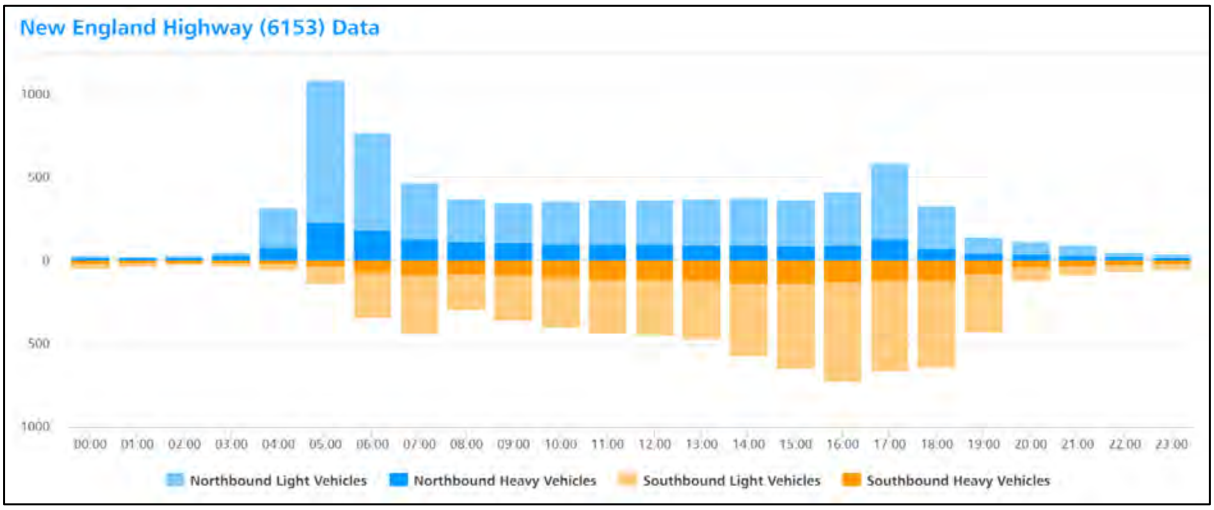

Figure 5-1 2021 Traffic Data – New England Highway (seven day average)

Source: TfNSW

The data in **Figure 5-1** for New England Highway indicates:

- Peak morning demand occurs between 5:00 am – 6:00 am, with a total of 1,217 vehicles (1,079 northbound vehicles and 138 southbound vehicles).
- Peak evening demand occurs between 5:00 pm – 6:00 pm, with a total of 1,242 vehicles (581 northbound vehicles and 661 southbound vehicles).
- Heavy vehicles constitute approximately 20 percent of total vehicles.

The 2021 traffic data for the Golden Highway count station is displayed in Figure **5-2**.

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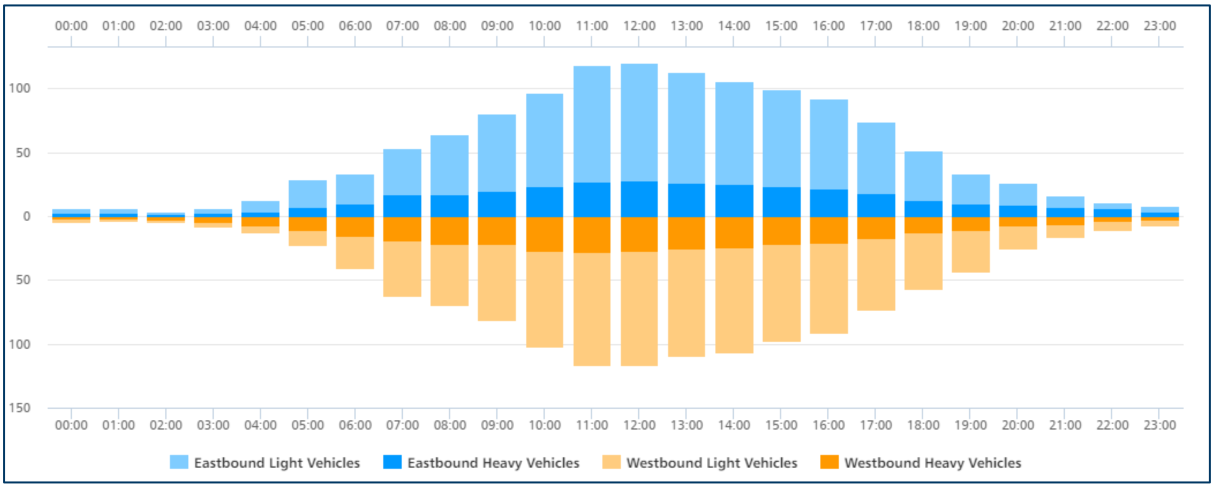

Figure 5-2 2021 Traffic Data – Golden Highway (seven day average)

Source: TfNSW

The data in **Figure 5-2** for Golden Highway indicates that the peak period of activity occurs between 12:00 pm - 1:00 pm with a total of 236 vehicles (116 westbound and 120 eastbound). Heavy vehicles constitute approximately 20 percent of total vehicles. These counts would include the supply of AN and other ANFO products to HVO South but not the material used to manufacture ANE at the Orica Liddell facility nor the currently imported ANE.

The *Roads and Maritime Services Guide to Traffic Generating Developments* specificities that for rural roads with a speed limit of 100 km/h, a single travel lane in each direction, level terrain and approximately 15 percent heavy vehicles have a mid-block capacity (to a LOS D) of 1,410 vehicles [1](bi-directional traffic).

The available traffic data indicates the New England Highway and Golden Highway are currently operating within the acceptable limits of their mid-block capacity. Further, the additional traffic volumes associated with the expected increase in ANE production will have a negligible impact on the key roads included in the travel route to/from the proposed HVO Plant.

Key intersections on the haulage route between Kooragang Island and HVO include:

- Golden Highway and New England Highway
- Mitchell Line of Road (Golden Highway) and Putty Road
- Golden Highway and Lemington Road

As stated in Section 4, the New England Highway/Golden Highway will be upgraded by 2024.

The available traffic data indicates that:

[1] As detailed in Table 4.5 of the Roads and Maritime Services Guide to Traffic Generating Developments

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- The intersection of Golden Highway and Putty Road generally operates with a good level of service during peak periods of activity.
- The intersection of Golden Highway and Lemington Road generally operates with a good level of service during peak periods of activity and this is expected to improve following construction of proposed intersection upgrade works.

For each of these intersections, the traffic impacts associated with (up to) eight additional truck movements per day associated with the proposed HVO Plant will be negligible.

6 Summary and conclusion

In summary;

- HVO are seeking to lodge an application for the development of an ANE manufacturing plant within the HVO South mine site.
- The relocation will reduce the distance vehicles are required to travel to produce ANE, with corresponding environmental benefits.
- The proposed modification does not result in any increase in heavy vehicle movements along the haul route from the Lower Hunter to HVO South via the Golden Highway relative to existing approved operations.
- The proposed sourcing of raw materials from the Lower Hunter for the manufacture of ANE at HVO South would reduce heavy vehicle movements through Singleton.
- ANE is transported to the site seven days per week and is approved to occur 24 hours per day.
- These additional traffic volumes along the Golden Highway (relative to existing operating conditions) are expected to have a negligible impact on the road network.

In accordance with the information included in this assessment, the provision of ANE plant at the HVO can be supported from a transport planning perspective.

Regards

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Senior Transport Planner

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APPENDIX D

Air Quality Impact Assessment

Modular Ammonium Nitrate Emulsion Manufacturing Plant

Air Quality Assessment

Final | Revision 0

21 May 2021

Umwelt (Australia) Pty Ltd on behalf of Glencore

Umwelt 20242

Modular Ammonium Nitrate Emulsion Manufacturing Plant

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Client Name: Umwelt (Australia) Pty Ltd on behalf of Glencore
Client No: Umwelt 20242
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D2R0	3/3/21	Draft report	S Lakmaker	Umwelt	P Horn
D3R0	14/4/21	Draft report	S Lakmaker	-	P Horn
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Final	21/5/21	Final report	S Lakmaker	-	P Horn

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Acronyms and definitions

Abbreviation	Definition
AUSPLUME	Computer-based air dispersion model
BoM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CO	Carbon monoxide
DA	Development Approval
DEC	Department of Environment and Conservation
DPIE	Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
HVAS	High volume air sampler
Jacobs	Jacobs Group (Australia) Pty Limited
NEPM	National Environment Protection Measure
NEPC	National Environment Protection Council of Australia
NO_2	Nitrogen dioxide
NPI	National Pollutant Inventory
OEH	Office of Environment and Heritage, now part of the Department of Planning, Industry and Environment as Environment, Energy and Science
PA	Project Approval
PM_{10}	Particulate matter with equivalent aerodynamic diameters less than 10 microns
TEOM	Tapered Element Oscillating Microbalance
WHO	World Health Organisation

Executive Summary

The Hunter Valley Operations Joint Venture (HVO JV) is proposing the construction and operation of a modular ammonium nitrate emulsion (ANE) manufacturing plant to be located within the Hunter Valley Operations (HVO) mine, and potentially near an existing, approved ammonium nitrate (AN) and ANE storage compound. The proposed plant will manufacture emulsion for use at the HVO mine (the project). Application for the manufacturing activities is sought as a modification to the approved HVO activities. This report provides an assessment of the potential air quality impacts of the project.

The air quality key issues for the project were identified as:

- Emissions (dust) due to machinery used for construction works.
- Potential emissions (CO, NO_2 and PM_{10}) from the thermic fluid heating units during use of an optional diesel powered generator.

These issues were the focus of the assessment.

A review of the existing environment was carried out including an analysis of historically measured concentrations of key quality indicators from representative monitoring stations. This review showed that there was deterioration in air quality conditions (affecting particulate matter concentrations) between 2017 and 2019, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Hunter Valley. Concentrations of other key air quality indicators have complied with air quality criteria noted by the Environment Protection Authority (EPA).

The potential significance and impacts of construction dust was determined from a qualitative review. The nature, scale and duration and proximity to sensitives areas indicated that air quality impacts are not expected to arise during construction. Dust management including the modification of activities during unfavourable weather conditions is however recommended to keep dust impacts to a minimum.

Potential impacts due to project emissions during operation were quantified by modelling. This modelling was based on conservative assumptions, such as continuous operation, to determine the potential concentrations of key air quality indicators at all ground-level locations and nearest sensitive receptors. Results from the modelling confirmed that the project is a small operation in terms of emissions to air and potential impacts. In addition, the modelling showed that the project emissions would not cause exceedances of EPA ambient air quality assessment criteria.

Based on these investigations it has been concluded that the project would not result in adverse air quality impacts.

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 of a proposed modular ammonium nitrate emulsion plant in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client 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 the Client (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.

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1. Introduction

1.1 Background

The Hunter Valley Operations Joint Venture (HVO JV) is proposing the construction and operation of a modular ammonium nitrate emulsion (ANE) manufacturing plant to be located within the Hunter Valley Operations (HVO) mine, and potentially near an existing, approved ammonium nitrate (AN) and ANE storage compound. The proposed plant will manufacture emulsion for use at the HVO mine (the project). Application for the manufacturing activities is sought as a modification to the approved HVO activities. This report provides an assessment of the potential air quality impacts of the project.

1.2 Project Description

The plant is proposed to be located in the upper Hunter Valley of New South Wales (NSW), approximately 20 kilometres northwest of Singleton. Two locations are being considered; referred to as Location A and B (see Figure 1).

The HVO Complex is comprised of two mine sites, separated by the Hunter River and operating under two separate development approvals with fully integrated environmental management systems. The mining operations at the HVO Complex include the integrated use of the Hunter Valley Coal Preparation Plant (HV CPP) and Howick CPP, coal stockpiles and the Newdell rail load-out facility.

It is proposed that Glencore will engage a reputable supplier to construct the modular ANE plant within the HVO approved project boundary at Location A or Location B. The modular ANE plant is a relocatable container-based structure with onboard critical controls in place, the design of which has been used globally within the mining industry and as such the risks, requirements and limitations of these facilities are well understood. Supporting infrastructure will include electricity supply and controls, staff facilities (relocatable office, lunch-room and toilets), water supply tanks (potable and process water), a temporary workshop igloo, light vehicle parking bay, etc.

It is noted that the increase to storage capacities will not exceed the allowable storage volumes under the Major Hazard Facility Threshold, as identified by the *Work Health and Safety Regulation 2017*.

It is proposed to modify HVO South consent (PA 06_0261) to provide for the manufacture of ANE on site and to increase the existing AN and ANE storage capacities. The overall nature of HVO South as originally approved will remain unchanged. All other aspects of the operation i.e. the annual production rates, types of products, hours of operation, life of mine, mining method, coal transportation and coal processing remain unchanged by the project.

The emulsion manufacturing will involve:

- Dissolving high density ammonium nitrate (HDAN).
- Adding emulsifier and fuel phase.
- Pumping the formulation through a static mixer.
- Pumping the manufactured emulsion into storage tank(s).

Figure 2 shows the facility locations and layouts that have been assessed.

A detailed project description is provided in the Statement of Environmental Effects (SEE).

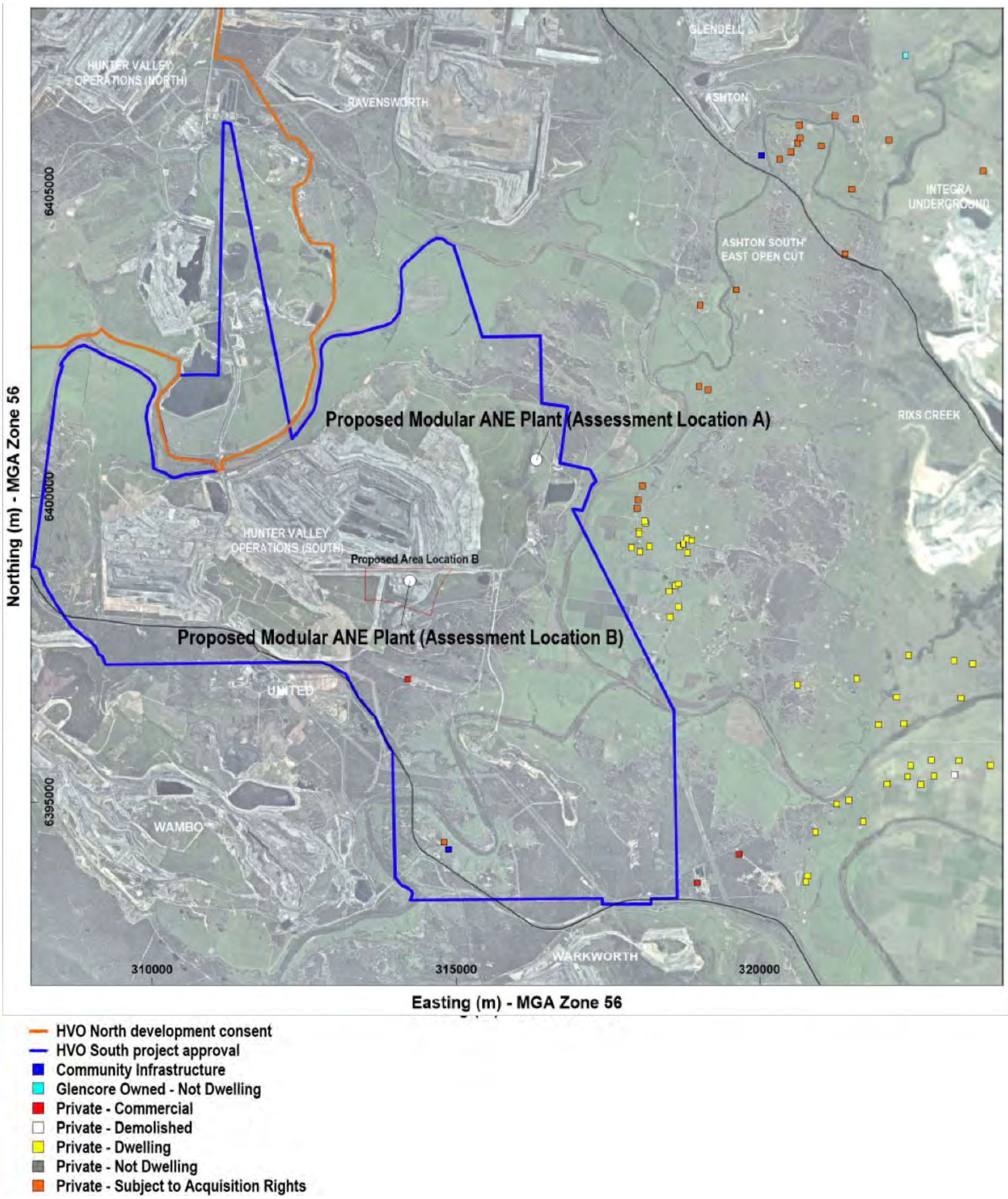

Figure 1 Locations being considered and assessed for the proposed modular ANE manufacturing plant

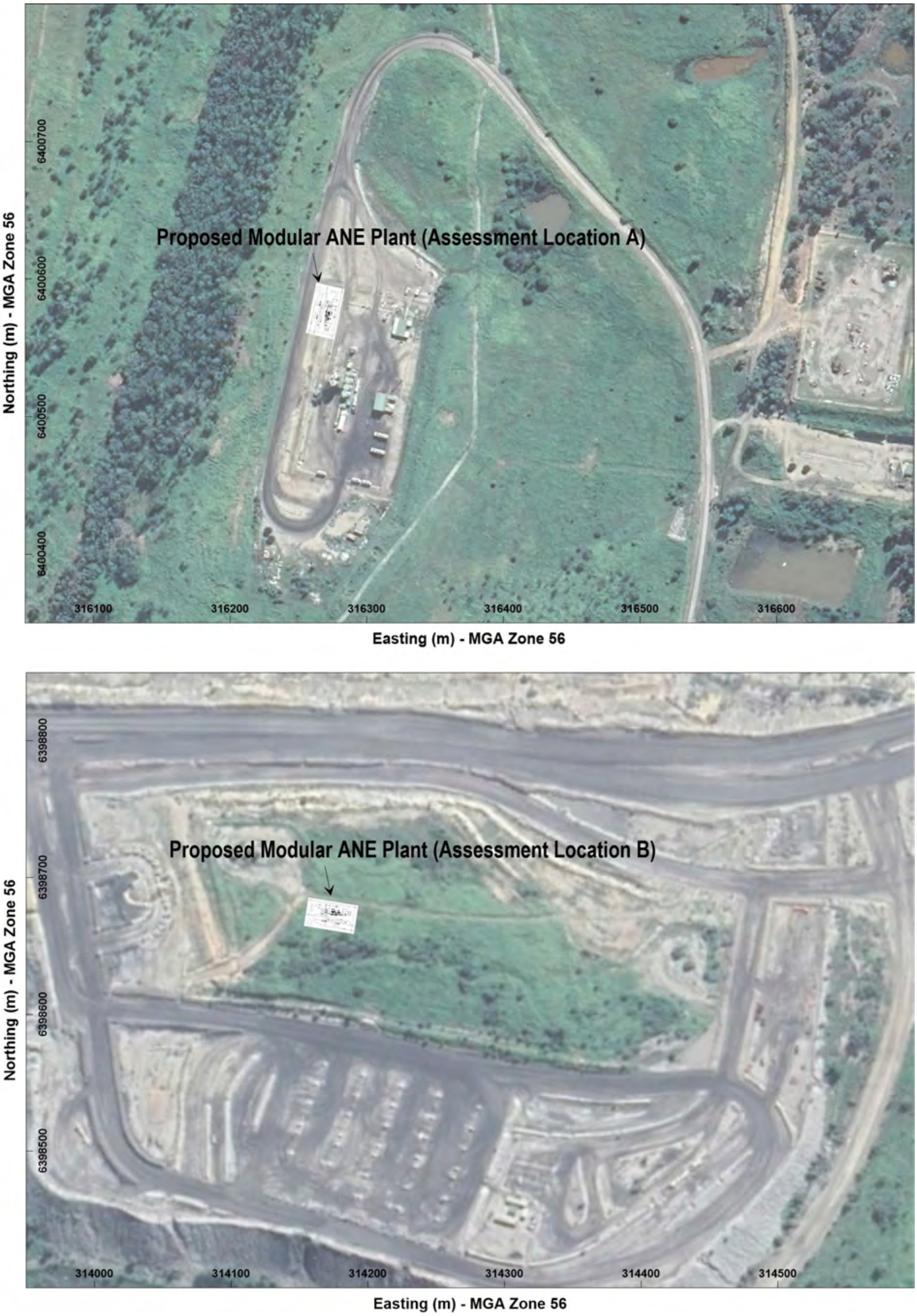

Figure 2 Proposed site layout

1.3 Performance Outcome

The desired performance outcome for the project relating to air quality is to minimise air quality impacts to reduce risks to human health and the environment to the greatest extent practicable through the design, construction and operation of the project.

1.4 Report Structure

The report is structured as follows:

- Section 1 – Introduces the project with a summary of the project background, project description, and performance outcomes.
- Section 2 – Identifies the key air quality issues to be addressed.
- Section 3 – Outlines the key legislative and policy assessment requirements for air quality.
- Section 4 – Discusses key features of the existing environment including surrounding land uses, sensitive receptors, and local meteorological and air quality conditions.
- Section 5 – Provides an overview of the methods used to assess the potential for air quality impacts.
- Section 6 – Provides an assessment of the potential construction and operational air quality impacts including potential cumulative impacts.
- Section 7 – Provides the conclusions of the assessment.

2. Key Issues

Air quality issues can arise when emissions from an industry or activity lead to deterioration in the ambient air quality. Potential air quality issues have been identified from a review of the project and associated activities. This identification process has considered the types of emissions to air and proximity of these emission sources to sensitive receptors.

The process to manufacture emulsion involves semi-continuous blending of two main raw materials; oxidiser solution and a fuel/emulsifier blend. The four basic steps in the production of emulsion include:

- Preparing the oxidiser solution by combining AN solutions and minor chemicals in a series of insulated batch tanks. The tanks are heated using circulating hot water from thermic fluid heating units. Whilst it is anticipated to use site electricity to power the heating units, this assessment has allowed for power to be supplied from a diesel generator.
- Creating fuel oil blends using, typically, diesel, canola, paraffin and emulsifiers. Products are combined in a blend tank for short term storage. Fuel oils are stored at ambient temperature and then blended and heated inline as they are pumped to the ANE manufacturing area.
- Formation of the ANE by spray emulsification of the oxidiser solution and fuel blend, in a process commonly referred to as the ELK process. Freshly formed ANE is refined using static mixers.
- Storage of the ANE in surge tanks prior to distribution.

Emissions to air may occur during both the construction and operational phases of the project. Machinery and activities involved in the construction of the facility have the potential to generate dust. Once operational, the plant and equipment used for the emulsion manufacturing have the potential to generate emissions that include carbon monoxide (CO), oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2) and particulate matter (as PM_{10}). These emissions will be primarily produced as exhaust gas from combustion of diesel fuel used in an optional diesel generator to power two thermic fluid heating units if mains power is unavailable.

The air quality key issues for the project will therefore be:

- Emissions (dust) due to machinery used for construction works.
- Emissions (CO, NO_2 and PM_{10}) from the optional diesel generator supplying power to the thermic fluid heating units during operation.

These two issues are the focus of this assessment.

3. Air Quality Criteria

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 air quality indicators most relevant to the project have been identified, from Section 2, as CO, NO_2 and PM_{10}.

The Environment Protection Authority (EPA) has developed assessment criteria for a range of air quality indicators including CO, NO_2 and PM_{10}. These criteria are outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2016), 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 Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 2003). To measure compliance with ambient air quality criteria, the Department of Planning, Industry and Environment (DPIE) has established a network of monitoring stations across NSW and up-to-date records are published on the DPIE website.

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 1 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 1 EPA air quality assessment criteria

Air quality indicator	Averaging time	Criterion*
Carbon monoxide (CO)	24-hour	30 mg/m^3
	Annual	10 mg/m^3
Nitrogen dioxide (NO_2)	1-hour	246 $\mu g/m^3$
	Annual	62 $\mu g/m^3$
Particulate matter (PM_{10})	24-hour	50 $\mu g/m^3$
	Annual	25 $\mu g/m^3$

**Source: Table 7.1 of the Approved Methods.*

The EPA air quality assessment criteria relate to the total concentration of pollutants in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. In situations where background levels are elevated the proponent must "*demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical*" (EPA, 2016). Section 4 provides further discussion of background levels.

4. Existing Environment

This section provides a description of the environmental characteristics in the area, including a review of recent and historical meteorological and ambient air quality conditions. One of the objectives for this review was to develop an understanding of any existing air quality issues and to identify the main factors that have influenced air quality conditions.

4.1 Local Setting

The project sites are located in a predominantly rural-residential area in the upper Hunter Valley of NSW, approximately 20 kilometres northwest of Singleton, and within the Singleton local government area (LGA). The sites are positioned near the floor of the Hunter Valley at an elevation of approximately 100 metres above sea level. Figure 3 shows a pseudo three-dimensional representation of the local terrain.

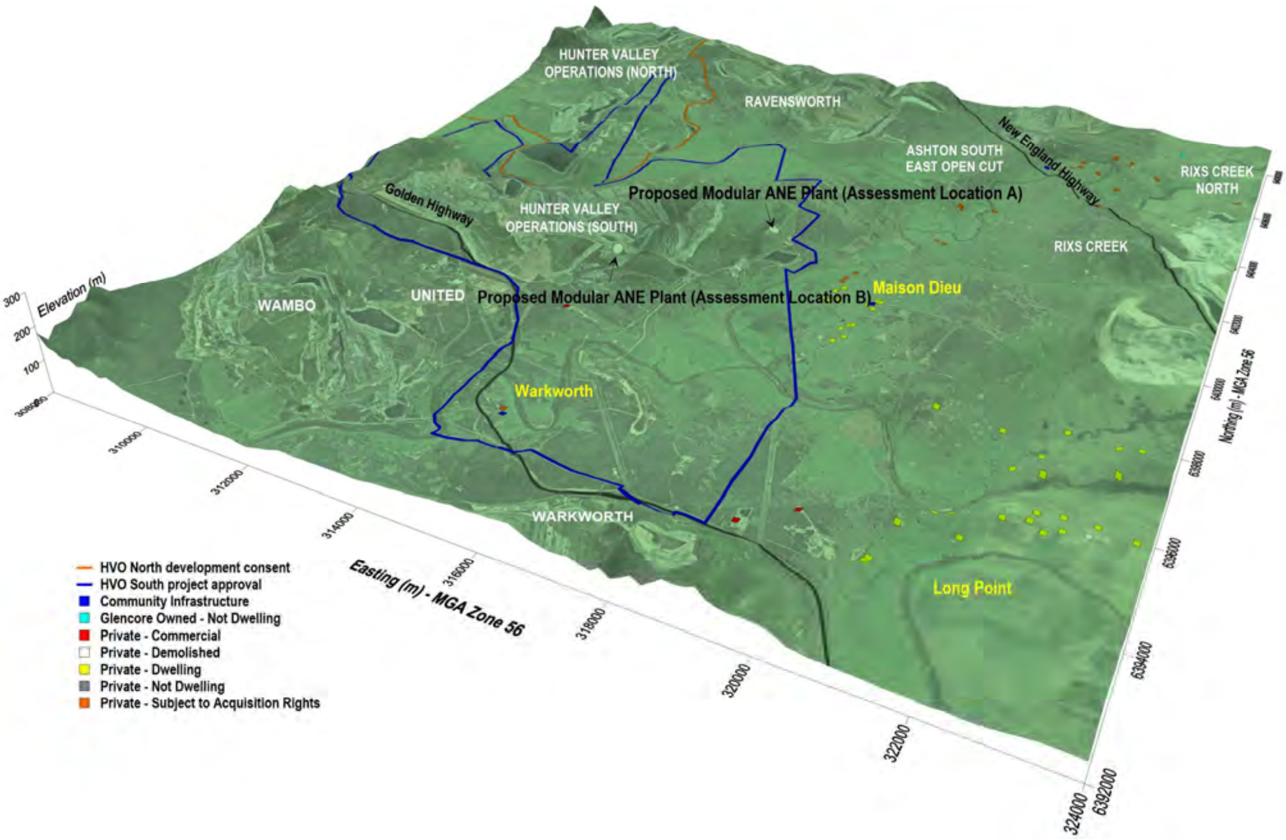

Figure 3 Pseudo three-dimensional representation of the local terrain

Surrounding main roads include the Golden Highway to the southwest and the New England Highway to the northwest. Local industry and agricultural activities include power stations, coal mines, dairy farming, and wineries. The closest local community is Maison Dieu with the nearest properties located approximately 1.8 kilometres to the southeast of Location A.

4.2 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 the meteorological conditions near the project and identifies the datasets that are representative of the long term, local conditions.

There is an extensive meteorological monitoring network in the Hunter Valley and most mining companies are required to operate at least one meteorological station as part of their development consent. The HVO JV operates two meteorological stations, referred to as “HVO Corporate” and “Cheshunt”. The DPIE also conducts meteorological monitoring in the Hunter Valley as part of their Upper Hunter Air Quality Monitoring Network. Figure 4 shows the location of the HVO JV and DPIE meteorological stations.

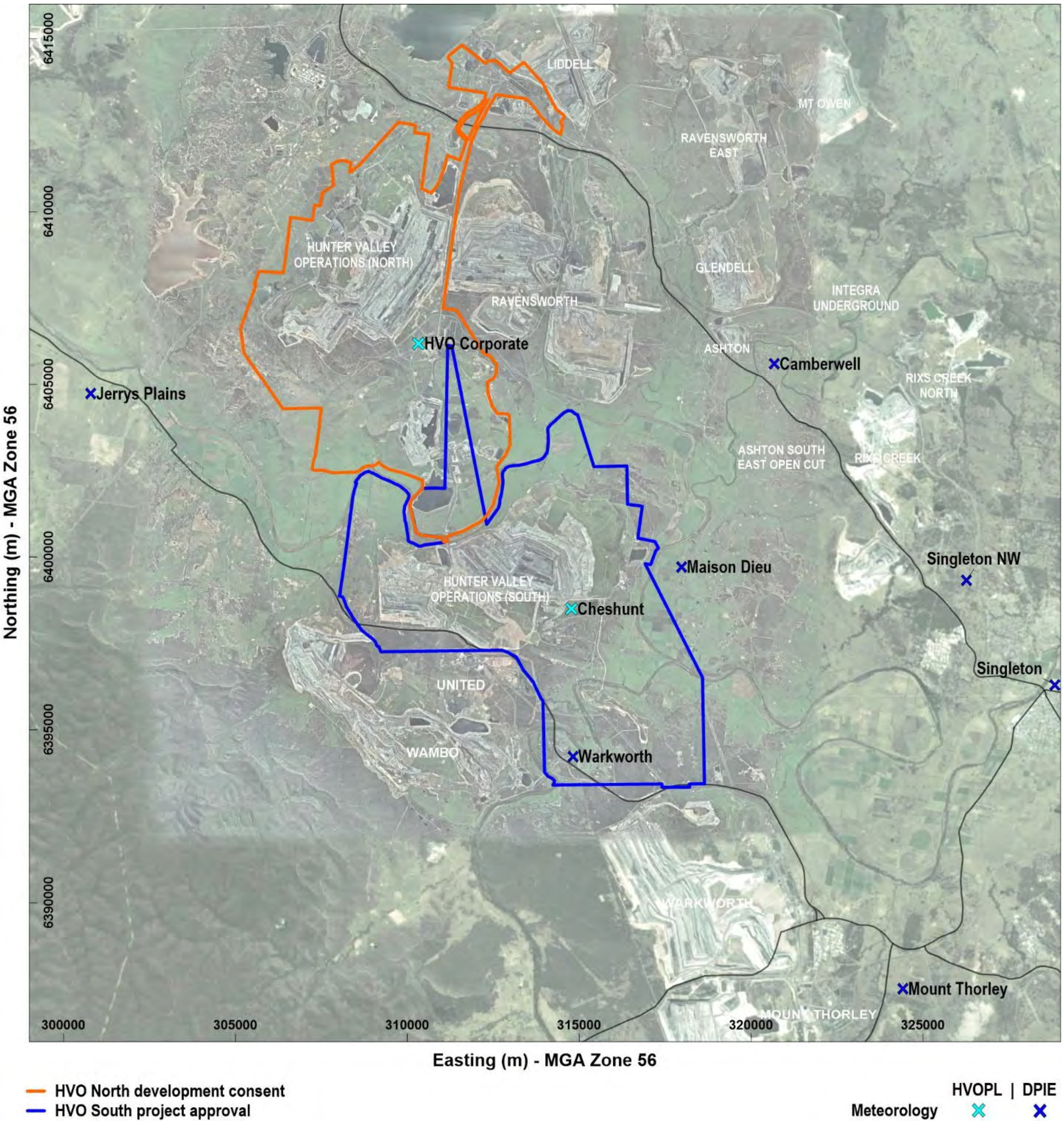

Figure 4 Location of meteorological stations

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 are also acceptable provided that analysis indicate that the data adequately describe the expected meteorological conditions at the site of interest. From the EPA descriptions (EPA, 2016) there will be multiple meteorological stations collecting data that can be classified as representative of conditions around the project.

Seven years of data from the Cheshunt meteorological station have been analysed in order to characterise the local conditions and to identify representative datasets. The analysis involved comparing statistics from the data collected in each calendar year to determine a year-long dataset that most closely reflects the longer term, local conditions. Wind data have primarily been used for this purpose although rainfall data have also be considered.

Wind-roses have been prepared from the data collected at the Cheshunt station in the most recent seven year period (2013 to 2019 inclusive). The wind-roses (Figure 5) show the frequency of wind speeds and wind directions based on hourly records for each location. The circular format of the wind rose shows the direction from which the wind blew and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colours of each spoke provide details on the speed of the wind from each direction.

The most common winds in the area are from the southeast and west to northwest. This pattern of winds is common for many parts of the Hunter Valley and reflects the northwest-southeast alignment of the valley. There are seasonal variations (Appendix A) where winds in summer are typically from the southeast and winds in winter are typically from the northwest. It is also clear from Figure 5 that the wind patterns were similar across all seven years of data presented. This suggests that wind patterns do not vary significantly from year to year, and potentially the data from any of the years presented could be considered as representative of the longer term conditions.

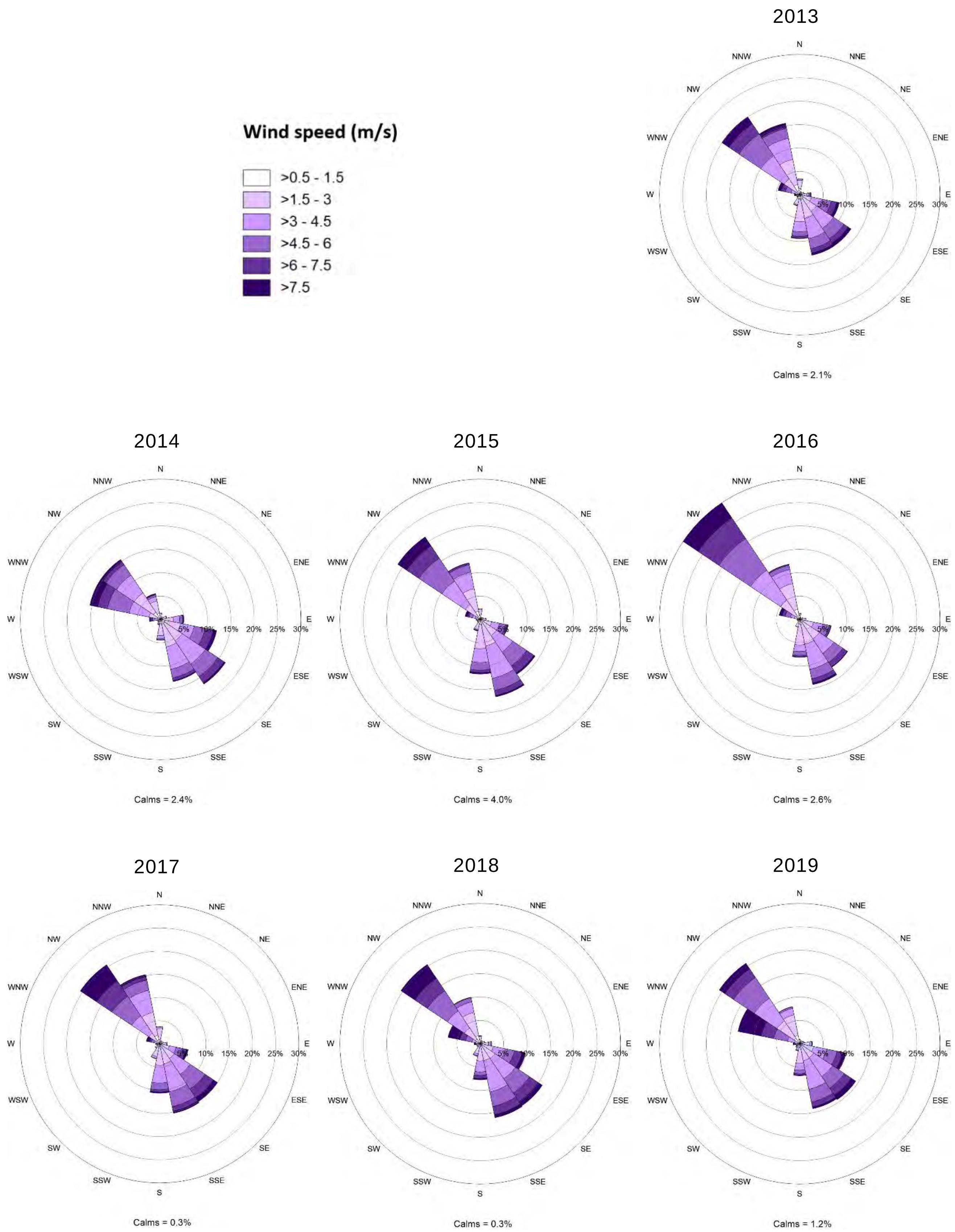

Figure 5 Annual wind-roses for data collected at the Cheshunt meteorological station

Figure 6 shows the hourly wind speed data from Cheshunt. These data show that wind speeds are generally lower in autumn and higher in spring with maximum wind speeds reaching around 12 metres per second. Rainfall data from the Bureau of Meteorology's Bulga (South Wambo) station (SN 61191) have also been presented. The rainfall data show the effect of the drought from 2017 to 2019, with annual rainfall at least 30 per cent lower than the long term average of 657 mm (based on 61 years of data collected between 1959 to 2020).

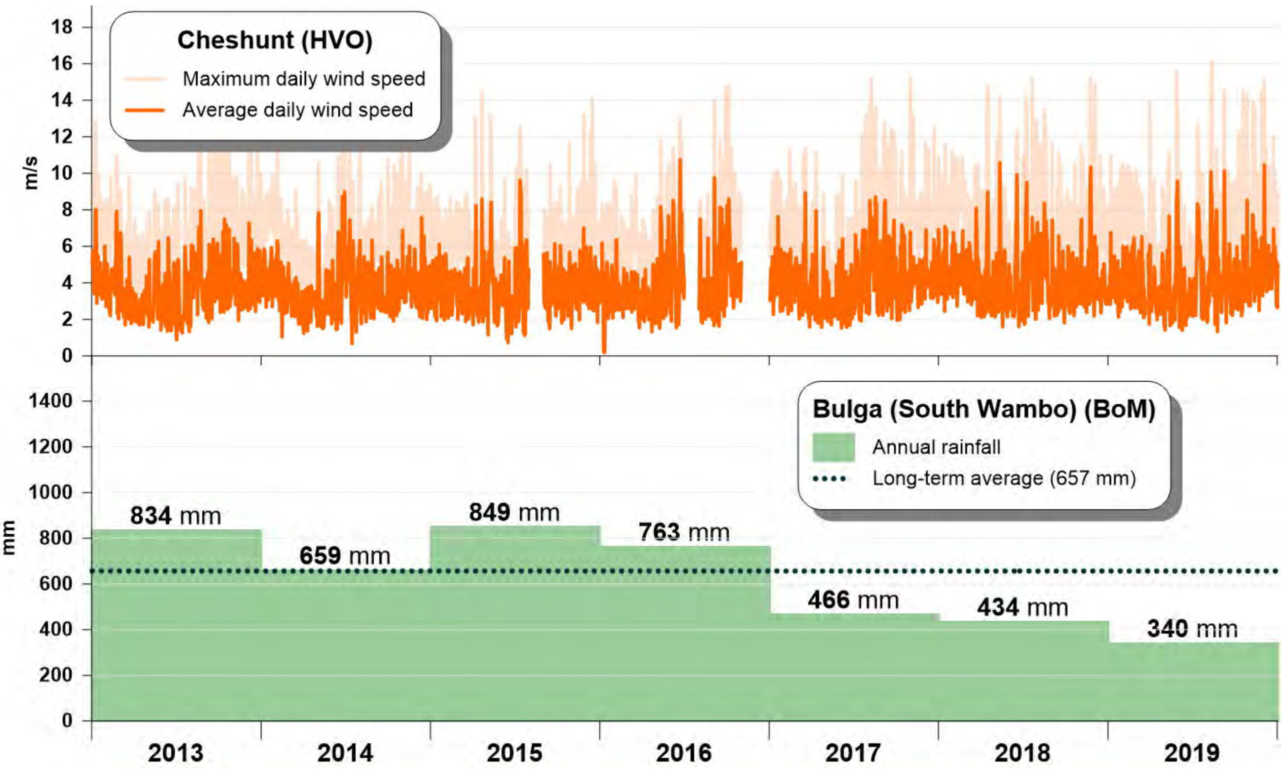

Figure 6 Wind speed and rainfall data collected between 2013 and 2019

Table 2 provides annual wind statistics for the 2013 to 2019 calendar years. Mean wind speeds for each year differ from the long term average by no more than 8%. Data from the 2014 calendar year have been identified as being representative of the long term, local conditions and suitable for informing the air quality impacts of the project. This outcome was based on:

- High data capture rate, meeting the EPA's requirement for a minimum 90% complete dataset.
- Similar wind patterns to other years.

It will be seen later (Section 6) that the choice of meteorological year will not affect the outcome of this assessment as the modelled contributions of the plant to local air quality are very low.

Table 2 Statistics from meteorological data collected at Cheshunt between 2013 and 2019

Year	2013	2014	2015	2016	2017	2018	2019
Percentage complete (%)	100	100	91	75	100	100	99
Mean wind speed (m/s)	3.7	3.6	3.7	3.8	4.1	4.2	4.2
Percentage of calms (<= 0.5 m/s)	2.1	2.4	4	2.6	0.3	0.3	1.2
Percentage of wind speeds >6 m/s	13.4	11.8	12.1	15.7	17.6	20.3	19

Section 4.3 also shows that air quality conditions in 2014 were similar to other years and not adversely influenced by bushfire activity or extreme conditions. Methods used for incorporating the 2014 data into modelling for the project are discussed in detail in Section 5. Annual and seasonal wind-roses from data collected at Cheshunt in 2014 are provided in Appendix A.

4.3 Air Quality

There is an extensive air quality monitoring network in the Hunter Valley and most mining companies are required to operate multiple monitoring stations as part of their development consent. The DPIE also conducts monitoring as part of their Upper Hunter Air Quality Monitoring Network. This section examines the historical air quality conditions around the HVO Complex and establishes the appropriate background levels to be considered for assessment of the project.

It should be noted that air quality monitoring data represent the contributions from all sources that have at some stage been upwind of each monitor. In the case of particulate matter (as PM_{10}) for example, a measurement may contain contributions from many sources such as from mining activities, construction works, bushfires and 'burning off', agricultural activities, industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds, and so on.

4.3.1 Extraordinary Events

Air quality in many parts of NSW, including the Hunter Valley, was adversely influenced by drought conditions between 2017 to 2019 and lower than average rainfall. A deterioration in air quality conditions in recent years was not unique to the Hunter Valley 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 DPIE 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 DPIE 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 DPIE's monitoring data. Figure 7 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.

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.

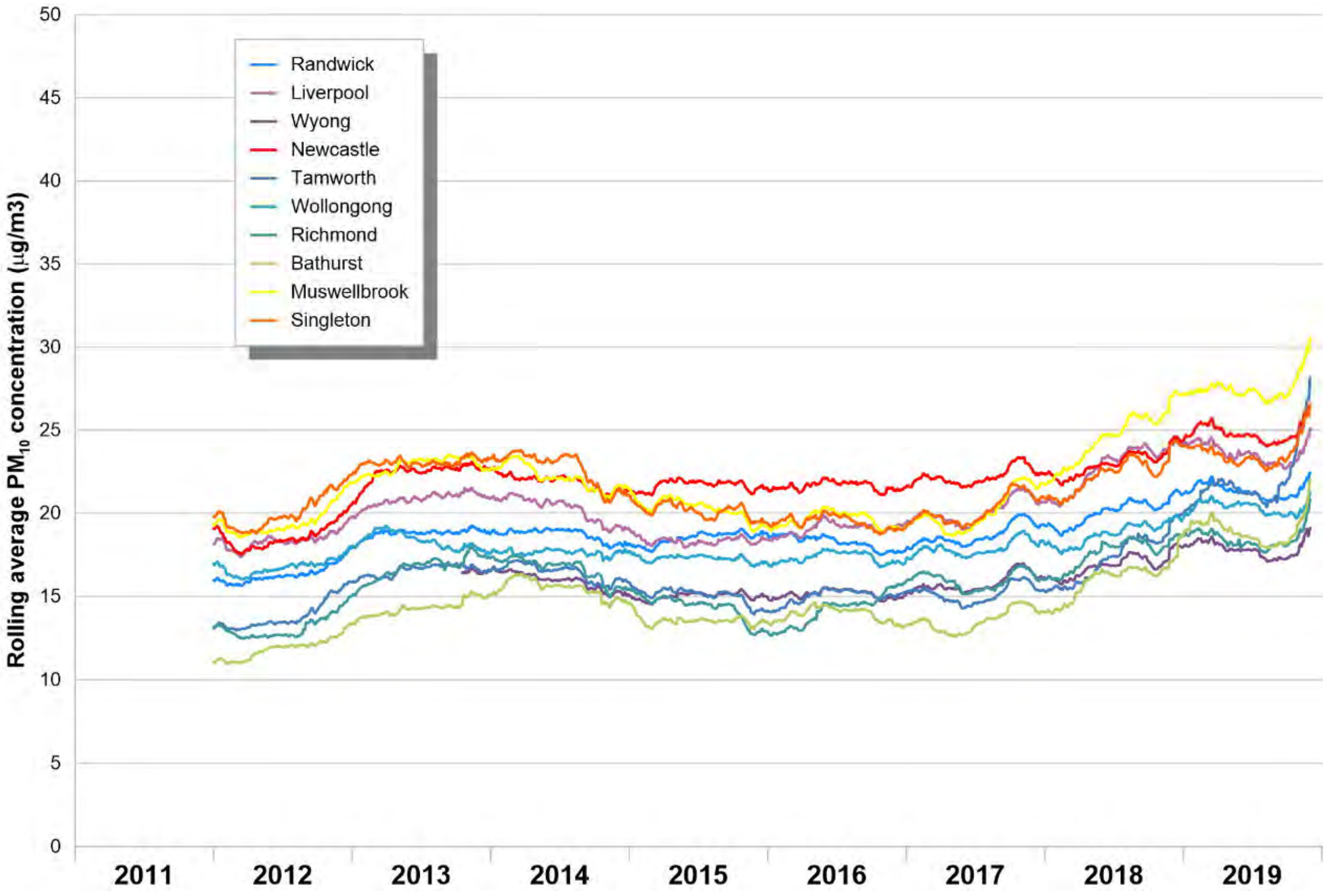

Figure 7 Annual average PM_{10} concentrations at various NSW air quality monitoring sites

4.3.2 Carbon Monoxide (CO)

Table 3 provides a summary of the measured CO concentrations from Newcastle, the closest known air quality monitoring site which records this air quality indicator. These data show that the maximum CO concentrations have not exceeded the EPA's 1-hour or 8-hour average criteria. Concentrations of CO are also unlikely to exceed the EPA criteria near the project, given the lower population density.

Table 3 Summary of measured CO concentrations

Year	Newcastle	EPA criterion
Maximum 1-hour average in mg/m^3		
2013	2.1	30
2014	3.3	30
2015	2.1	30
2016	2.6	30

Year	Newcastle	EPA criterion
2017	1.8	30
2018	1.5	30
2019	2.4	30
Maximum 8-hour average in mg/m^3		
2013	1.8	10
2014	3.0	10
2015	1.9	10
2016	1.8	10
2017	1.4	10
2018	1.3	10
2019	1.9	10

4.3.3 Nitrogen Dioxide (NO_2)

Table 4 provides a summary of the measured NO_2 concentrations from Singleton, the closest known air quality monitoring site which records this air quality indicator. These data show that the maximum NO_2 concentrations have not exceeded the EPA's 1-hour average criterion of 246 $\mu g/m^3$. Annual averages have not exceeded the EPA's annual average criterion of 62 $\mu g/m^3$.

Table 4 Summary of measured NO_2 concentrations

Year	Singleton	EPA criterion
Maximum 1-hour average in $\mu g/m^3$		
2013	84	246
2014	74	246
2015	66	246
2016	66	246
2017	74	246
2018	72	246
2019	76	246
Annual average in $\mu g/m^3$		
2013	18	62
2014	16	62
2015	16	62
2016	16	62
2017	17	62
2018	16	62
2019	14	62

4.3.4 Particulate Matter (as PM_{10})

The DPIE monitors PM_{10} as part of their Upper Hunter Air Quality Monitoring Network and historical data from Jerrys Plains, Maison Dieu and Warkworth have been reviewed. Table 5 provides a summary of the measured PM_{10} concentrations collected at Jerrys Plains, Maison Dieu and Warkworth from data collected between 2013 and 2019.

The data from Table 5 show that PM_{10} concentrations increased from 2017 to 2019 coinciding with drought conditions and lower than average rainfall. These conditions led to increases in the number of days when the 24-hour average PM_{10} concentration exceeded 50 µg/m^3 and increases in the annual average PM_{10} concentrations. The increases in PM_{10} concentrations were not unique to the Hunter Valley.

Table 5 Summary of measured PM_{10} concentrations

Year	Jerrys Plains	Maison Dieu	Warkworth	EPA criterion
Maximum 24-hour average in µg/m^3				
2013	63	84	65	50
2014	64	64	68	50
2015	70	77	68	50
2016	43	48	42	50
2017	51	79	51	50
2018	201	192	162	50
2019	227	446	182	50
Number of days above 50 µg/m^3				
2013	6	28	8	-
2014	6	6	2	-
2015	1	5	3	-
2016	0	0	0	-
2017	1	9	1	-
2018	11	23	15	-
2019	54	66	57	-
Annual average in µg/m^3				
2013	19	26	21	30
2014	18	23	21	30
2015	15	20	18	30
2016	17	20	19	30
2017	18	23	22	25
2018	24	28	26	25
2019	32	38	33	25

4.4 Summary of Existing Environment

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

- Meteorological conditions in 2014 were representative of the long term, local conditions near the project.
- There was deterioration in air quality conditions (affecting particulate matter concentrations) in the recent two to three years, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Hunter Valley. Concentrations of other key air quality indicators have complied with EPA air quality criteria.

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to project contributions for the assessment of potential cumulative impacts. Table 6 shows the assumed background levels that apply at sensitive receptors, taking into account the objectives described above. These levels (or approach) have been added to project contributions to determine the potential cumulative impacts.

Table 6 Assumed background levels that apply at sensitive receptors

Air quality indicator	Averaging time	Assumed background level that applies at sensitive receptors	Notes
Carbon monoxide (CO)	1-hour	3.3 mg/m^3	Level 1 assessment according to the Approved Methods. Maximum 1-hour average CO concentration in the representative year, 2014, from Newcastle.
	8-hour	3.0 mg/m^3	Level 1 assessment according to the Approved Methods. Maximum 8-hour average CO concentration in the representative year, 2014, from Newcastle.
Nitrogen dioxide (NO_2)	1-hour	74 µg/m^3	Level 1 assessment according to the Approved Methods. Maximum 1-hour average NO_2 concentration in the representative year, 2014, from Singleton.
	Annual	16 µg/m^3	Level 1 assessment according to the Approved Methods. Annual average NO_2 concentration in the representative year, 2014, from Singleton.
Particulate matter (PM_{10})	24-hour	64 µg/m^3	Level 1 assessment according to the Approved Methods. Maximum 24-hour average PM_{10} concentrations in the representative year, 2014, from Maison Dieu.
	Annual	23 µg/m^3	Level 1 assessment according to the Approved Methods. Annual average PM_{10} concentration in the representative year, 2014, from Maison Dieu.

5. Assessment Methodology

This assessment has followed the procedures outlined in the Approved Methods (EPA, 2016). The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of expected impacts.

Specific methodologies for each of the identified key issues (from Section 2) are described below.

5.1 Construction

Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using modelling. To do so would require knowledge of weather conditions for the period in which work will be taking place in each location on the site. The potential significance and impacts of construction dust has therefore been determined from a qualitative review, taking into consideration the intensity, scale, location and duration of the proposed works. Section 6.1 provides the assessment of construction dust.

5.2 Operation

Potential impacts due to project emissions during operation have been quantified by modelling. The choice of model has considered the relative significance of the project emissions, expected transport distances for the emissions, topography land use.

The computer-based air dispersion model known as AUSPLUME has been selected. This model is listed in the Approved Methods and has been used to predict ground-level concentrations due to the estimated project emissions. Concentrations in the ambient air have been simulated for every hour of the representative year and results at nearest sensitive receptors have then been compared to the relevant air quality assessment criteria.

Key model settings and inputs for AUSPLUME are provided in Table 7.

Table 7 Model settings and inputs for AUSPLUME

Parameter	Value(s)
Model version	6
Prediction domain	3 km x 3 km
Receptors	Gridded at 50 m spacing
Terrain effects	None. Flat
Horizontal dispersion curves for source <100m	Pasquill Gifford
Vertical dispersion curves for source <100m	Pasquill Gifford
Horizontal dispersion curves for source >100m	Briggs rural
Vertical dispersion curves for source >100m	Briggs rural
Adjustment for wind shear factor	None
Plume rise options	Gradual plume rise and stack tip downwash
Entrainment coefficients	0.6 Adiabatic and Stable
Exponent schemes	Irwin rural
Surface roughness	0.4
Stability class adjustments	None
Building wake effects	Yes

Emissions to air would be released from optional diesel generators if required to power the two thermic fluid heating units. Sampling of CO and NO_x concentrations in the exhaust streams of similar units at an ANE manufacturing plant in Bajool Qld was carried out by Steer Environmental Consulting (2017) and the results from this sampling have been used as estimates for the project.

Table 8 shows the source and emission data as used by the dispersion model. Mass emission rates of each pollutant were calculated from the Bajool sampling data, except for PM_{10} where it was assumed that the limit for scheduled premises under the *Protection of the Environment Operations (Clean Air) Regulation 2010* applied. It was assumed that emissions would be released continuously for 24 hours per day, every day of the year even though the plant will not operate continuously. This is a conservative approach that will over-state potential impacts.

Table 8 Source and emissions data as used by the model

Parameter	Assessment Location A		Assessment Location B		Notes
	Thermal Oil Heating Unit 1	Thermal Oil Heating Unit 2	Thermal Oil Heating Unit 1	Thermal Oil Heating Unit 2	
Easting (m)	316270	316270	314174	314176	Based on layout
Northing (m)	6400574	6400576	6398672	6398672	Based on layout
Elevation (m)	100	100	116	116	From topographical data
Height (m)	5	5	5	5	Estimated from height of plant
Stack tip diameter (m)	0.13	0.13	0.13	0.13	Estimated
Temperature (C)	232	274	232	274	Bajool sampling data
Velocity (m/s)	8	8	8	8	Estimated from literature
Flow rate (Am^3/s)	0.101	0.101	0.101	0.101	Calculated from diameter and flow
Flow rate (Nm^3/s)	0.055	0.051	0.055	0.051	Calculated from diameter and flow with temperature correction
CO (ppm)	13	32	13	32	Bajool sampling data
NO_x (ppm)	48	72.6	48	72.6	Bajool sampling data
NO_2 (ppm)	2.7	8.8	2.7	8.8	Bajool sampling data
Mass emission rates					
CO (g/s)	0.0009	0.0020	0.0009	0.0020	Calculated from Bajool sampled concentrations
NO_x (g/s)	0.0054	0.0075	0.0054	0.0075	Calculated from Bajool sampled concentrations
PM_{10} (g/s)	0.0011	0.0010	0.0011	0.0010	Calculated from Clean Air Reg emission limit
Calculated / assumed concentrations					
CO (mg/Am^3)	8.78	19.98	8.78	19.98	Bajool sampling data
NO_x (mg/Am^3)	53.25	74.45	53.25	74.45	Bajool sampling data
Particulates (mg/Nm^3)	20	20	20	20	Clean Air Regulation 2010 limit

Finally, the model predictions at identified sensitive receptors were then compared with the EPA air quality criteria, previously discussed in Section 3. Contour plots have also been created to show the spatial distribution of model predictions. Section 6.2 provides the assessment of operational emissions.

6. Air Quality Assessment

This section provides an assessment of the identified key air quality issues (from Section 2).

6.1 Construction

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the site and plant construction. Specifically, these works will primarily include:

- Levelling and site preparation works.
- Delivery of machinery, plant, equipment and building materials.
- Construction of buildings.
- Installation and commissioning of plant and equipment.

These works would generally occur 7.00 am to 6.00 pm seven days per week with the majority of construction works being completed within six months. The total amount of dust generated would depend on the types of activities being carried out, exposed areas, frequency of water spraying and speed of machinery. The approach to construction will depend on decisions that will be made by the contractor(s) and changes to the construction methods and sequences that are expected to take place during the construction phase.

Material handling quantities in the construction phase are expected to be much lower than the material handling quantities in the operations phase. Consequently, the air quality impacts during construction will be lower than during operations. However, as for the operations phase, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. Dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme, unfavourable weather conditions, such as dry, high wind speed conditions. Monitoring would also continue to be carried out during the construction phase to assess compliance with EPA criteria.

The nature, scale and duration and proximity to sensitives areas mean the air quality impacts are not expected to arise during construction. However, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. Appropriate dust management will involve the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and modification of work under unfavourable weather conditions, such as dry wind conditions.

6.2 Operation

Modelling has been carried out to determine the potential concentrations of the key air quality indicators due to project emissions. Table 9 shows the results as predicted ground-level concentrations at both the most affected location in the model domain and at the nearest Maison Dieu properties. These results show the maximum contribution from the plant emissions, the assumed background level (from Section 4.3), and cumulative concentrations (that is, the contribution from plant emissions plus the background level). The cumulative concentrations have been compared to the air quality assessment criteria. The results have also been presented as contour plots in Appendix B showing the predicted air pollutant concentrations due only to emissions from the proposed plant.

A “Level 1” assessment approach has been adopted, as per the procedures outlined in the Approved Methods (EPA, 2016). This involved determining maximum potential impacts by adding maximum background levels to maximum predicted project increments. This level of assessment represents a conservative approach that will likely over-estimate actual impacts.

Table 9 Predicted ground level concentrations

Statistic	Due to ANE plant at Location A	Due to ANE plant at Location B	Background	Cumulative (highest of Location A and B)	EPA criterion
Predicted maximum 1-hour average CO (mg/m^3)					
Highest in model domain (located within 200 m of plant)	0.007	0.033	3.3	3.333	30
Maison Dieu nearest properties	0.0002	0.00006	3.3	3.300	30
Predicted maximum 8-hour average CO (mg/m^3)					
Highest in model domain (located within 200 m of plant)	0.007	0.006	3	3.007	10
Maison Dieu nearest properties	0.0002	0.00001	3	3.000	10
Predicted maximum 1-hour average NO_2 ($\mu g/m^3$)					
Highest in model domain (located within 200 m of plant)	29.4	149.9	74	223.9	246
Maison Dieu nearest properties	1.1	0.25	74	75.1	246
Predicted annual average NO_2 ($\mu g/m^3$)					
Highest in model domain (located within 200 m of plant)	1.1	1.3	16	17.3	62
Maison Dieu nearest properties	0.01	0.0004	16	16.0	62
Predicted maximum 24-hour average PM_{10} ($\mu g/m^3$)					
Highest in model domain (located within 200 m of plant)	1.0	1.5	64	65.5	50
Maison Dieu nearest properties	0.01	0.0017	64	64.0	50
Predicted annual average PM_{10} ($\mu g/m^3$)					
Highest in model domain (located within 200 m of plant)	0.2	0.2	23	23.2	25
Maison Dieu nearest properties	0.001	0.00006	23	23.0	25

The results from Table 9 show that maximum CO concentrations, including background levels, would be very low and would not exceed the relevant EPA assessment criteria at any location including at nearest sensitive receptors.

Table 9 includes the predicted maximum 1-hour average NO_2 concentrations. It has been assumed that 100% of the NO_x is NO_2 at the point of maximum ground-level impact, a conservative approach as air quality monitoring from Singleton shows that NO_2 is closer to 20% when NO_x concentrations are elevated. Maximum 1-hour average NO_2 concentrations, due to the maximum plant emissions, and with maximum assumed background levels, would not exceed the EPA's 246 $\mu g/m^3$ criterion. The highest annual average NO_2 concentrations would also be below the EPA's annual average criterion. Based on these results, NO_2 concentrations are expected to comply with EPA criteria at all locations, including at sensitive receptor locations.

Above certain concentrations, NO_2 does have a characteristic pungent odour. The World Health Organisation (WHO) reports an odour threshold for NO_2 between 100 $\mu g/m^3$ and 410 $\mu g/m^3$. The modelling shows that the NO_2 concentrations due to the plant would be well below the odour threshold reported by the WHO at the nearest sensitive receptors. It has therefore been inferred that the project would not lead to adverse odour impacts.

Table 9 shows the predicted maximum 24-hour and annual average PM_{10} concentrations due to maximum plant emissions. These results show that maximum 24-hour average PM_{10} concentrations due to the plant would be no more than 1.5 $\mu g/m^3$ at the most affected ground-level location. Concentrations at the nearest properties would be two orders of magnitude lower. It was noted from Section 4.3 that background PM_{10} concentrations have historically exceeded 50 µg/m^3 from time-to-time and in the representative year, 2014, there were six days above 50 µg/m^3. The next highest monitored concentration was 48 µg/m^3 and combining this result with the maximum modelled contribution from the project (1.5 µg/m^3) demonstrates that the project would not cause exceedances of the EPA's 50 µg/m^3 criterion. Similarly, compliance is predicted for annual average PM_{10} concentrations where the highest cumulative concentration of 23.2 µg/m^3 is below the 25 µg/m^3 criterion.

The model results from Table 9 highlight some potential differences in impacts between Location A and Location B. Specifically, the highest concentrations due to the plant in Location B are generally higher than the highest concentrations due to the plant in Location A. This is because the terrain surrounding Location B is more undulating than the terrain surrounding Location A and, for Location B, the model has determined that the plant emissions would be more likely to intersect with this terrain, leading to potentially higher concentrations.

These results confirm that the project is a small operation in terms of emissions to air and potential impacts. Modelling has shown that the project emissions would not cause exceedances of EPA ambient air quality assessment criteria. It has therefore been concluded that the project would not result in adverse air quality impacts.

7. Conclusions

This report has provided an assessment of the potential air quality impacts associated with a proposed modular ammonium nitrate emulsion manufacturing plant to be located in the boundary of the existing HVO mine.

The air quality key issues for the project were identified as:

- Emissions (dust) due to machinery used for construction works.
- Emissions (CO, NO_2 and PM_{10}) from the optional diesel generator supplying power to the thermic fluid heating units during operation.

These issues were the focus of the assessment.

A review of the existing environment was carried out including an analysis of historically measured concentrations of key quality indicators from representative monitoring stations. This review showed that there was deterioration in air quality conditions (affecting particulate matter concentrations) in the recent two to three years, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Hunter Valley. Concentrations of other key air quality indicators have complied with EPA air quality criteria.

The potential significance and impacts of construction dust was determined from a qualitative review. The nature, scale and duration and proximity to sensitives areas indicated that air quality impacts are not expected to arise during construction. Dust management including the modification of activities during unfavourable weather conditions is however recommended to keep dust impacts to a minimum.

Potential impacts due to project emissions during operation were quantified by modelling. This modelling was based on conservative assumptions, such as continuous operation, to determine the potential concentrations of key air quality indicators at all ground-level locations and nearest sensitive receptors. Results from the modelling confirmed that the project is a small operation in terms of emissions to air and potential impacts. In addition, the modelling showed that the project emissions would not cause exceedances of EPA ambient air quality assessment criteria at either of the two locations being considered.

Based on these investigations it has been concluded that the project would not result in adverse air quality impacts.

8. References

DPIE (2020) "*Annual Air Quality Statement 2019*". Now a web-based document, available from https://www.environment.nsw.gov.au/

EPA (2016) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*".

NEPC (2003) *National Environment Protection (Ambient Air Quality) Measure*. National Environment Protection Council, Canberra.

OEH (2019) "*Annual Air Quality Statement 2018*". Available from https://www.dpie.nsw.gov.au/air-quality.

Appendix A. Annual and seasonal wind-roses

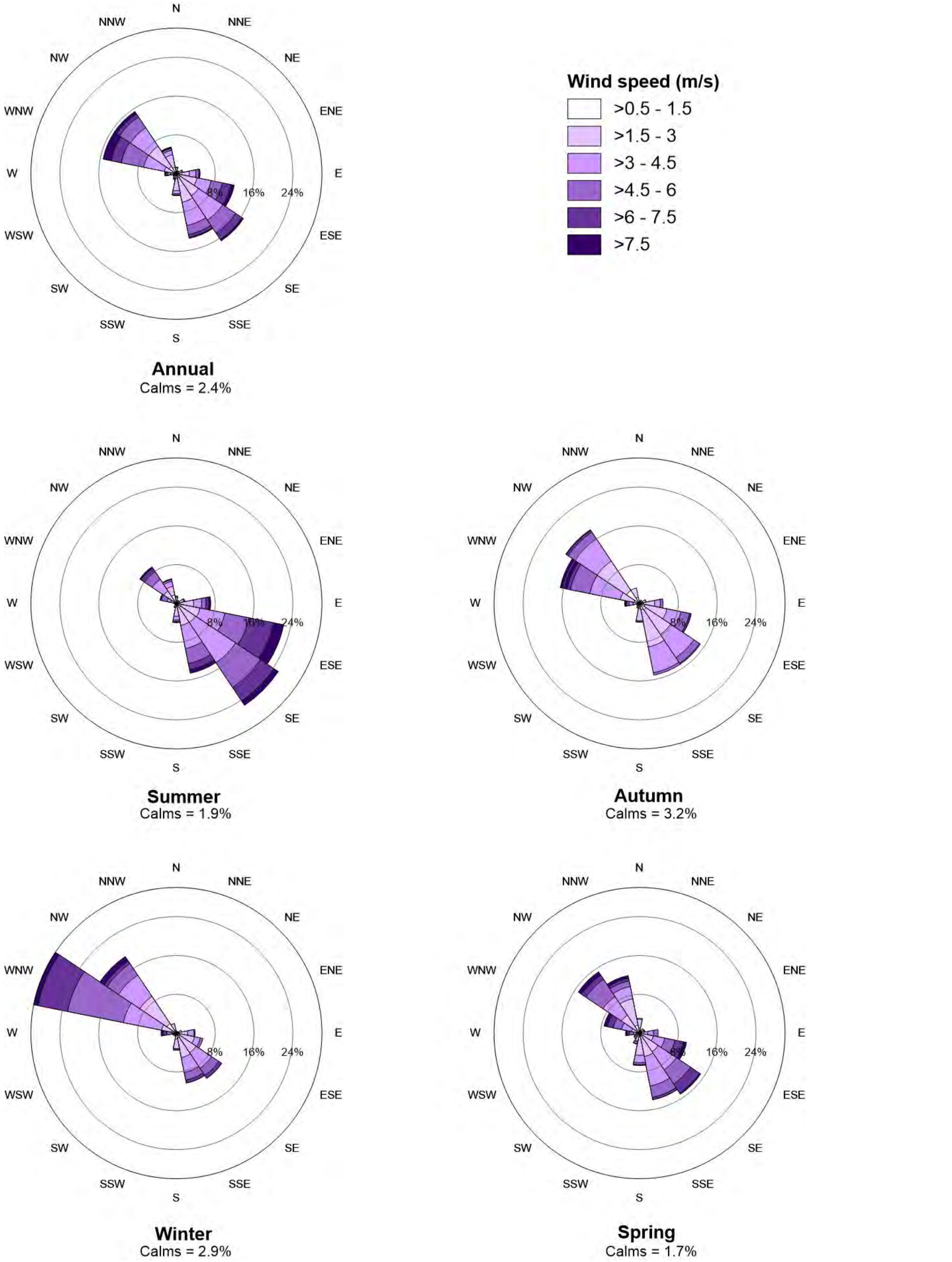

Figure A1 Annual and seasonal wind-roses for data collected at the Cheshunt meteorological station in 2014

Appendix B. Contour plots

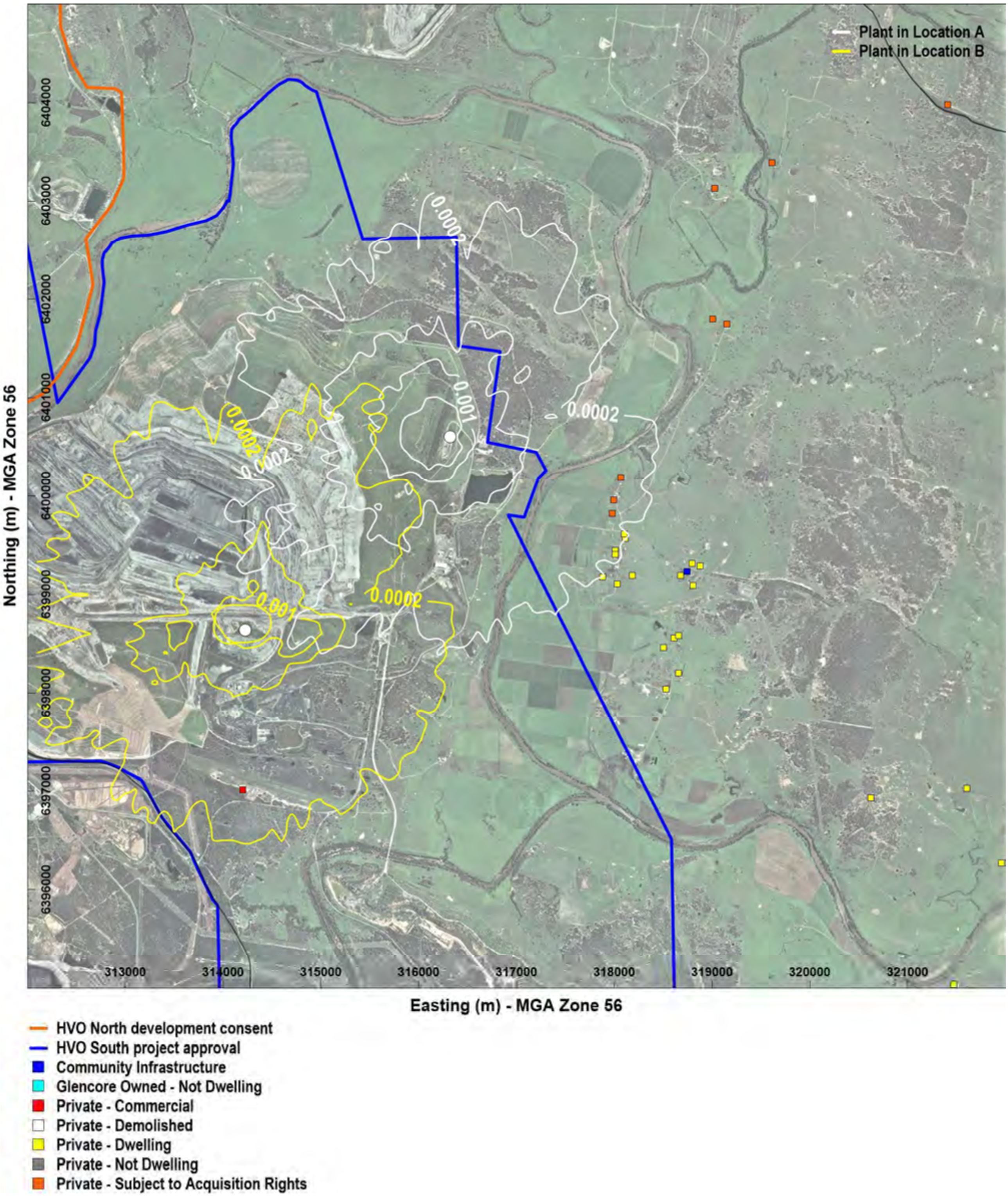

Figure B1 Predicted maximum 1-hour average CO concentrations due to ANE plant (mg/m^3)

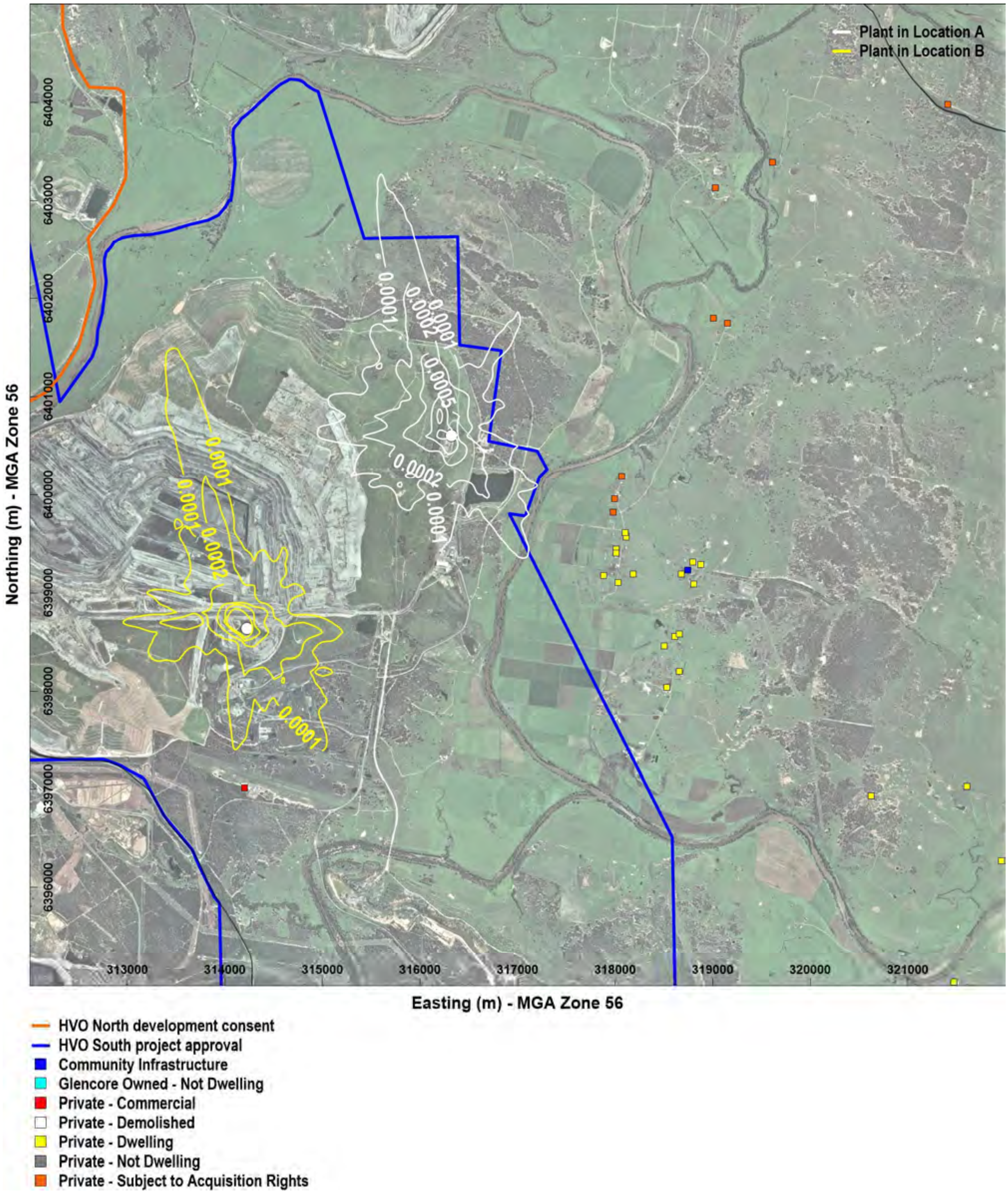

Figure B2 Predicted maximum 8-hour average CO concentrations due to ANE plant (mg/m^3)

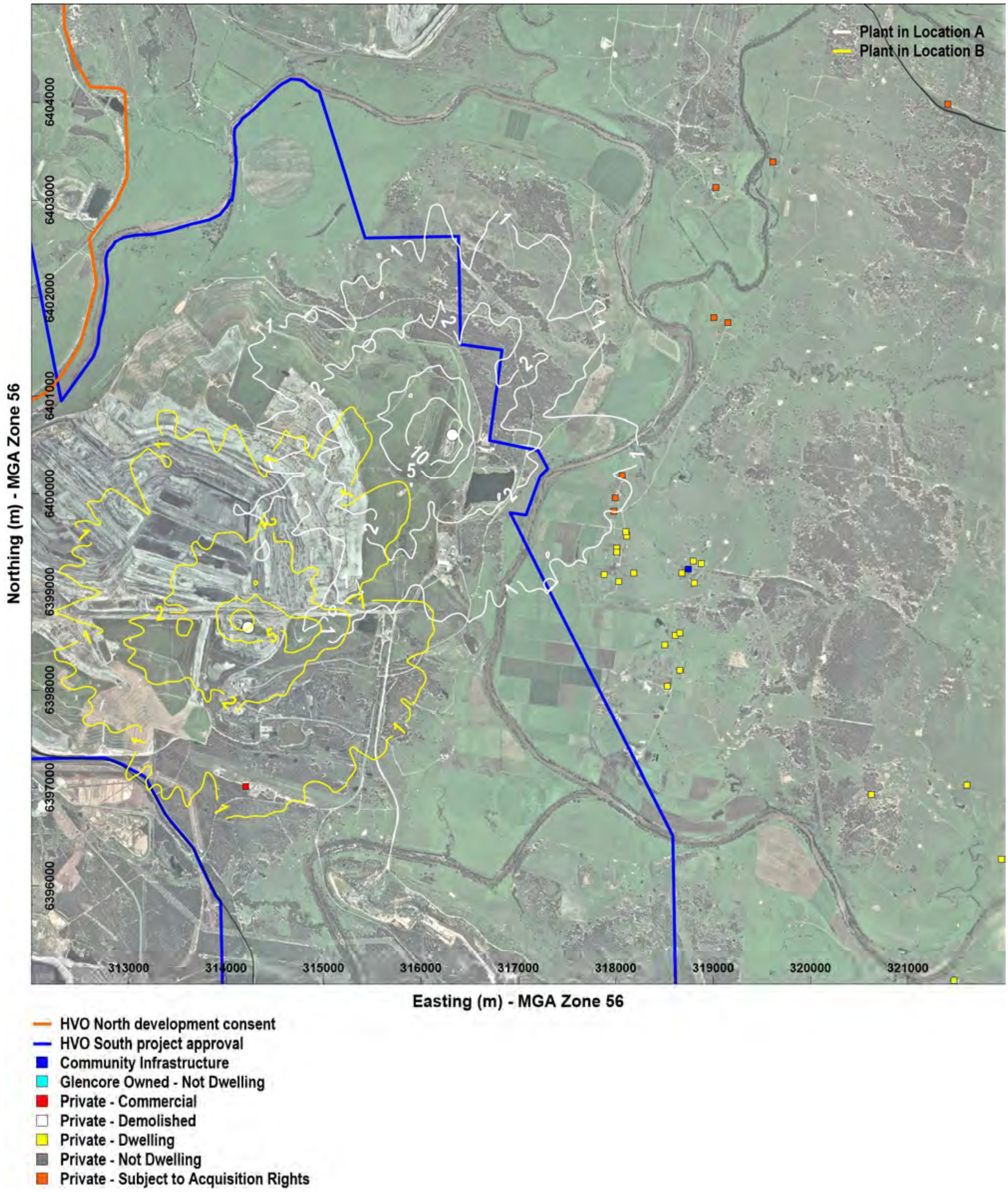

Figure B3 Predicted maximum 1-hour average NO_x concentrations due to ANE plant (µg/m^3)

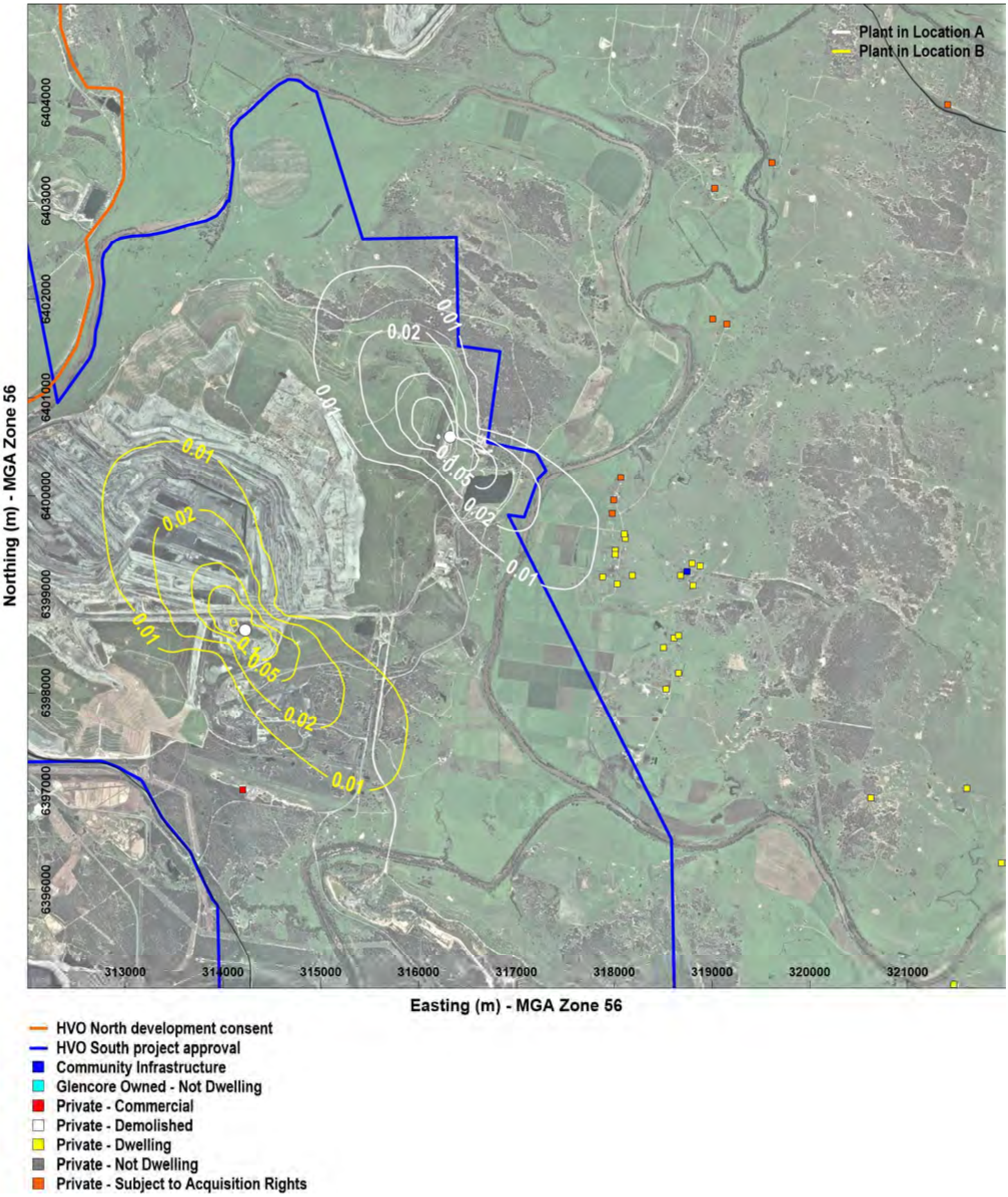

Figure B4 Predicted annual average NO_x concentrations due to ANE plant ($\mu g/m^3$)

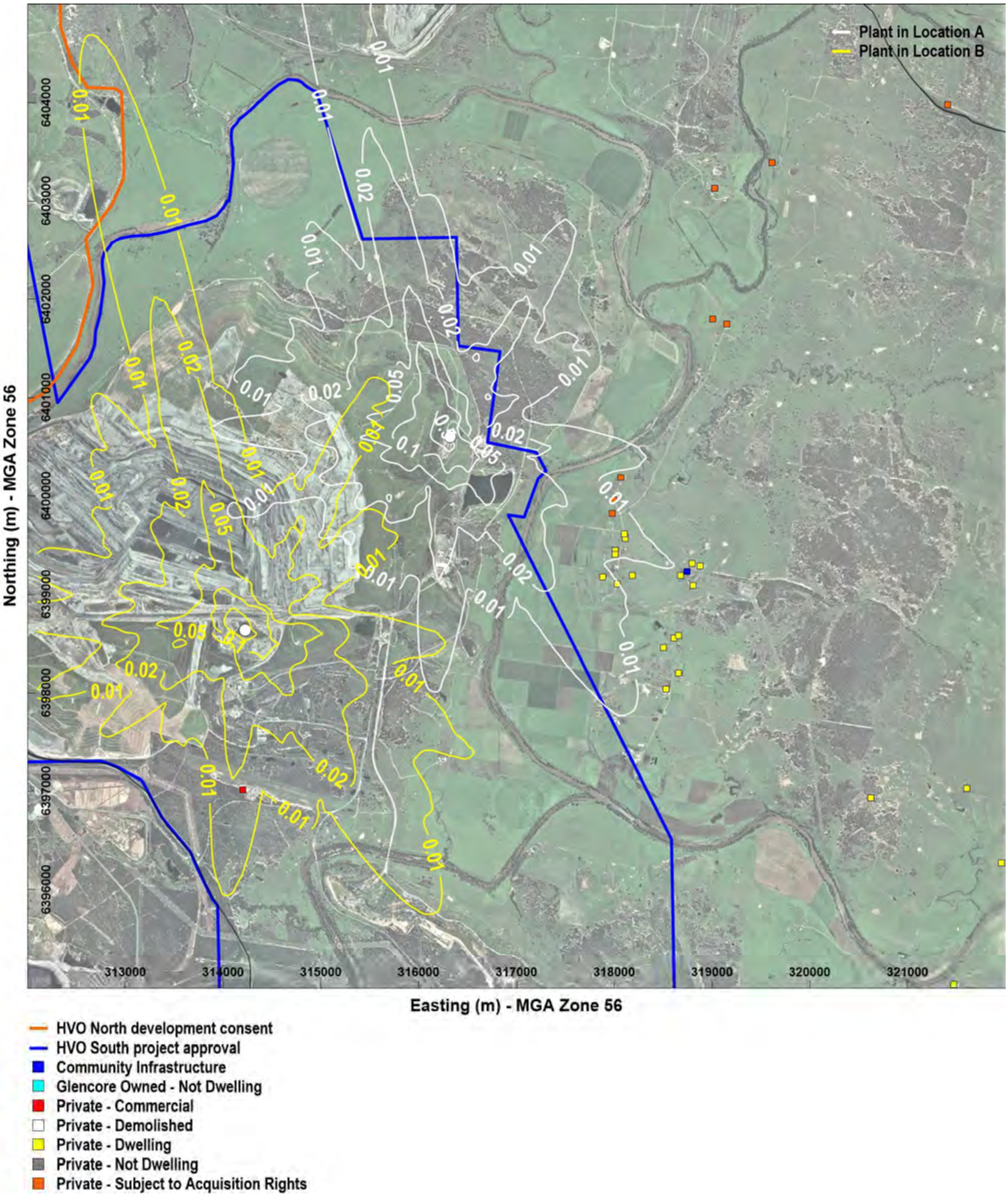

Figure B5 Predicted maximum 24-hour average PM_{10} concentrations due to ANE plant (µg/m^3)

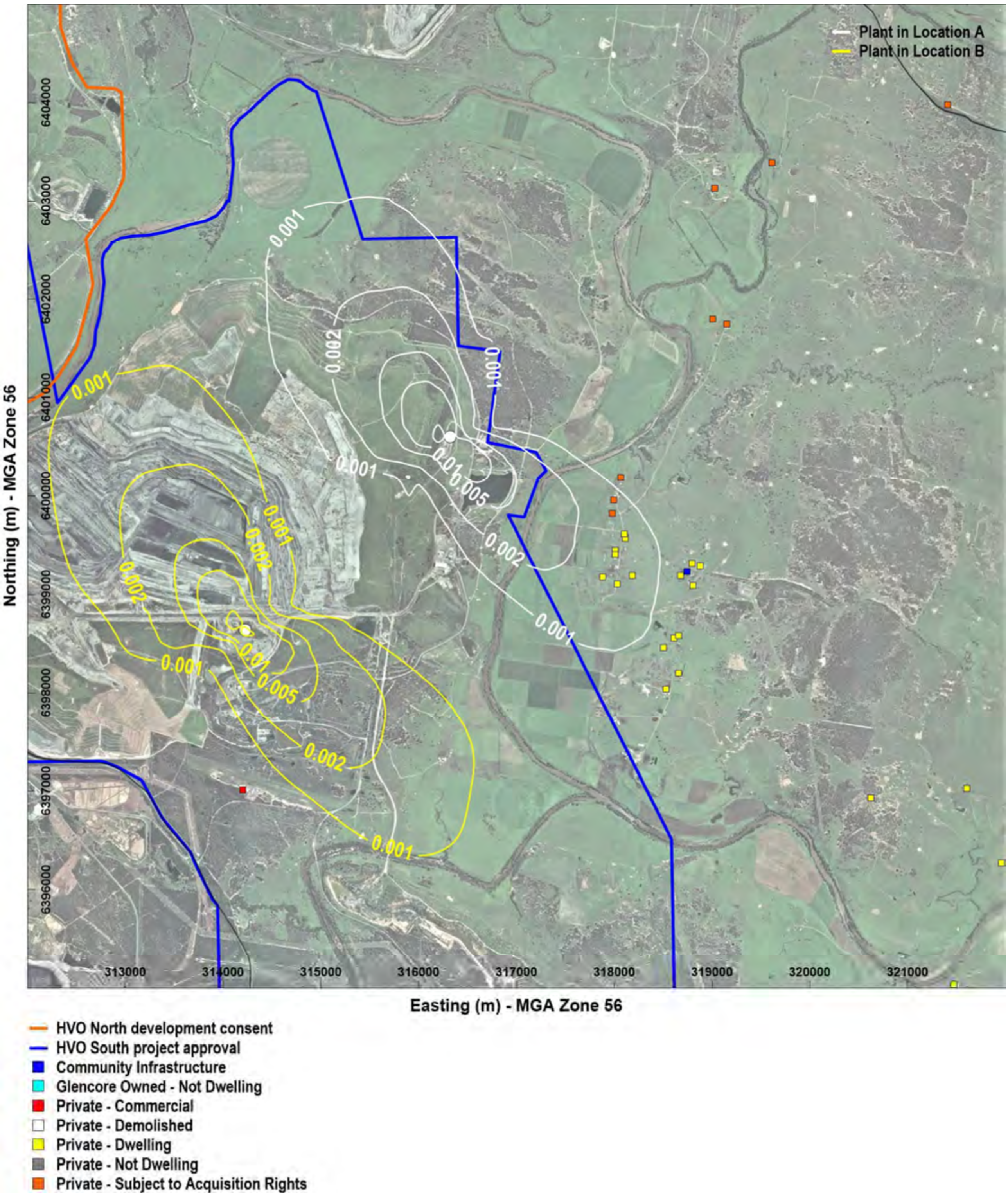

Figure B6 Predicted annual average PM_{10} concentrations due to ANE plant (µg/m^3)

APPENDIX E

Greenhouse Gas and Energy Assessment

GHGEA for the Proposed Modular Ammonium Nitrate Emulsion Plant

FINAL

May 2021

GHGEA for the Proposed Modular Ammonium Nitrate Emulsion Plant

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Hunter Valley Operations

Technical Director:	Malcolm Sedgwick
Report No.	20242/R02
Date:	May 2021

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

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Malcolm Sedgwick	24/5/21	Malcolm Sedgwick	24/5/21

Executive Summary

Hunter Valley Operations (HVO) is seeking to modify HVO South SSD Project Approval PA 06_0261 so it has approval to construct and operate an Ammonium Nitrate Emulsion (ANE) manufacturing plant within the existing HVO South mine disturbance area (the Proposed Modification). The key objectives of the Proposed Modification include:

- reduce the transport of Ammonium Nitrate (AN) and ANE by truck through the township of Singleton
- improve supply reliability and consistency of ANE for its operations.

No other changes to currently approved operations are proposed as part of the Proposed Modification.

This greenhouse gas and energy use assessment (GHGEA) assesses the likely greenhouse gas emissions associated with the Proposed Modification. The GHGEA found that the Proposed Modification can be associated with the following greenhouse gas emissions.

Net Greenhouse Gas Emissions associated with the Proposed Modification	
	t CO_2-e
Scope 1	14
Scope 2	314
Scope 3	-514

The Proposed Modification is expected to increase the proponent's net Scope 1 and 2 emissions by approximately 328 t CO_2-e per annum.

The Proposed Modification largely redistributes the source of Scope 3 emissions from Orica Liddell, to feedstock suppliers in Newcastle. The net change in Scope 3 emissions is generated by re-classifying some Scope 3 emissions as Scope 1 and 2 emissions. Subsequently the Proposed Modification reduces Scope 3 emissions by approximately -514 t CO_2-e per annum through transport related efficiencies.

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Tables

Appendices

1.0 Introduction

Hunter Valley Operations (HVO) is seeking to modify its Project Approval so it has approval to construct and operate an Ammonium Nitrate Emulsion (ANE) manufacturing plant (the Proposed Modification).

HVO currently sources ANE from an Orica Liddell manufacturing facility. ANE plant based near Liddell, NSW. The Proposed Modification will enable HVO to produce its annual ANE requirements, and reduce the need to transport ANE from Orica Liddell. The key objectives of the Proposed Modification include:

- reduce the transport of Ammonium Nitrate (AN) and ANE by truck through the township of Singleton
- to improve supply reliability and consistency of ANE for its operations.

No other changes to currently approved operations are proposed as part of the Proposed Modification.

Table 1.1 includes the key features of the Proposed Modification that may impact greenhouse gas emissions.

Table 1.1 Key Features of the Proposed Modification that May Impact Greenhouse Gas Emissions

Stage	Key Components of the Proposed Modification
Construction	• Engaging contractors to prepare the site and assemble the modular production facility (diesel use) • Purchasing construction materials for foundations and hard stand areas (embedded emissions) • Engaging contractors to transport construction materials (diesel use) • Purchasing modular components of the ANE plant (embedded emissions) • Engaging contractors to transport the modular components (diesel use)
Operation	• Decrease in ANE purchased from Orica • Decrease in ANE transported from Liddell • Increase in materials required for ANE production (AN, diesel and emulsifier) • Increase in materials transported from Sandgate / Newcastle • Increase in on-site energy use (electricity and diesel)

2.0 Assessment Framework

2.1 Objectives

It is proposed to modify the HVO South Project Approval (PA 06_0261) in accordance with the *Environmental Planning and Assessment Act 1979* Section 4.55 (1A). A Statement of Environmental Effects (SEE) is required to assess the environmental and social impacts of the Proposed Modification. This GHGEA has been prepared to support the SEE.

2.2 Scope

The scope of the GHGEA is limited to:

- calculating Scope 1, 2 and 3 greenhouse gas emissions for the Proposed Modification
- calculating energy use for the Proposed Modification.

2.3 Definitions

Table 2.1 contains concepts and a glossary of terms relevant to this GHGEA.

Table 2.1 Glossary of Terms[1]

Concept	Definition
Greenhouse gases	The greenhouse gases referred to in this GHGEA include: • Carbon dioxide • Methane • Nitrous oxide • Hydrofluorocarbons • Perfluorocarbons • Sulphur hexafluoride.
Scope 1 emissions	Direct emissions that occur from sources that are owned or controlled by the Proponent (e.g. fuel use). Scope 1 emissions are emissions over which the Proponent has a high level of control.
Scope 2 emissions	Emissions from the generation of purchased electricity consumed by the Proposed Modification.
Scope 3 emissions	Indirect emissions that are a consequence of the activities of the Proposed Modification, but occur at sources owned or controlled by other entities (e.g. outsourced services). Scope 3 emissions can include emissions generated upstream of the Proposed Modification by providers of energy, materials and transport.

2.4 Emission Assessment Methodology

The GHGEA framework is based on the methodologies and emission factors contained in the National Greenhouse Accounts (NGA) Factors 2020 (DISER 2020) (the NGA Factors). The assessment framework also incorporates the principles of The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (WRI/WBCSD 2004) (the GHG Protocol).

[1] The GHG Protocol 2004

The GHG Protocol provides an internationally accepted approach to greenhouse gas accounting. The GHG Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality.

Scope 1 and 2 emissions were calculated based on the methodologies and emission factors contained in the NGA Factors 2020 (DISER 2020). Scope 3 emissions associated with product transport were calculated based on emission factors contained in the *National GHG Inventory: Analysis of Recent Trends and GHG Indicators* (AGO 2007).

All methodologies and calculations have been made assuming that all operations will continue as described in **Section 1.0**.

2.5 Data Sources

The calculations in this report are based on activity data developed by the Proponent. **Table 2.2** contains the source of activity data.

Table 2.2 Source of Activity Data Used for the Assessment

Activity data	Source
On-site fuel consumption	HVO
Electricity consumption	HVO
ANE consumption	HVO

A detailed description of activity data and calculations are provided in **Appendix A** and **B**.

2.6 Assessment Boundary

The GHGEA boundary was developed to include all significant Scope 1, 2 and 3 emissions.

2.7 Data Exclusions

The GHG Protocol requires inventory data and methodologies to be relevant, consistent, complete, transparent and accurate. The relevance principle states that the greenhouse gas inventory should appropriately reflect greenhouse gas emissions and serve the decision-making needs of users – both internal and external [to the Proposed Modification] (WRI/WBCSD 2004).

The Proposed Modification has a number of potential emission sources, however, the key emission sources often targeted by mitigation measures and stakeholders can be summarised as:

- diesel use
- electricity use
- materials transport
- embedded emissions in materials.

The completeness principle states that all relevant emission sources within the chosen inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled (WRI/WBCSD 2004).

The emission sources listed in **Table 2.3** have been excluded from the GHGEA as modelling activity data for these sources is unlikely to generate sufficient emissions to influence the decision making outcomes of stakeholders.

Table 2.3 Data Exclusions

Emission source	Scope	Description
Combustion of fuel for energy	Scope 1	Small quantities of fuels such as petrol and LPG
Industrial processes	Scope 1	Sulphur hexafluoride (high voltage switch gear). Hydrofluorcarbon (commercial and industrial refrigeration)
Waste water handling (industrial)	Scope 1	Methane emissions from waste water management
Solid waste	Scope 3	Solid waste to landfill
Business travel	Scope 3	Employees travelling for business purposes
Employee travel	Scope 3	Employees travelling between their place of residence and HVO

2.8 Materiality

The GHG Protocol states "information is considered to be material if, by its inclusion or exclusion, it can be seen to influence any decisions or actions". This assessment assumes data, results and impacts can be significant and influence decision makers, while also being numerically immaterial (i.e. less than 5%).

3.0 Emission and Energy Assessment Results

Greenhouse gas and energy use estimates have been calculated for the Proposed Modification. The greenhouse gas estimates referenced in this document only relate to the Proposed Modification. Estimates in this document do not include emissions associated with currently approved operations.

3.1 Construction Emissions

The construction of the Proposed Modification will be outsourced to a reputable contractor. The contractor will prepare a site for the ANE plant, and assemble all components of the modular, container-based system. The modular system is designed to be trucked and relocatable, and the contractor will supply and assemble the following components:

- ANE manufacturing container
- high density ammonium nitrate (HDAN) stack and transit bin
- AN solution production tanks
- AN solution melt tanks
- diesel transfer tanks and fill point
- thermal oil heating units
- gassing solution manufacture container
- ANE product tanks.

Supporting infrastructure will include electricity supply and controls, staff facilities, water supply tanks, a temporary workshop, light vehicle parking bay, and bunding infrastructure.

3.1.1 Direct Emissions

All construction related activities will be outsourced to third party contractors. The Proposed Modification's construction related activities will not generate direct Scope 1 emissions for the Proponent.

3.1.2 Indirect Emissions

The construction of the Proposed Modification is likely to generate Scope 3 emissions from the following sources:

- On-site energy use by contractors (diesel used during site preparation and module assembly).
- Transport energy use by contractors (diesel used during the delivery of modular equipment).
- Embedded emissions in construction materials (foundations and hard stand areas).
- Embedded emissions in modular equipment.

Embedded emissions in modular equipment is likely to be the primary source of Scope 3 emissions (based on capital value), however, these emissions are very difficult to estimate with any degree of certainty.

3.2 Operational Emissions

The net impact of the Proposed Modification is assessed by comparing current operations with proposed operations. The following sections estimate greenhouse gas emissions associated with existing ANE consumption and the Proposed Modification.

3.2.1 Existing operations

HVO currently purchases approximately 31,000 tonne of ANE from Orica in Liddell, NSW. The following information was used to estimate greenhouse gas emissions associated with existing ANE consumption.

- HVO purchases 31,000 tonne of ANE per annum from Orica
- approximately 1.145 t CO_2-e / tonne of ANE is embedded in ANE (see **Appendix A**)
- 31,000 tonne of ANE per annum is transported 55 km from Liddell to HVO
- ANE is transported using trucks with a payload of 32 tonne.

The estimated annual greenhouse gas emissions associated with existing ANE consumption are summarised in **Table 3.1**.

Table 3.1 Summary of Annual Greenhouse Gas Emissions Associated with Existing ANE Consumption

Stage	Scope	Source	Source Totals (t CO_2-e)	Scope Totals (t CO_2-e)
Operation	Scope 1 (Direct)	Diesel use	0	0
	Scope 2 (Indirect)	Electricity	0	0
	Scope 3 (Indirect)	Purchased ANE	35,485	35,651
		ANE transport	166	
Greenhouse gas emissions associated with existing ANE consumption				**35,651**

(Refer to **Appendix A** for further detail)

3.2.2 Proposed Operations

The following information was used to estimate the greenhouse gas emissions associated with the Proposed Modification.

- The HVO ANE plant will purchase 23,250 tonne of AN per annum from Newcastle.
- The HVO ANE plant will purchase 2,170 tonne of feedstock diesel per annum from Newcastle.
- HVO will truck AN and diesel 92 km from Newcastle.
- The HVO ANE plant will consume approximately 5 kL of diesel per annum (operating equipment such as forklifts).
- The HVO ANE plant will consume approximately 390,000 kWh per annum.

The annual greenhouse gas emissions associated with the Proposed Modification are summarised in **Table 3.2**.

Table 3.2 Summary of Annual Greenhouse Gas Emissions Associated with the Proposed Modification

Stage	Scope	Source	Source Totals (t CO_2-e)	Scope Totals (t CO_2-e)
Operation	Scope 1 (Direct)	Diesel use	14	14
	Scope 2 (Indirect)	Electricity	314	314
	Scope 3 (Indirect)	Purchased AN	34,875	35,137
		Purchased diesel	0	
		Materials transport	228	
		Associated with energy extraction and distribution	34	
Greenhouse gas emissions associated with the Proposed Modification				**35,465**

(Refer to **Appendix B** or further detail)

3.2.3 Net Direct Operational Emissions

The Proposed Modification is expected to increase the proponent's net Scope 1 emissions by approximately 14 t CO_2-e. Scope 1 emissions will be generated by diesel combustion.

3.2.4 Net Indirect Operational Emissions

The Proposed Modification is expected to increase the proponent's net Scope 2 emissions by approximately 314 t CO_2-e. Scope 2 emissions are generated by electricity generators in NSW.

The Proposed Modification is expected to decrease the proponent's net Scope 3 emissions by approximately 514 t CO_2-e.

The primary source of Scope 3 emissions are materials use and transport. The Proposed Modification largely redistributes the source of Scope 3 emissions from Orica Liddell, to feedstock suppliers in Newcastle.

The net change in Scope 3 emissions is generated by re-classifying some Scope 3 emissions as Scope 1 and 2 emissions (i.e. emissions associated with electricity use and diesel combustion). The Proposed Modification also reduces Scope 3 emissions through transport related efficiencies. The Proposed Modification will reduce transport distances for both feedstock materials and the ANE product.

3.3 Energy Use

The Proposed Modification is forecast to require approximately 1,600 GJ per annum from diesel and grid electricity. The Proposed Modification is also expected to consume approximately 100 GJ per annum in feedstock diesel. Feedstock diesel will increase energy consumption, but will not generate greenhouse gas emissions.

4.0 Conclusion

The Proposed Modification is expected to increase the proponent's net Scope 1 and 2 emissions by approximately 328 t CO_2-e per annum.

The Proposed Modification largely redistributes the source of Scope 3 emissions from Orica Liddell, to feedstock suppliers in Newcastle. The net change in Scope 3 emissions is generated by re-classifying some Scope 3 emissions as Scope 1 and 2 emissions. Subsequently the Proposed Modification reduces Scope 3 emissions by approximately -514 t CO2-e per annum through transport related efficiencies.

5.0 References

Australian Greenhouse Office (2007). National Greenhouse Gas Inventory: Analysis of Recent Trends and Greenhouse Gas Indicators

Australian Government Department of Industry, Science, Energy and Resources (DISER) (2020). National Greenhouse Accounts (NGA*)* Factors October 2020

URS (2012). Greenhouse Gas Assessment for Proposed Incitec Pivot Ammonium Nitrate Plant, Kooragang Island

World Resources Institute and the World Business Council for Sustainable Development (WRI/WBCSD) (2004). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard

APPENDIX A

Calculation of Current Operational Emissions

An estimate of greenhouse gas emissions associated with purchased ANE

Process	Material	Quantity	Data for calculations	Emission Factor (Kg CO_2-e / Material unit)	Totals (t CO_2-e)
Purchased materials	AN	23,250 tonne	23,250 tonne	1,500 Kg CO_2-e / AN tonne[2]	34,875
	Diesel feedstock	2,170 tonne	100.194 GJ[3]	3.6 Kg CO_2-e / GJ	0.36
	Water	5,270 tonne	5,270 tonne	0	0
	Emulsifier	310 tonne	310 tonne	0[4]	0
Materials transport	AN and diesel feedstock (100 Km one way)	25,420 tonne	3,348.386[5] GJ	74[6] Kg CO_2-e / GJ	247.78
On-site energy use	Diesel use	5,000 litres	193 GJ	73.8[7] Kg CO_2-e / GJ	14.24
	Electricity use	390,000 kWh	390,000 kWh	0.89[8] Kg CO_2-e / kWh	347.1
Potential greenhouse gas emissions associated with producing 31,000 tonnes of ANE					**35,484.48**

[2] Approximate emission factor based on Orica KI 2009 EIS (1.81 t CO2-e / AN tonne) and Incitec Pivot KI 2012 EIS (1.00 t CO2-e / AN tonne)

[3] Assuming diesel density of 0.836tonnes / litre and 38.6 GJ / kL

[4] Not assessed

[5] Assuming 32 tonne payload, 200km round trip and diesel use of 0.546 Litres / km

[6] Full life cycle for transport diesel use

[7] Full life cycle for stationary diesel use

[8] Full life cycle for NSW grid electricity

ANE Transport – Truck

Activity Data				Emission Factors
				Full Life Cycle – Scope 3
Transport mode	Usage	Units	GJ	kg CO_2-e/GJ
Truck (Liddell – HVO)	58.183[9]	kL	2,245.868	74[10]
				t CO_2-e
			Total GHG Emissions (t CO_2-e)	**166**

[9] Assuming 32 tonne payload, 110 km round trip and diesel use of 0.546 Litres / km

[10] Full life cycle for transport diesel use

APPENDIX B

Calculation of Proposed Operational Emissions

Stationary Diesel Use

Activity Data	Energy Use		Emission Factors		
			CO_2	CH_4	N_20
kL	GJ/kL	GJ	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
5	38.6	193	69.9	0.1	0.2
			t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)			13.5	0.02	0.04
				Total GHG Emissions (t CO_2-e)	**14**

Electricity Use

Activity Data	Energy Use	Emission Factors		
		CO_2	CH_4	N_20
kWh	GJ	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
390,000	1,404	224	N/A	N/A
		t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)		314	N/A	N/A
			Total GHG Emissions (t CO_2-e)	**314**

Extraction, Production and Distribution of Energy Purchased

Activity Data		Emission Factors		
		CO_2	CH_4	$N_2$0
Purchased energy	GJ	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
Diesel	193	3.6	N/A	N/A
Electricity	1,404	24	N/A	N/A
		t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG Emissions (t CO_2-e)		14,356	N/A	N/A
			Total GHG Emissions (t CO_2-e)	**34**

Purchased Ammonium Nitrate

Activity Data				Emission Factors
				Full Life Cycle – Scope 3
Material	Usage	Units		kg CO_2-e/GJ
Ammonium Nitrate	23,250	tonne		1,500
				t CO_2-e
			Total GHG Emissions (t CO_2-e)	**34,875**

Purchased feedstock diesel

Activity Data				Emission Factors
				Scope 3
Material	Usage	Units	GJ	kg CO_2-e/GJ
Diesel feedstock (not combusted)	2,170	tonne	100.194	3.6
				t CO_2-e
			Total GHG Emissions (t CO_2-e)	**0.36**

Product Transport – Truck

Activity Data				Emission Factors
				Full Life Cycle – Scope 3
Transport mode	Usage	Units	GJ	kg CO_2-e/GJ
Truck	79.806[11]	kL	3,080	74
				t CO_2-e
			Total GHG Emissions (t CO_2-e)	**228**

[11] Assuming 32 tonne payload, 184km round trip and diesel use of 0.546 Litres / km

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