Penrith Lakes Development Corporation

Importation of VENM and ENM Modification

Section 75W Modification Environmental Assessment

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Executive Summary

Penrith Lakes Development Corporation (PLDC) currently has approval to import up to 3 million tonnes of VENM (Virgin Excavated Natural Material) to the Penrith Lakes Scheme (Scheme) over a 3 year period.

A Statement of Environmental Effects (SEE) was conducted in 2008, and consent was granted on the 4th of July 2009 to modify DA2, DA3 and DA4 for the importation of VENM.

A modification application was submitted to the then Department of Planning and Infrastructure (DP&I) (now Department of Planning and Environment, DP&E) in 2012 as the schedule for importing the VENM to the site had changed and as such, the previous consents for the VENM importation had not been activated. The updated schedule of importation of VENM was approved by DP&E in February 2014.

PLDC now propose to further modify DA2, DA3 and DA4 for the importation of an additional 5 million tonnes of VENM and Excavated Natural Material (ENM) in early 2015 to fulfil the landform requirements as set out in the 2 year plans, previously approved by DP&I in 1990, 2000, 2001 and 2013.

This environmental assessment therefore proposes the following modifications:

- Importing source Excavated Natural Material (ENM), as well as VENM, with strict import protocols including geotechnical and environmental sampling, testing and certification;
- Increasing the amount of VENM and ENM to be imported by an additional five million tonnes at a rate of up to two million tonnes per year (for a total of eight million tonnes including the three million tonnes of VENM already approved for importation);
- Sourcing VENM and ENM from excavation sites anywhere in the Sydney Metropolitan Area and surrounding areas using the public road network and legal road trucks for haulage to Penrith; and
- Commencing the importation of the additional five million tonnes of VENM and ENM in early to mid-2015 when quarrying operations have ceased.

Availability of VENM/ENM in the Sydney Metropolitan Area would determine the rate of importation (up to a ‘worst case’ maximum of 2 million tonnes per year).

Overall, the proposed modification for VENM/ENM Importation will have low environmental impact. Some aspects of the proposed modifications will require management measures to ensure that impacts remain low. These include noise resulting from additional traffic, air quality (dust) and soil erosion and sedimentation.

1 Introduction

1.1 Project Outline

Penrith Lakes Development Corporation (PLDC) currently has approval to import up to 3 million tonnes of VENM (Virgin Excavated Natural Material) to the Penrith Lakes Scheme (Scheme) in a period of 3 years.

A Statement of Environmental Effects (SEE) was conducted in 2008, and consent was granted on the 4th of July 2009 to modify DA2, DA3 and DA4 for the importation of VENM.

A modification application was submitted to the then Department of Planning and Infrastructure (DP&I) (now Department of Planning and Environment, DP&E) in 2012 as the schedule for importing the VENM to the site had changed and as such, the previous consents for the VENM importation had not been activated. The updated schedule of importation of VENM was approved by DP&E in February 2014.

PLDC now propose to further modify DA2, DA3 and DA4 for the importation of an additional 5 million tonnes of VENM and Excavated Natural Material (ENM) in early 2015 to fulfil the landform requirements as set out in the 2 year plans, previously approved by the DP&I in 1990, 2000, 2001 and 2013.

Arup has been commissioned by PLDC to prepare an Environmental Assessment (EA) to assess the potential environmental impacts associated with the modification of the previous consent granted in February 2014 for the importation of VENM to the Penrith Lakes Scheme.

This EA is to accompany the application to modify the existing consents to Development Application 2 (DA2), Development Application 3 (DA3), and Development Application 4 (DA4). The EA and modified Development Applications will be lodged by PLDC to the Minister of Planning for determination under Section 75W of the *Environmental Planning and Assessment Act* 1979.

1.2 Report Structure

This report presents the Environmental Assessment for the proposed modification. The EA is structured as follows:

Section 1	Background to the Penrith Lakes Scheme including existing environmental management measures and surrounding areas.
Section 2	Legislative framework and planning context of the Scheme and this modification of proposal.
Section 3	Background context to the modification of the approved development consent and the Scheme describing the modification in terms of differences to the approved development.
Section 4	Agency Consultation.
Section 5	Risk Assessment of the potential environmental impacts of the modification

Section 6 Detailed assessment of key issues including a description of the baseline environmental conditions currently experienced on the site, the potential environmental effects likely to arise from the Project and description of environmental management measures to be implemented on site.

Key issues discussed are:

- Traffic and Access
- Noise and Vibration
- Air Quality
- Soils, Water and Landform

Section 7 Statement of Commitments

Section 8 Justification for the Project and Conclusions

1.3 Background to PLDC and the Scheme

Extraction of sand and gravel from the Penrith-Castlereagh floodplain, on the Nepean River, began on a large scale in the 1950's, progressing for three decades in a 'piecemeal', haphazard fashion. At the request of Penrith City Council, and in acknowledgement of a growing concern over the rehabilitation of the existing quarrying operations, the then State Planning Authority (now DP&E) undertook a Regional Environmental Statement (RES) for the area. The aim of the study was to examine the feasibility of coordinating the extraction and rehabilitation activities of the separate companies and to create a regional water-orientated recreation resource in the former quarry areas. Penrith Lakes Development Corporation was the resultant body, commencing operation in 1980, to coordinate the 1935 ha site. The Scheme boundary is illustrated in Figure 1.

PLDC is an unlisted public company which coordinates the extraction and rehabilitation operations of its three shareholder companies in accordance with the expectations of the NSW Government. The shareholders, currently Boral Resources (NSW) Pty Ltd, Hanson Australia Ltd (Heidelberg, and formerly Pioneer International Ltd) and Holcim Pty Ltd (formerly Readymix Holdings Pty Ltd), exercise joint control by means of their ownership in PLDC.
The shareholders process the raw feed in their existing processing plants. Now that the operations are winding down, only the offsite Boral plant is still operational, with Readymix (Holcim) having ceased operations and the Pioneer (Hanson) Plant has been fully decommissioned. Extraction and processing at the Scheme is expected to be completed by approximately early to mid-2015.

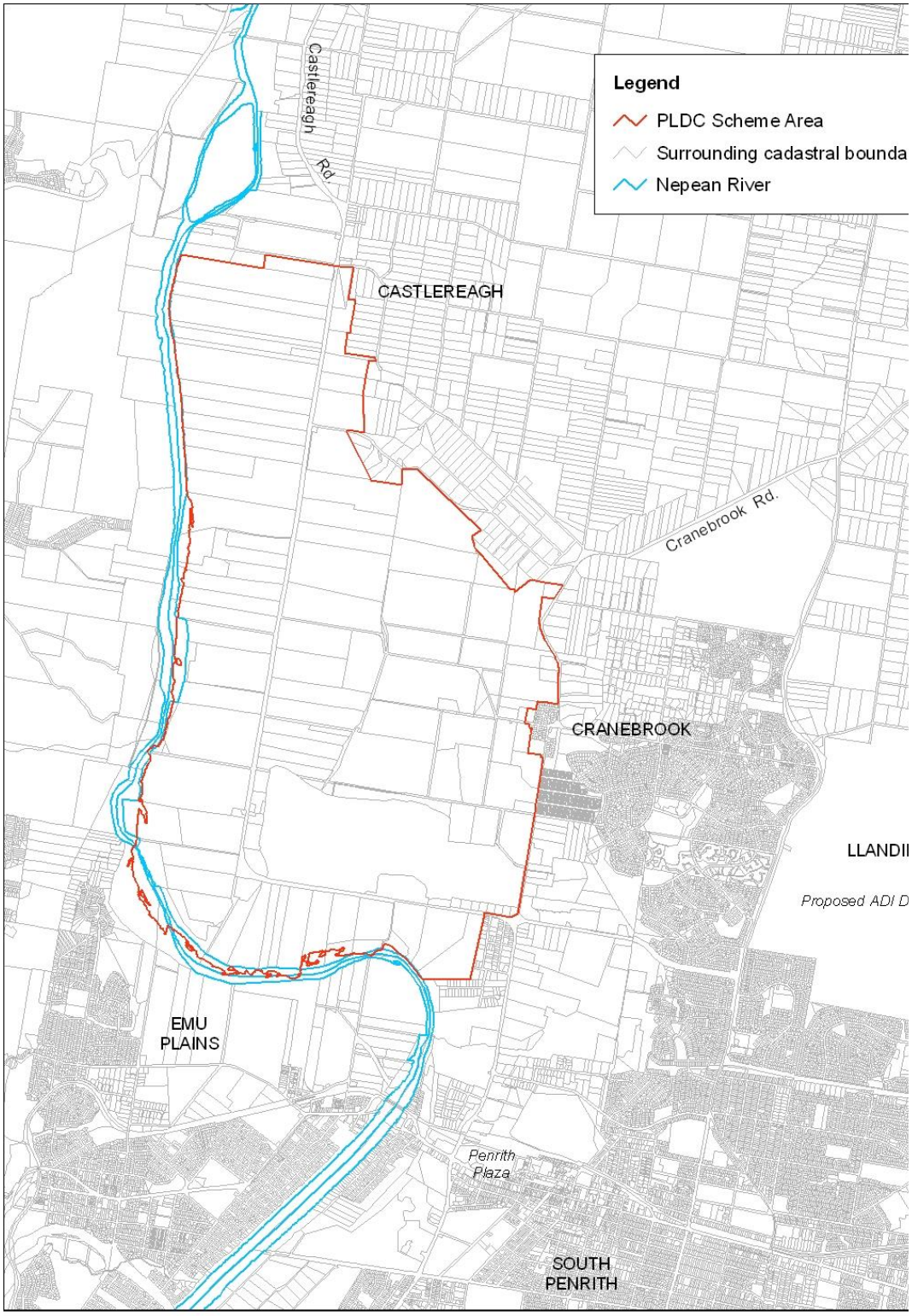

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Figure 1 Extent and geographical location of the Penrith Lakes Scheme

1.4 Site Description

The Penrith Lakes Scheme is located on a 1935 ha area of floodplain north of Penrith CBD (Figure 1). It is situated with the Blue Mountains escarpment to the west, and the Nepean River traversing both the western and southern boundaries. To the north east, flat floodplain is sharply contrasted by Castlereagh Escarpment. Cranebrook Village lies to the east, with further urban settlement to the south and southwest.

Within the Scheme, colonial settlement, farming and gravel extraction have been historical activities, although it wasn't until the 1950s that extraction occurred on a large commercial scale. Sand and gravel from extraction operations on the site have provided building materials for much of the residential and business developments in the Sydney Metropolitan Area over the past fifty years. Quarrying operations are ongoing at the Scheme, however, two of the three processing plants have ceased operations, and Boral are expected to conclude activities within three years.

Also of note are the Sydney International Regatta Centre (SIRC) Lakes, and the nearby Penrith White Water Rafting facility which were both used as part of the Sydney Olympic Games. They are still used extensively by the public for similar events and recreational purposes.

1.5 Surrounding Features

Residences: Except to the west, the boundaries of the site are dominated by low to medium density housing. There are extensive urban areas to the south and southwest of the site, with a number of residential properties inside the southern boundary of the Scheme site. On the eastern boundary of the site is Cranebrook Village (Figure 2), which will likely be the most sensitive receiver for any offsite impacts of the proposed modifications.

Heritage: There are several heritage items within and nearby the Penrith Lakes Scheme. Items in the vicinity of the modification works are discussed in Appendix G and include; Upper Castlereagh School & Residence, Upper Castlereagh Methodist Church and Hall and the Methodist Cemetery (Figure 2).

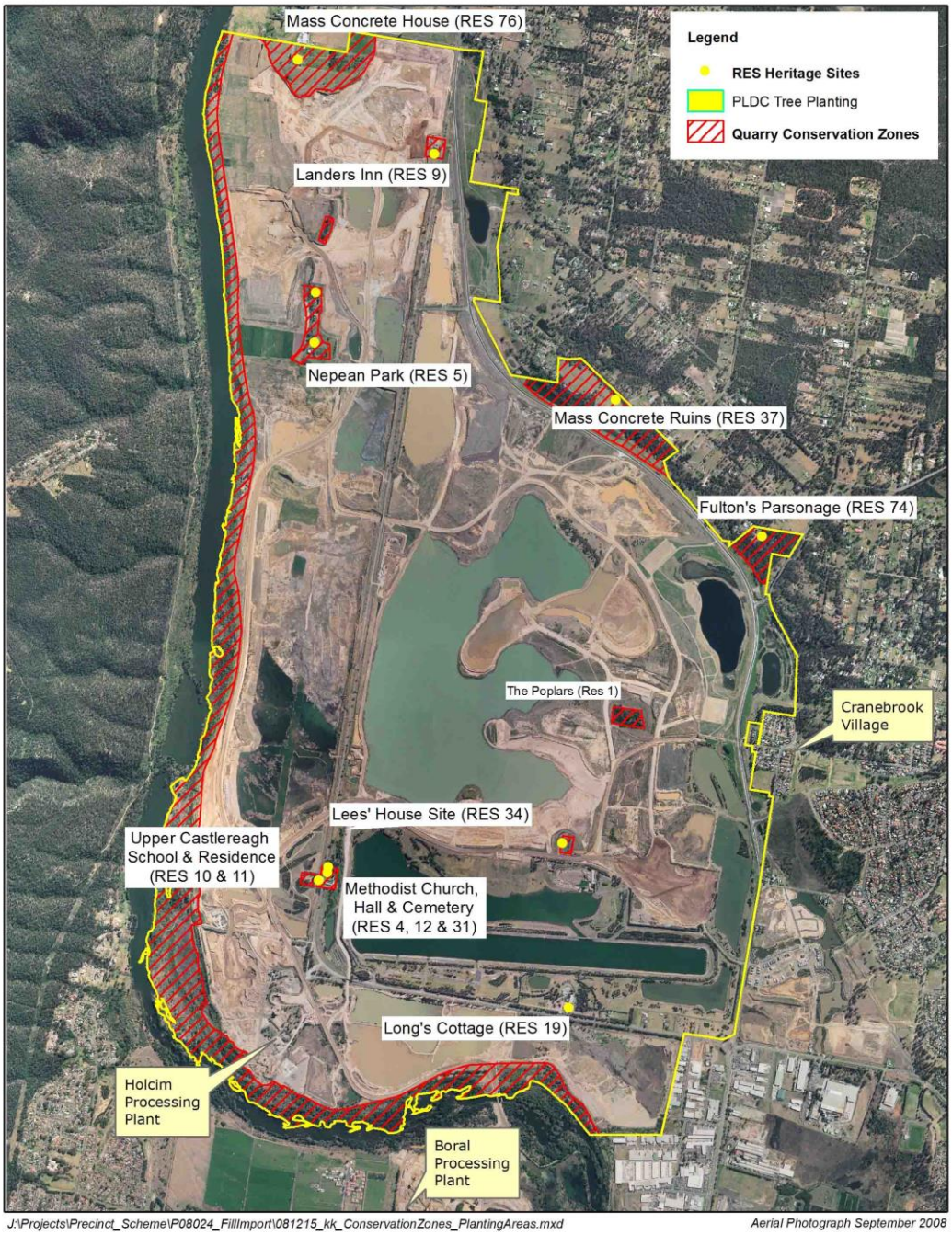

Figure 2 Surrounding Features Map

1.6 Environmental Management at PLDC

As per consent and licence conditions there is a broad range of other ongoing management procedures in place across the Scheme to prevent and mitigate any environmental impacts including, but not limited to:

- Water quality monitoring;
- Dust suppression and monitoring;
- Noise monitoring; and,

- Monitoring of fish stock, and management of European carp.

PLDC operations are governed by four principal operational approvals, being the consent conditions contained within DA 2, 3 and 4 Consents (refer to Section 2.4) and the Environmental Protection Licence #2956.

PLDC undertake monitoring and reporting in accordance with the requirements of these DA's and the Environmental Protection Licence including an existing telephone complaints line. PLDC also prepares and submits an annual return to the EPA detailing all monitoring results and any non-conformances. No noise complaints have been received for several years. Any dust non-conformances have generally been attributed to causes outside of PLDC's control such as vandalism and back burning by the Fire Brigade.

2 Legislative Framework

2.1 Commonwealth Legislation

2.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection to matters of National Environmental Significance (NES) which include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mines);
- A water resource, in relation to coal seam gas development and large coal mining development.

The proposed development will not affect any matters of NES, and therefore referral to the Department of Environment and Heritage is not required. Section 6 provides an assessment of environmental impacts associated with the proposal.

2.2 State Legislation (NSW)

2.2.1 Environmental Planning and Assessment Act 1979

The Project constitutes 'development' and therefore is to be considered under the *Environmental Planning & Assessment Act* 1979 (the Act) and the *Environmental Planning & Assessment Regulation* 2000 (the Regulation). The Act and Regulation set out the assessment framework under which development must be assessed.

The existing development consents DA2, DA3 and DA4 were granted by DP&E (then DUAP) in 1995 and 1998 respectively under Part 4 of the Act. The original consents permitted development for the progressive extraction and rehabilitation of land within the Penrith Lakes Scheme.

The Section 75W of the Act allows for development applications made under Part 4 to be modified under the same part provided that, 'the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted'. Following consultation with DP&E, it was agreed that since the modification included the following, then the modified consents would relate to substantially the same development as permitted by the existing DA's:

- The source material changed from VENM to both VENM and ENM;
- The amount of VENM and ENM to be imported has increased;
- The timeframe for importing the additional fill has changed (commencing in early-mid 2015).

2.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (POEO Act) regulates emissions to air, water and land. It offers an integrated system to regulate specific types of activities and installations that have the potential to cause environmental harm as a result of their operations.

The Office of Environment and Heritage (OEH) is the regulatory authority that administers the POEO Act, and has the power under the Act to issue clean up notices if it reasonably suspects that a pollution incident has occurred or is occurring. Council also has certain authority under the POEO Act in relation to pollution incidents.

Extractive industries are listed under Part 1, Schedule 1 as an activity for which the occupier of a premises at which the activity is carried on, requires an Environmental Protection Licence (EPL) from OEH authorising the activity to be carried on at that premises.

PLDC currently holds an EPL (Licence Number 2956) authorising crushing, grinding or separating works, extractive industries and other land-based extraction.

This project will not require any additional approvals, licences or permits under the POEO Act.

The proposed ENM imported would meet the requirements of the *Excavated Natural Material Exemption 2012* under Part 6, Clause 51 and 51A of the POEO (Waste) Regulation 2005.

2.2.3 Roads Act 1993

The *Roads Act* 1993 outlines the functions of the roads authorities in the development, maintenance and operation of public roads, including additional works.

The roads authority for most local public roads is the local council; however the roads authority for classified roads is the Roads and Maritime Services (RMS). Approval under Section 138 of the *Roads Act* 1993 must be attained from the RMS in order to connect a private or public road to a classified road or to remove or interfere with a structure on a classified road.

The project will require work and modifications to classified roads and as such will need approval under the Roads Act. The roads requiring modification include Castlereagh Road, for the purpose of upgrading an access location.

2.3 NSW Planning Instruments

2.3.1 State Environmental Planning Policy (Penrith Lakes Scheme 1989)

The State Environmental Planning Policy (Penrith Lakes Scheme 1989) aims to permit the implementation of the Scheme through development controls and with regard to the protection of the environment. Activities within the Scheme require Council's approval under this SEPP, unless otherwise stated by the EP&A Act.

2.3.2 State Environmental Planning Policy No 55 – Remediation of Land

State Environmental Planning Policy No. 55 (SEPP No. 55) requires that the issue of contamination be considered whenever a planning authority considers a development in NSW. Clause 7, subclause 1 of SEPP No. 55 is as follows:

7 Contamination and remediation to be considered in determining development application

(1) A consent authority must not consent to the carrying out of any development on land unless:

(a) it has considered whether the land is contaminated, and

(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

2.4 Previous and Existing Development Applications and Environmental Assessment

Several development applications (DAs) have been approved to implement the Scheme. Under SREP 11, provision was made for the submission of sequential DAs, each accompanied by a Statement of Environmental Effects (SEE) for the progressive release of extraction areas.

Table 1 summarises the sequential list of DAs approved for extraction areas since 1981. All current extraction activities are being carried out in the DA4 areas of the Scheme. Figure 3 depicts the areas associated with different development applications, together forming Penrith Lakes Scheme.

Table 1: Summary of Sequential DAs for Extraction and Rehabilitation

Date	DA No	Description
July 1982	DA1	For interim extraction while detailed planning studies of the scheme were completed
Feb 1987	DA2	For extraction in accordance with SREP11, in the central area of the scheme
Nov 1989	DA2 Modification (Rowing Lake)	To modify DA2 and extract additional funds to construct the rowing course
June 1995	DA3	For extraction in accordance with SREP 11 in the north east area of the scheme
September 1998	DA4	For extraction in accordance with SREP 11 within the scheme area to the west of Castlereagh road
April 2005	DA Pioneer Plant	For extraction in accordance with SREP 11 in the South East area of that scheme
October 2005	DA4 modifications (Camenzuli)	For extraction in accordance with SREP 11 in the north west area of the scheme
February 2006	DA2 modification (DC Prototype Trial)	For dynamic compaction prototype trial in the eastern section of the Precinct A
October 2006	DA2 modification	For dynamic compaction within Precinct A
June 2009	DA 2, DA3 & DA4	For importation of VENM from 2009-2012
February 2014	DA 2, DA3 & DA4	For importation of VENM from 2012-2015

2.4.1 Development Consents to be Modified

DA2

Penrith Lakes Scheme – DA2 was granted consent on 24 February 1987 by the Minister for Planning and Environment (now Minister for Planning and Infrastructure) (ref P92/00744/001), under Section 92 of the EP&A Act 1979. DA2 permits continued extraction and rehabilitation on land included within the DA1 consent (Schedule 2 areas for rehabilitation), and prior to that within the pre-DA1 areas for extraction. There is no expiry date on the DA2 consent, and Condition No. 8 of DA2 modifies previous consent conditions to include conditions pertaining to the land as set out in the DA2 consent. These include:

- Extraction of approximately 786 ha of land (including 459 ha from previous development consents) containing approximately 39 million tonnes of raw feed and 20 million cubic metres of overburden;
- Transportation of extracted raw feed to shareholder processing plants (Boral, Cemex and Hanson) via internal haul routes;
- Rehabilitation to achieve landforms appropriate for the completed Scheme; and
- Importation of VENM to fill areas where extraction has occurred on the site, specifically for landform creation.

DA3

Penrith Lakes Scheme – DA3 was granted consent on 27 June 1995 by the Minister for Urban Affairs and Planning (now Minister for Planning and Infrastructure) (ref P92/00744/001), under Section 92 of the EP&A Act 1979. DA3 was accompanied by an SEE prepared in accordance with SREP 11.
The consent permits continued extraction operations including:

- Extraction of approximately 286 ha of land containing approximately 35 million tonnes of raw feed and 14 million tonnes of overburden;
- Transportation of extracted raw feed to shareholder processing plants (Boral, Cemex and Hanson) via internal haul routes;
- Rehabilitation of 407 ha to achieve landforms appropriate for the completed Scheme;
- Transportation of overburden via internal haul routes from subsequent stages (DA4) to meet a fill deficit of approximately 16 million tonnes; and
- Importation of VENM to fill areas where extraction has occurred on the site, specifically for landform creation.

DA4

Penrith Lakes Scheme –DA4 was granted consent on 9 September 1998 by the then Minister for Urban Affairs and Planning (now Minister for Planning and Infrastructure) (ref P97/00237 Pt4), under Section 92 of the EP&A Act.
The consent for DA4 permits quarrying of sand and gravel in the Scheme area generally to the west of Castlereagh Road including:

- Extraction of approximately 737 ha of land containing approximately 63 million tonnes of raw feed;
- Transportation of extracted resources to shareholder processing plants (Boral, Cemex and Hanson) via internal haul routes;
- Rehabilitation of 407 ha to achieve landforms appropriate for the completed Scheme;
- Transportation of DA4 overburden surplus of approximately 30.4 million tonnes via internal haul roads to meet the fill deficit in DA3 (revised to 30.0 million); and,
- Importation of VENM to fill areas where extraction has occurred on the site, specifically for landform creation.

A copy of consent conditions for DA2, DA3 and DA4 is included Appendix A.

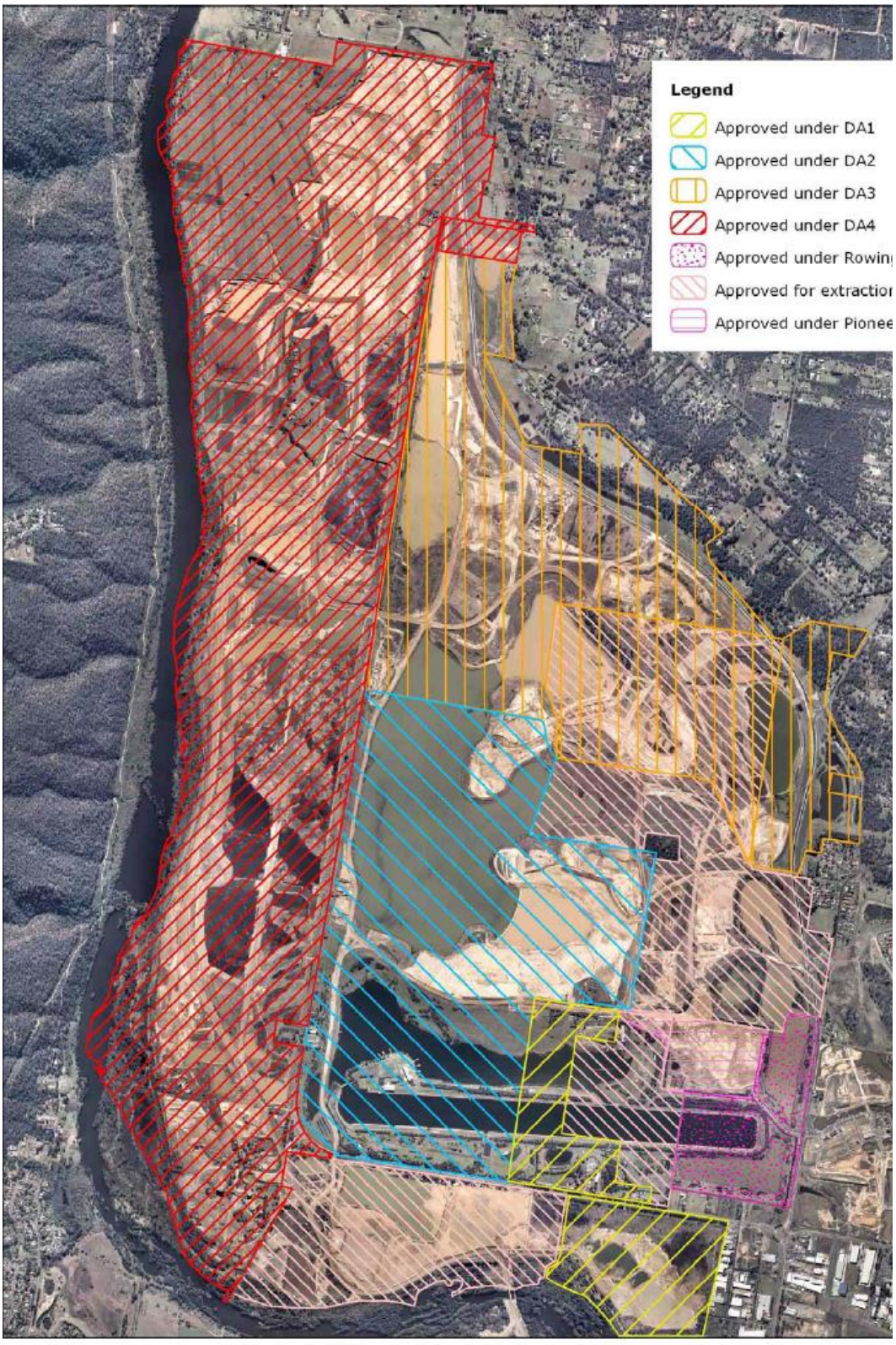

Figure 3 Areas associated with different development applications, together forming Penrith Lakes Scheme.

3 Project Modification for VENM/ENM Importation

3.1 Previously Approved Project

PLDC previously proposed to import up to 1 million tonnes of VENM to the Penrith Lakes Scheme each year for a period of 3 years from late 2012 until late 2015. The VENM was required to fill areas where extraction had occurred on the site, specifically for landform creation.

The Environmental Assessment (EA) was conducted in 2012 to assess the importation of VENM onto the site from the Sydney Metropolitan Area. Consent was granted in February 2014 to modify DA2, DA3 and DA4 under Section 96(2) of the *Environmental Planning and Assessment Act 1979.*

The importation of fill was required as there is not enough remaining material within the Penrith Lakes Scheme, of adequate quality or characteristics, to utilise as fill. The option of gaining additional fill by increasing the depth of the Penrith Lakes has been investigated, but is likely to create unacceptable impacts on habitat function, leading to adverse impacts on water quality. The approved modification is believed to have positive outcomes with limited impacts mainly relating to external truck movements and associated noise. The requirement to import fill material would not greatly increase the number or distance of internal truck movements, and existing approvals allow for as many vehicle movements on internal roads as operations require.

Coffey Geotechnics gave the opinion that VENM is suitable for use in the general landforms proposed, subject to compliance with technical specifications and quality assurance procedures. Therefore, this application sought approval for the sourcing of VENM from numerous sources to be able to meet demand, subject to the conditions of consent.

The EA concluded that there were no issues of significant environmental impact. The majority of the issues that were assessed had negligible or low impacts. Traffic and Transport, Noise, Air quality, Water Quality and Heritage were assessed as having a low impact. In the 2012 EA, the Traffic and Transport and Noise assessments identified prescribed haulage routes for the trucks to follow in order to remain below the noise limits. All other environmental issues were prescribed management measures which ensured no significant environmental impact from the project. Table 1 is a summary from the 2012 EA including the environmental issues assessed, the potential impact and management measures to ensure no significant impact.

Table 2 Summary of 2012 EA Environmental Issues, Impacts and Measures

Environmental Issue	Impact	Management Measures
Soils, Geology and Contamination	Negligible	Soil testing, QA procedures for detecting contamination and contingency measures to remove soil from site where contamination is detected. The proposed imported fill material will be tested in accordance with PLDC's QA procedure to detect any contamination prior to deposition on site.
Traffic and Transport	Low	The road network adjacent to Gate 3 (Castlereagh Road north of Cranbrook Road intersection) would be upgraded to provide an auxiliary left turn treatment for northbound traffic turning into the site.
Noise	Low	Prescribed haul routes and proportions must be adhered to in order to remain below noise limits Traffic Noise Management Plan to be submitted
Vibration	Negligible	No additional management measures are required.
Air Quality	Low	Continuation of existing management measures as well as vehicle wash stations established at the new access points to the site. Continued monitoring of dust particle sizes and composition by the three dust deposition gauges located around the site, and the High Volume Dust Sampler (HVDS) will ensure compliance and success of measures.
Water Quality	Low	Continued routine monitoring to ensure compliance with ANZECC and RACC guidelines. Emergency spill procedures and equipment to be put in place.
Flora and Fauna	Negligible	No additional management measures are required.
Waste	Negligible	Continuation of existing management measures- the modification is not likely to generate any additional waste.
Heritage	Low	Minimum curtilages from heritage items to be maintained, as per CMP.
Landscape and Visual	Negligible	The modification will not result in any significant change of planned landform. No additional management measures are required.

3.2 Proposed Modifications for VENM and ENM Importation

Additional fill is required to fulfil the landform requirements as set out in Penrith Lakes Two Year Plans which were previously approved by the DP&I in 1990, 2000, 2001 and 2013. The four Two Year Plans have been combined to produce a combined finished surface terrain, as shown in Figure 4.

A comparison was undertaken between the existing survey levels at the Penrith Lakes Scheme in June 2014 to the approved combined Two Year Plan's design contours. Excluding the three million tonnes of VENM already approved by DP&E, it was determined there is a net deficit of an additional five million tonnes of fill required to fulfil the landform requirements as set out in the Two Year Plans.

This environmental assessment therefore proposes the following modifications to the existing development consents DA2, DA3 and DA4:

- Importing source Excavated Natural Material (ENM), as well as VENM, with strict import protocols including geotechnical and environmental sampling, testing and certification;
- Increasing the amount of VENM and ENM to be imported by an additional five million tonnes at a rate of up to two million tonnes per year (for a total of eight million tonnes including the three million tonnes of VENM already approved for importation);
- Sourcing VENM and ENM from excavation sites anywhere in the Sydney Metropolitan Area and surrounding areas using the public road network and legal road trucks for haulage to Penrith; and
- Commencing the importation of the additional five million tonnes of VENM and ENM in early to mid-2015 when quarrying operations have ceased.

The source and type of material to be imported (VENM and/or ENM) will depend on availability of sources. However, the proposed imported fill materials would be from various sites around Metropolitan Sydney and could be described as potentially clay shale or sandy clay depending on the site of the source. Availability of VENM/ENM in the Sydney Metropolitan Area would determine the rate of importation (up to a 'worst case' maximum of 2 million tonnes per year).

Before importation, the VENM and ENM is subject to testing and compliance with the Penrith Lakes Technical Specifications requirements and once at the site the VENM and ENM may undergo further testing for quality assurance. Further details of the Penrith Lakes Technical Specifications requirements are available in Section 6.5.3.

Additionally, as described in the previously approved EA, prior to the commencement of importation, the road network adjacent to Gate 3 (Castlereagh Road north of Cranbrook Road intersection) (refer to Figure 7) would be upgraded to provide an auxiliary left turn treatment for northbound traffic turning into the site as well as an auxiliary turn treatment for southbound traffic (refer to preliminary design in Appendix I).

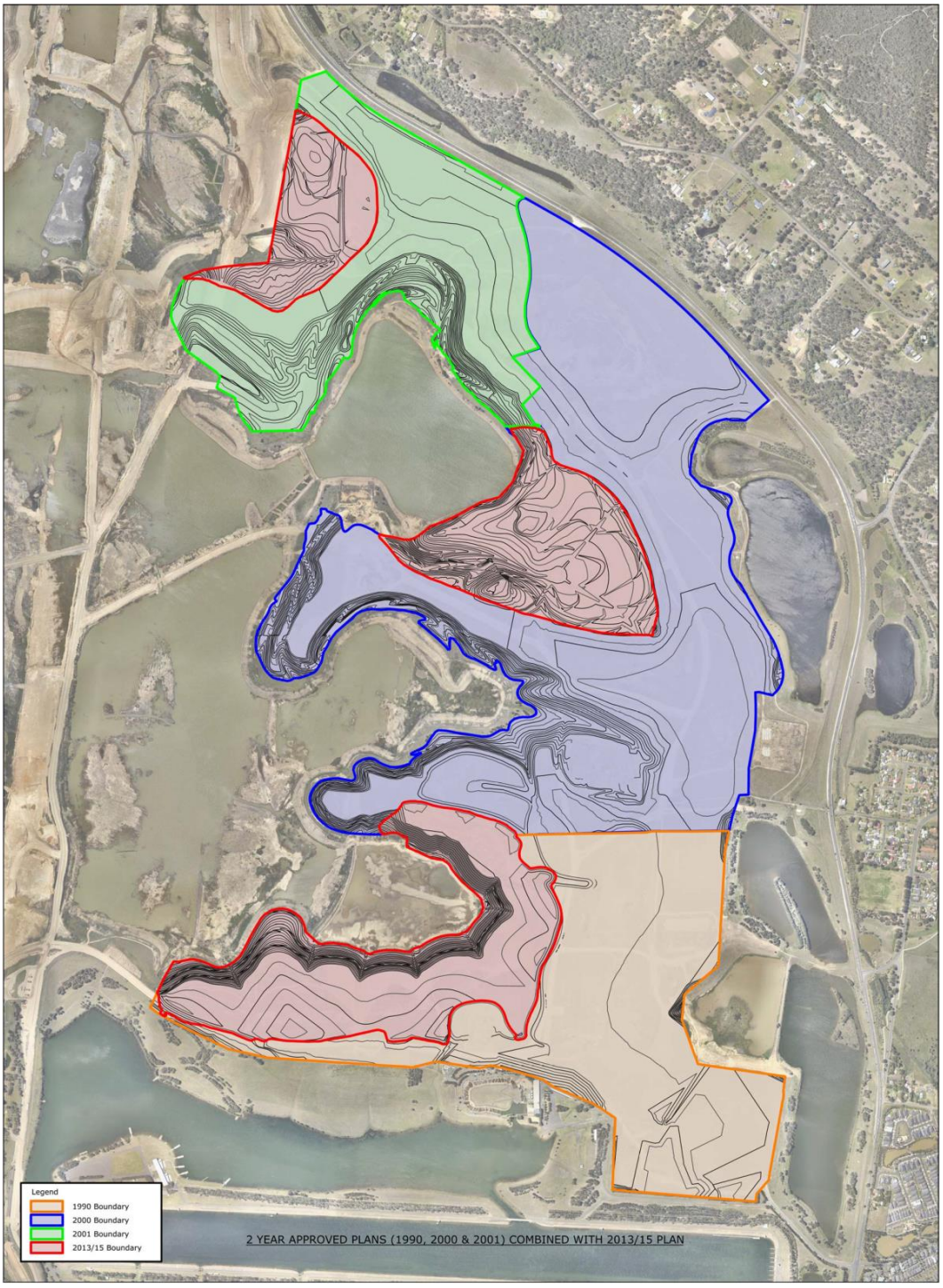

Figure 4 Combined approved 2 Year Plan at Penrith Lake Scheme

3.3 Comparison with the Approved Project

The table below (Table 3) provides a comparison between the existing approved VENM importation project at PLDC and the proposed modifications subject to this EA.

Table 3 Comparison of Approved and Proposed projects

Item	Approved Project	Proposed Modification	Difference
Source	Various source locations in Sydney Metropolitan Area	Various source locations in Sydney Metropolitan Area	None
Timing	Late 2012- Late 2015/2016 (Approved by DP&E in early 2014- commenced importation in mid-2014)	Commencing early to mid-2015 once quarrying operations have ceased	Concurrent importation timeframes once quarrying exportation cease.
Type of fill	VENM	VENM and ENM	Modification includes VENM as well as ENM
Amount of fill	3 million tonnes over 3 years – at a rate of 1 million per year	Additional 5 million tonnes– at a rate of up to 2 million tonnes per year	Additional 5 million tonnes
Location of fill at site	Selected areas throughout DA2,DA3, DA4	Selected areas throughout DA2, DA3, DA4 required to fulfil the combined 2 year plans. Refer to Figure 4.	None
Haulage route	Prescribed haulage routes depending on source of fill (refer to north haulage routes- Figure 9 and south haulage routes-Figure 10)	Prescribed haulage routes depending on source of fill (refer to north haulage routes- Figure 9 and south haulage routes-Figure 10)	None
Access Points	Three access points proposed to be utilised.	Three access points proposed to be utilised.	None
Noise	Traffic haulage route to avoid exceedences of criteria	Traffic haulage route to avoid exceedences of criteria	None
All other environmental issues	Management measures in place	Management measures in place	None

3.4 Consideration of Alternatives

Under the SEPP (PLS) 1989, a discussion is required to determine any feasible alternatives to carrying out the proposed development as well as the consequences of not carrying out the proposed development.

3.4.1 Alternatives

When Penrith Lakes Scheme was initiated, the intent was to source fill internally for the creation of landforms. Further investigation has found that this is no longer a feasible option. The area now has several large depressions where extraction has occurred which must be filled to achieve the rehabilitation and landform objectives referred to in the existing development consents and Deed of Agreement. The only potential area from where appropriate fill could be sourced internally is the lake floors. However, to increase the depth of the lakes would result in unacceptable water quality impacts, and associated poor ecosystem health.

This proposal is further concerned with obtaining suitable fill for this purpose within a timeframe which ensures the required heavy machinery currently used for quarrying activities is still present on site. With the majority of operations coming to an end, it is timely for PLDC to commence the importation of fill as soon as possible. If this machinery is not present on site, the cost of rehabilitation, as well as environmental impacts, would increase substantially.

3.4.2 'Do Nothing' Scenario

The 'do nothing' scenario is not an option for Penrith Lakes Scheme to achieve the rehabilitation and landform outcomes as prescribed in the existing development consents, the Two Year Plans as well as the Deed of Agreement.

4 Consultation

Prior to the submission of the EA, consultation with DP&E, the NSW Environmental Protection Authority (EPA), NSW Roads and Maritime Services (RMS) and Penrith City Council was undertaken.

No responses or comments were received from RMS. Penrith City Council raised issues to be considered within this modification on 22 August 2014 while EPA provided a letter with comments on the proposed modification on 22 September 2014. Comments received have been addressed throughout this EA as outlined in Table 4.

Note in the absence of any Secretary Environmental Assessment Requirements (SEARs) received from DP&E we have used the DGRs from 2012 which PLDC considers appropriated for the assessment of impacts of the modification sought.

Table 4: Agency Consultation Issues and responses

Issue	Stakeholder	How/Where Addressed in EA
Requirement for the Project/Modification		
A detailed description of the proposed modification including source, quantity and types of material to be imported	Department of Planning and Environment (DGR's)	Section 3
Comparison with approved project	Department of Planning and Environment (DGR's)	Section 3.3
Description of need for proposed modification and any alternatives considered	Department of Planning and Environment (DGR's)	Section 3.4
Risk Assessment of potential environmental impacts for further assessment	Department of Planning and Environment (DGR's)	Section 5
Requirement to consult with stakeholders	Department of Planning and Environment (DGR's)	Section 4
Statement of Commitments	Department of Planning and Environment (DGR's)	Section 7
Justification for Works- The assessment of environmental impact should specifically address the need for the additional 5 million tonnes of imported material and as part of the assessment consider the types and locations of future uses within the Scheme, which in turn should inform the final landform.	Penrith City Council	Section 3.2

Issue	Stakeholder	How/Where Addressed in EA
Flood Management Considerations – Further detail is required explaining how the use and impact of the additional 5 million tonnes of fill material and storage stockpiles will affect the landform (both interim and final form) of Penrith Lakes Scheme. Particular consideration of the associated impact to the flooding characteristics upstream and downstream of Nepean River and on the local catchment areas is required.	Penrith City Council	Section 3.2 Flooding has not been specifically considered in this EA as a PLDC have previously undertaken a comparison between the existing survey levels at the Penrith Lakes Scheme with the combined Two Year Plan's design contours which have been approved by DP&E which included flood considerations. As such, the proposed additional 5 million tonnes of fill would be required to fulfil the landform requirements identified in the Two Year Plans at the Scheme.
Traffic and Access		
An assessment of traffic impacts proposed, justification for and assessment of any changes to the approved site access arrangements	Department of Planning and Environment (DGR's)	Section 6.2
Details on nature of the traffic generated, haulage routes, traffic volumes and potential impact on public road networks, including mitigation measures.	Department of Planning and Environment (DGR's)	Section 6.2
Information addressing traffic impacts associated with the importation of fill, including movements of vehicles and vehicle access to the site should also be considered.	Penrith City Council	Section 6.2
Noise and Vibration		
Noise and vibration assessment of predicted impacts resulting from proposed modification in accordance with the NSW Industrial Noise Policy (OEH) and NSW Road Noise Policy (2010), including mitigation measures.	Department of Planning and Environment (DGR's)	Section 6.3
Consideration of potential acoustic impacts needs to be undertaken to ensure that there is no impact on sensitive receivers in relation to the proposed works. This should address noise impacts associated with the works taking place on the site, but also the noise impacts associated with the additional truck movements within the surrounding road network.	Penrith City Council	Section 6.3

Issue	Stakeholder	How/Where Addressed in EA
Air Quality		
Assessment of the potential air quality impacts associated with the proposal including vehicle emissions	Department of Planning and Environment (DGR's)	Section 6.4
Description/ Location of VENM/ENM stockpiles on site and mitigation measures to ensure air quality is under the project approvals EPL.	Department of Planning and Environment (DGR's)	Section 6.4
Mechanisms should be outlined on how the developer seeks to manage impacts associated with the dust generated by the transportation, stockpiling and placement of additional fill. These however will likely be the same as those already in place to manage the current site activities.	Penrith City Council	Section 6.4
Soils, Water and Landform		
Description of measures to ensure that a stable landform is provided and risks of contamination are limited.	Department of Planning and Environment (DGR's)	Section 6.5
The Environmental Assessment should identify those mechanisms put in place to prevent impacts on the waterways of the site. This may include sediment and erosion control measures and stabilisation of any stockpiled material. Again, these will likely be the same as those already in place to manage the current site activities.	Penrith City Council	Section 6.5
The correspondence received already identifies some of the procedures that will be put in place to ensure that the imported material is suitable for the site. Further detail regarding these aspects should be provided in support of these measures including the protocols for the importation, demonstrating compliance with EPA guidelines.	Penrith City Council	Section 6.5
Ensure that imported materials meet relevant geotechnical requirements for the PLDC site.	EPA	Section 6.5
For VENM, PLDC will need to be able to demonstrate that the material can be classified as VENM in the POEO Act.	EPA	Section 6.5
For ENM, PLDC will need to ensure that it meets the requirements of the General Exemption for excavated natural material 2012	EPA	Section 6.5
Undertake sampling for materials potentially classified as VENM or ENM before transport to PLDC	EPA	Section 6.5

Issue	Stakeholder	How/Where Addressed in EA
Undertake material tracking by recording: a. The source(s) of material generation, including site address(s); b. Total amount of material generated per site; and c. Transport & Receipt dockets that ensure total amount of material generated at the source site is consistent with the total amount received at PLDC.	EPA	Section 6.5
Undertaking validation inspections and sampling at the PLDC site to 'check' that imported materials meet either VENM or ENM. The sampling frequency can be flexible given this environmental control is simply a validation process.	EPA	Section 6.5

5 Risk Assessment

The Environmental Assessment as presented below provides an assessment of the changes to the Penrith Lakes Scheme, as they are described in Section 3.2 above. The assessment is based on the importation of an additional 5 million tonnes of VENM and ENM (up to a 'worst case' maximum of 2 million tonnes per year) into the Penrith Lakes scheme over a period of 3 years to fill where specific extraction has occurred and to create landform.

The Risk Assessment (Table 6) provides a summary of the potential environmental impact associated with the importation of VENM into the Penrith Lakes Scheme. The table will also assign a level of significance to each issue based on the extent and likelihood of:

- Potential impact with consideration of mitigation or management measures; and,
- Potential community or regulatory concern.

To aid in the assessment of the potential impacts and to ensure consistency between environmental assessment topics, significance criteria have been defined which follow the framework shown in Table 5. These have been used to guide the evaluation of potential environmental impacts unless otherwise stated.

Table 5: Significance Criteria

Significance	Impact Classification	Criteria
High	Impact a major problem	These effects are likely to be important considerations at a local scale but if adverse, are potential concerns to the continuation of the project. Mitigation measures and detailed design work are unlikely to remove all the effects upon the affected communities or interests. Residual effects would predominate
Moderate	Impact moderate but can be easily mitigated	These effects, if adverse, while important at a local scale, are not likely to be key decision making issues. Nevertheless, the cumulative effects of such issues may lead to an increase in the overall effects upon a particular area or on a particular resource. They represent issues where effects would be experienced but mitigation measures and detailed design work may ameliorate/enhance some of the consequences upon affected communities or interests. Some residual effects would still arise
Low	A small and acceptable impact	These effects may be raised as local issues, but are unlikely to be of importance in the decision making process. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures
Negligible	Minimal Change	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error

The environmental issues that are addressed in the risk assessment are under the following headings:

- Soils, Geology and Contamination
- Traffic and Access
- Noise and Vibration
- Air Quality
- Water Quality
- Flora and Fauna
- Waste
- Indigenous Heritage
- Non-Indigenous Heritage
- Landscape and Visual

No issues of high or moderate significance have been identified. Issues that were considered to have low environmental significance were taken forward for more detailed assessment. Where there was considered to be negligible environmental significance in relation to an issue, no further assessment has been provided and a brief summary of the proposed management measures is provided in Table 6.

Table 6 Environmental Risk Analysis

Issue	Potential Environmental Impact	Further Assessment
Soil, Geology and Contamination	It is a natural consequence of the proposed importation of fill that this will change the soil characteristics of the site. However, controls will be put in place to ensure that the fill will meet the geotechnical and contamination criteria for the site. Stringent testing of soil prior to transport from the source will ensure that it is unlikely that contaminants would be introduced to the Scheme site from the VENM and ENM. If the assigned control measures which are described in Section 6.5 are implemented there will be minimal effect on soils and geology, and no risk of contamination. **Low environmental significance**	More detail provided in Section 6.5
Traffic and Transport	The proposed modification is to import an additional 5 million tonnes of VENM and ENM (up to a 'worst case' maximum of 2 million tonnes per year), by approximately 240 trucks per day (480 truck movements). This is based on a 240 day working year, with each truck able to carry a 35 tonne payload The previously approved traffic analysis forecasted a slight increase in the number of daily vehicles travelling along key roads to the site. In percentage terms, the increases were generally relatively small due to the already high number of vehicles utilising these roads. The relative impact will be higher for roads closer to the site, compared with the motorways further away from Penrith. **Low environmental significance**	More detail provided in Section 6.2
Noise and Vibration	The additional trucks required to import the VENM and ENM to the site are likely to have the greatest acoustic impact on the roads immediately adjacent to the Penrith Lakes Scheme. Groundborne vibration impacts from road traffic are typically minimal, because the pneumatic tyres of vehicles act to isolate the mass of the vehicle from the road surface. Further, no significant increase in the maximum vibration levels at surrounding receivers is expected – these receivers are already exposed to vibration from existing heavy vehicle traffic. While the additional traffic will increase the number of vibration events, no increase in the magnitude of the vibration levels experienced at receivers is expected. **Low environmental significance**	More detail provided in Section 6.3 and in Appendix B.

Issue	Potential Environmental Impact	Further Assessment
Air Quality	Potentially, the two main sources of air pollution arising from this modification would be increased vehicle emissions (including CO, NOx and PM10) generated adjacent to the road and an increased potential for dust emissions generated within the Scheme. Under the current EPL for Penrith Lakes scheme, the air quality is monitored against the relevant criteria and mitigation measures are already in place throughout the Penrith Lakes Scheme in order to remain below the air quality criteria for the site. **Low environmental significance**	More detail provided in Section 6.4.
Water Quality	As a result of the proposed modification there would be some potential for additional sediment to enter the waterway system with an increase in the complexity of transport and soil movement. Increased sediment in the system may lead to increased turbidity, TDS and TSS, as well as associated impacts on ecosystem health. However management measures, including those included in previous consent conditions would be put in place. If these measures are implemented and adhered to, effects of the modification would be negligible. **Negligible environmental significance**	More detail provided in Section 6.5
Flora and Fauna	The existing flora and fauna values of the site are greatly reduced from original pre settlement levels. The site contains few native species of flora and is largely dominated by introduced species, in particular grasses and shrubs. For the proposed modification, as VENM is required for the rehabilitation of the Scheme and revegetation will occur once the development is finished, the effects of the proposed modification contribute to a positive impact. It is important that any existing native flora and fauna are protected during the redevelopment process, in order to maintain the existing biological value of the site. The creation of ecological corridors and core conservation areas would enhance the viability of threatened communities surrounding the site, and help increase the genetic stability and diversity of populations. **Negligible environmental significance**	No Further Assessment. Management measures are included in the Statement of Commitments The Flora and Fauna chapter from a previous SEE (Consent approval 2009) is provided in Appendix E for details of management measures.
Waste	The proposed modification to import VENM does not produce additional waste, thus the impact of the Project with respect to waste management at the Scheme is considered to be negligible. **Negligible environmental significance**	No Further Assessment. Management measures are included in the Statement of Commitments

Issue	Potential Environmental Impact	Further Assessment
Indigenous Heritage	Oral histories of the area talk about the escarpment and the associated lagoons as forming an important meeting or gathering place for different clans of the Darug People. Evidence from archaeological studies carried out by PLDC in partnership with the Aboriginal community, supports the idea that large gatherings occurred in this area. Due to extensive market garden farming and quarrying prior to PLDC activities on site the topsoil layer has been significantly disturbed greatly compromising the integrity of archaeological discoveries. PLDC have also obtained an Aboriginal Heritage Impact Permit (AHIP number 1131345) which covers the conditions regarding Aboriginal objects which may be harmed and the required procedures to be followed. **Negligible environmental significance**	No Further Assessment. Management measures are included in the Statement of Commitments. The Indigenous Heritage chapter from a previous SEE (Consent approval 2009) can be found in Appendix F for details of management measures.
Non-Indigenous Heritage	Retained within the Penrith Lakes Scheme are a number of conservation zones which range from local to national significance. These sites are indicative of early colonial (1806 – 1900's) contact and non-Indigenous heritage. These heritage items are significantly distant, and the levels of vibration from the haulage routes low enough that the impact of traffic induced vibration is likely to be negligible. However, a minimum curtilage of 15m will still be implemented as a protection measure. Impacts internally will be no different as a result of importing VENM and ENM. The same volume of material will be transported within the site therefore impacts are largely confined to external haul roads. Furthermore, the impact as a result of fill trucks will be no different from those associated with quarry activity operating since the 1980's. As the existing internal haulage routes will still be used, the appropriate curtilages will already be in place, and heritage items within the scheme are not predicted to be adversely affected. **Negligible environmental significance**	No Further Assessment. Management measures are included in the Statement of Commitments The Indigenous Heritage chapter from the previous SEE (Consent approval 2009) can be found in Appendix G for details of management measures.
Landscape and Visual	The landscape of the site has been altered over time through extraction activities, filling of the areas, lake formation and the construction of roads and other infrastructure. Following extraction for mining purposes, the excavated areas are filled and revegetated with suitable species. The proposal will not result in significant change of the proposed landform. **Negligible environmental significance**	No Further Assessment. Management measures are included in the Statement of Commitments. The Landscape & Visual chapter from the previous SEE (Consent approval 2009) can be found in Appendix H for details of management measures.

6 Environmental Assessment

6.1 Introduction

This chapter includes a detailed assessment of key issues which have been identified by the risk assessment of environmental impacts of the project in Section 5. For each of the key environmental issues, the assessment will identify and address measures to be implemented to mitigate the impacts of the project.

The environmental issues are addressed under the following headings:

- Traffic and Access;
- Noise and Vibration;
- Air Quality; and
- Soils, Water and Landform.

6.2 Traffic and access

This section provides an overview of the existing road network and traffic volumes relevant to the modification. It assesses the traffic and access impacts resulting from the proposed modification of importation of VENM/ ENM.

6.2.1 Existing environment

6.2.1.1 Road Network

The Penrith Lakes site is located on the western fringe of the Sydney Metropolitan area. Old Castlereagh Road (west of Andrews Road) and Castlereagh Road (north of Andrews Road) provide local access to the site. The site is well served by a number of key state and regional roads, including:

- The Northern Road;
- Andrews Road
- The M4 Motorway;
- The Great Western Highway;
- Cranebrook Road; and
- Castlereagh Road adjacent to the site.

6.2.1.2 Traffic Volumes

Arup undertook automated traffic counts over a seven day period along five key roads surrounding the Penrith Lakes site in May 2012 (outside of school and public holiday periods). The average weekday traffic (AWT) volumes along the surveyed roads are presented in Table 7.

Table 7 Existing Traffic Volumes

Location	2012 AWT	%Heavy Vehicles
Old Castlereagh Road, west of Andrews Road	1,544	12%
Andrews Road, west of Castlereagh Road	8,103	14%
Castlereagh Road, north of Nepean Street	18,343	7%
Cranebrook Road, east of Castlereagh Road	8,943	9%
The Northern Road, south of Ninth Avenue	20,551	7%

6.2.1.3 Existing Site Activity

There are currently in the order of around 400 trucks per day (800 vehicle movements[1]) in and around the Penrith Lakes site associated with transport of quarry materials from the existing processing plants to off-site locations. This is significantly lower when compared with the early part of the 2000's, when there were more than 2,000 movements per day when the PLDC Fine Sand Plant and Readymix plants were still in operation. A summary of historical truck movements at Penrith Lakes over the past decade is presented in Figure 5.

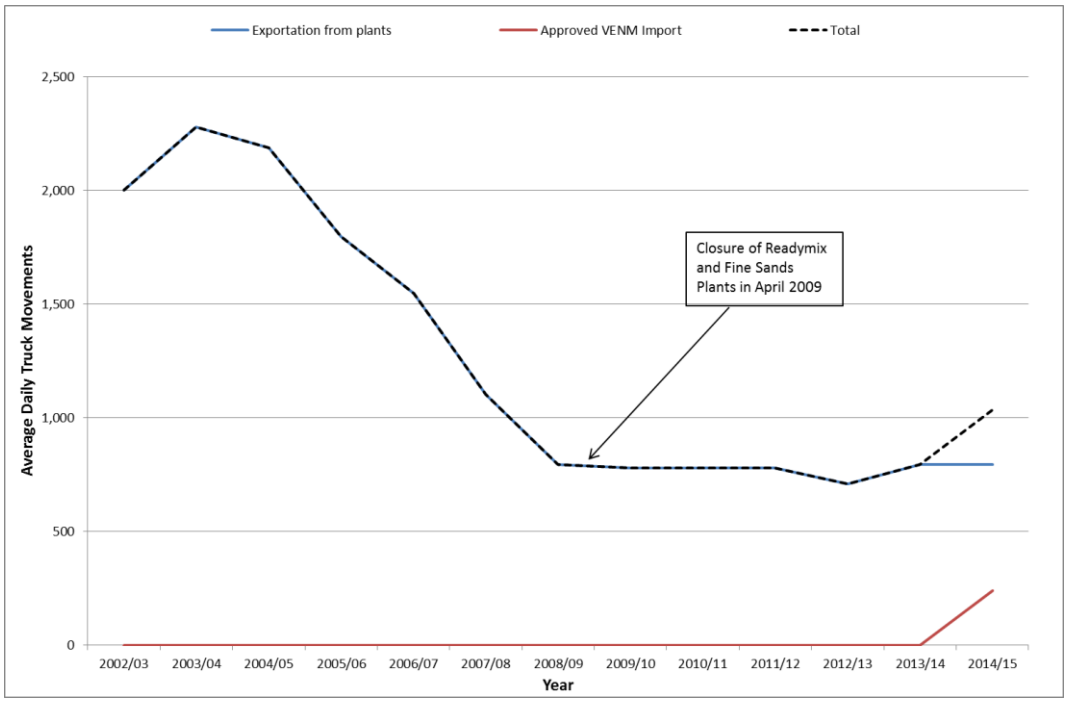

Figure 5 Historical Truck Movement Summary at Penrith Lakes Site

6.2.1.4 Previous approvals

PLDC has approval to import a total of 3 million tonnes of VENM over a 3 year period, between 2014 and 2017 (refer to Figure 5). To source the required average of 1 million tonnes of VENM per year, 120 trucks per day (240 truck movements) will be required to transport the fill. This is based on a 240 day working year, with each truck able to carry a 35 tonne payload.

The types of trucks being utilised for the VENM Importation are known as 'truck and dog trailers' or semi-trailers. No B-Doubles are to be utilised.

[1] For the purposes of this report, a traffic movement is defined as the one-way flow of a single vehicle at a particular location. A single truck entering the site, and departing some time later, is regarded to contribute two movements to the total traffic flow.

6.2.2 Impact Assessment

6.2.2.1 Future traffic demands

PLDC proposes to import an additional 5 million tonnes of VENM and ENM, up to a 'worst case' maximum of 2 million tonnes per year commencing in early to mid-2015. To source the required maximum 2 million tonnes per year, a maximum of 238 trucks per day (476 truck movements) will be required to transport the fill. This is based on a 240 day working year, with each truck able to carry a 35 tonne payload. These proposed truck movements would occur in addition to the already approved 1 million tonnes per year over 3 years.

The types of trucks being utilised for the VENM and ENM importation are known as 'truck and dog trailers' or semi-trailers. They are similar to those already used on site and those approved under the previous application. No B-Doubles will be utilised.

The forecast future traffic volumes on the main roads surrounding the proposed access locations are presented in Table 8. The values assume a worst-case scenario for each access point and road based on the maximum permissible daily truck movements.

Background traffic has been assumed to grow at a linear rate of 3%. This is a simplified and conservative growth model used for the purposes of forecasting future traffic flows on the local road network, consistent with the growth rate used in Arup's previous transport analysis for the Penrith Lakes area.

Forecasted traffic volumes have assumed that exports from the Penrith Lakes quarrying operations would have ceased in early-mid 2015, however the conservative background traffic growth rate means that, with the additional proposed VENM/ENM truck movements, traffic growth would still occur.

Table 8 Forecast Traffic Volumes on Surrounding Roads

Surrounding Road		**Old Castlereagh Road, west of Andrews Road**	**Andrews Road, west of Castlereagh Road**	**Castlereagh Road, north of Nepean Street**	**Cranebrook Road, east of Castlereagh Road**
2015/16	AWT (approved)	1,680	8,987	20,434	9,910
	AWT (approved +proposed)	1,837	9,225	20,672	10,149
	% Increase	9%	3%	1%	2%
2016/17	AWT (approved)	1,723	9,225	20,978	10,173
	AWT (approved +proposed)	1,880	9,463	21,216	10,411
	% Increase	9%	3%	1%	2%
2017/18	AWT (approved)	1,687	9,343	21,403	10,316

	AWT (approved +proposed)	1,766	9,462	21,522	10,435
	% Increase	5%	1%	1%	1%

Legend: AWT –Average Weekday Traffic, HGV – Heavy Goods Vehicles

The analysis presented in Table 8 forecasts only a minor increase in the number of daily vehicles travelling along key roads to the site. As previously noted, heavy vehicles will utilise key arterial roads to access the site which already carry significant traffic volumes.

The majority of the VENM and ENM truck movements will occur outside of the commuter peak hours which will further reduce the impact on the local road network.

Access to the site will be via three gates which utilise the existing road network (refer to Figure 7). Both Castlereagh Road and Old Castlereagh Road are both considered appropriate to carry the additional VENM and ENM traffic.

The number of heavy vehicles operating within the Penrith Lakes site in previous years has been significantly higher than the existing and proposed future levels.

As seen in Figure 6, truck movements will peak in 2014/2015 with an increase in quarry exports as well as the commencement of the previously approved VENM importation.

Quarrying export will cease onsite in early-mid 2015, therefore with the inclusion of the proposed additional VENM/ENM truck movements at a maximum ‘worst case’ importation of 2 million tonnes per annum, the overall total truck movements associated with the Penrith Lakes site would decrease from 2015/2016.

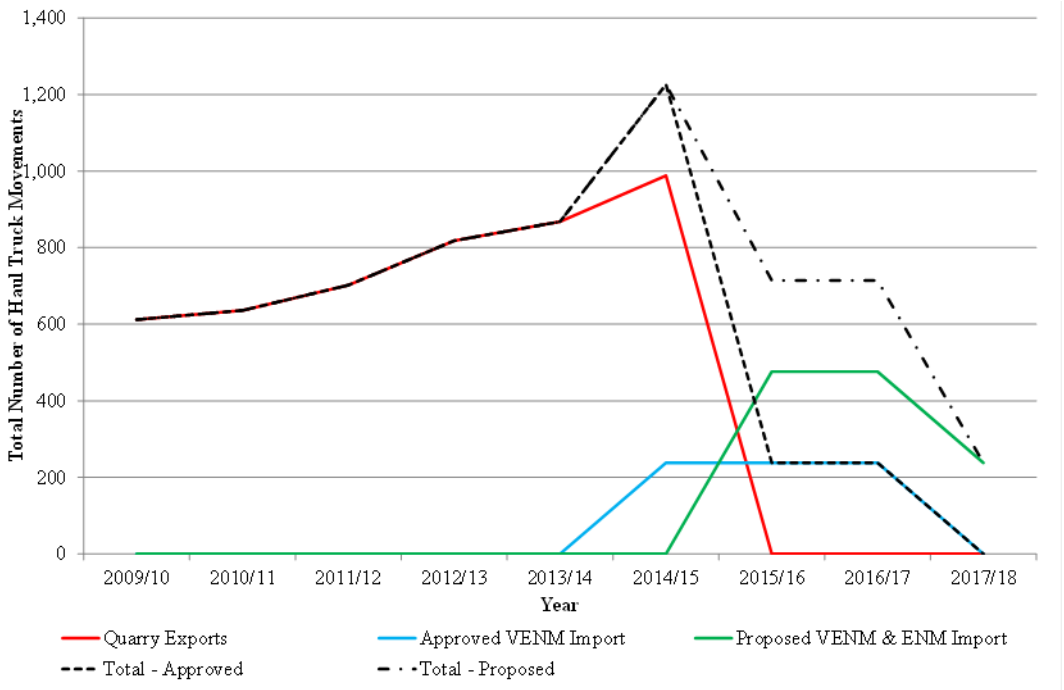

Figure 6 Historical and ‘worst case’ forecasted future truck movements

6.2.2.2 Impacts on Site Access Points

There are no changes proposed to the existing three access locations approved in the previous application as described below and presented in Figure 7. For the purposes of this assessment these access points have been nominated as gates 1, 2 and 3.

- Old Castlereagh Road near Sheens Road, previous access gate for Readymix and Fine Sands Plants vehicle (Gate 1);
- Castlereagh Road at McCarthys Lane, former Pioneer site access (Gate 2);
- Castlereagh Road north of Cranebrook Road intersection (Gate 3).

Figure 7 Proposed Site Access Points

6.2.2.3 Impacts on Access Routes

PLDC are currently in ongoing discussions regarding the source of the VENM and ENM to be imported to site. Vehicle approach and departure routes to the site will be restricted to state roads such as the M2, M4 & M7 Motorways, The Northern Road, Andrews Road, Mulgoa Road and Cranebrook Road.

Trucks will access the site via existing left and right turn treatments opposite Gate 2 (from McCarthys Lane), facilitating all traffic movements both into and out of the site (see Figure 8), or alternatively using the existing intersection at Gate 1.

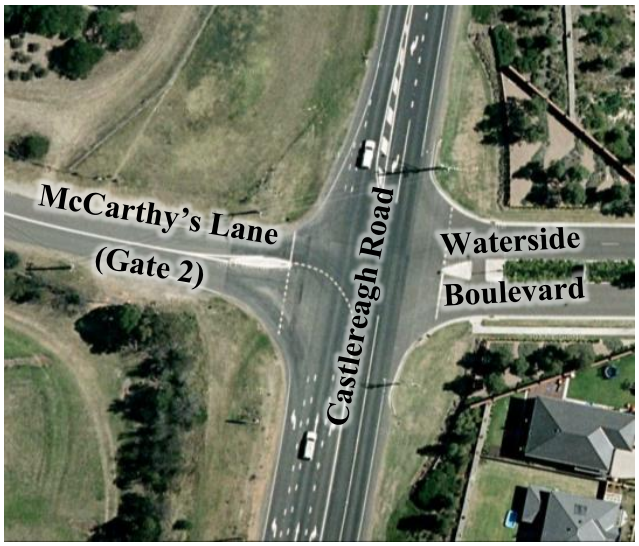

Figure 8 Existing Left/Right Turn Treatment at Gate 2 to Penrith Lakes Site

Prior to the commencement of the VENM/ENM importation, the road network adjacent to Gate 3 (Castlereagh Road north of Cranbrook Road intersection) (refer to Figure 7) would be upgraded to provide auxiliary left turn treatment for northbound traffic turning onto the site and right turn treatment for southbound traffic. A preliminary design for the proposed road upgrade at Gate 3 has been included for approval in this assessment in Appendix I.

There are two likely routes that vehicles would take to access the site. The proposed site access and departure routes, unchanged from those assessed and approved under the previous 2012 VENM importation modification, are indicated in Figure 9 and Figure 10 and described on the following pages.

Approaching the site from the north, trucks would travel south via The Northern Road and Cranebrook Road onto Castlereagh Road. From there they would turn left into the site at Gate 3, utilise the existing right turn bay on Castlereagh Road to enter via Gate 2, or continue to Old Castlereagh Road and enter the site via Gate 1. The departure route would mirror the approach route.

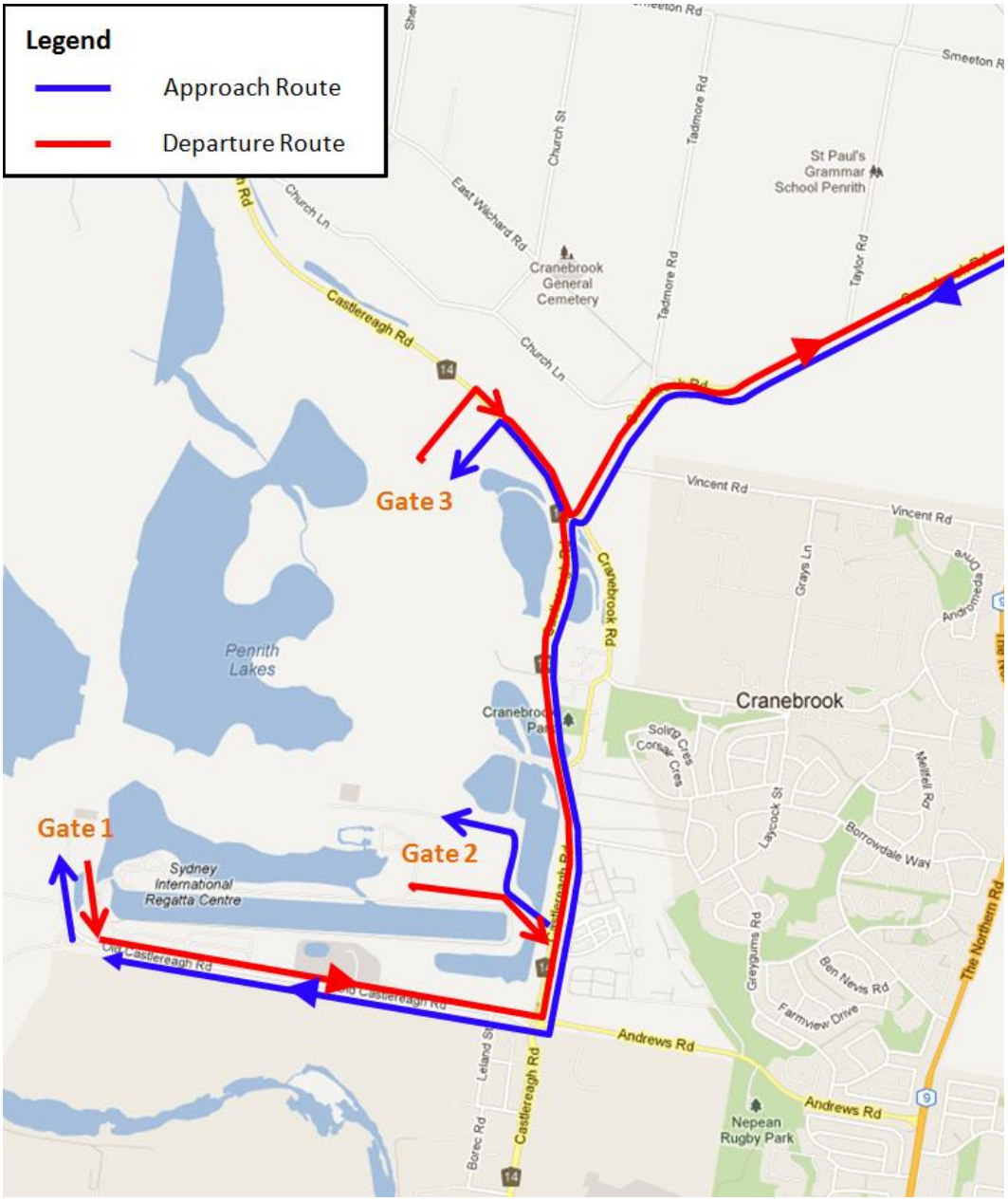

Figure 9 Vehicle Access Routes for Trucks Approaching from the North

Image Source: Google Maps (2012)

Approaching the site from the south, trucks would travel via The Northern Road and turn left onto Andrews Road before accessing the site.

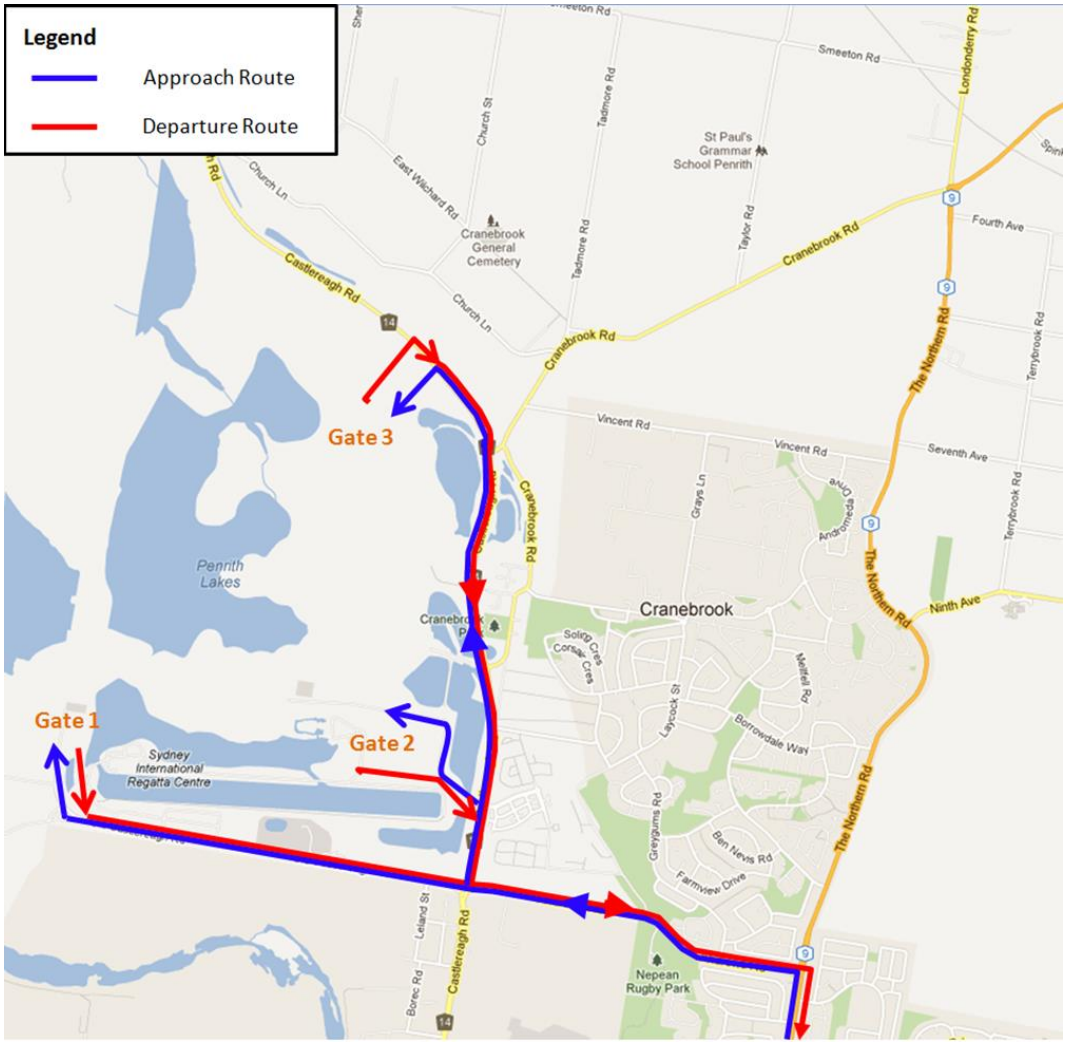

Figure 10 Vehicle Access Routes for Trucks Approaching from the South

Image Source: Google Maps (2012)

6.2.3 Mitigation / Management Measures

The proposed VENM/ENM importation will have a minimal impact on the local road network. Notwithstanding this, a number of management measures are to be implemented during the importation period to further mitigate this impact. These are listed below:

- Vehicle approach and departure routes to the site will be restricted to major arterial roads such as the M2, M4 & M7 Motorways, The Northern Road, Mulgoa Road and Cranebrook Road.
- Prior to the commencement of the VENM/ENM importation, the road network adjacent to Gate 3 (Castlereagh Road north of Cranbrook Road intersection) (refer to Figure 7) would be upgraded to provide auxiliary left turn treatment for northbound traffic turning onto the site and right turn treatment for southbound traffic. Refer to Appendix I for preliminary design details.
- The majority of the importation truck movements are expected to occur outside of the commuter peak hours.

The impact of the modification on Traffic and Access is considered to be low.

6.3 Noise and Vibration

This section provides a summary assessment of the noise and vibration impacts resulting from the proposed modification of importation of VENM/ ENM, in accordance with appropriate assessment criteria set by the OEH. This assessment is subsequent to the original SEE undertaken in 2008 (that was approved in 2009) and the modification EA undertaken in 2012 (approved in 2014) and has been based on previous noise and traffic monitoring data. The full assessment of noise and vibration impacts can be found in Appendix B.

Given the relatively short timeframe between the previous assessment and this current assessment, no additional noise measurements have been conducted as the previous 2012 noise survey and subsequent noise monitoring following the commencement of VENM haulage is considered to adequately capture the existing road traffic noise environment on the road network adjacent to the Penrith Lakes scheme.

6.3.1 Assessment Criteria

6.3.1.1 Operational Noise Criteria

There are two sets of conditions in respect of noise emitted from within the PLDC site:

- One from the EPL issued by the Department of Environment and Conservation (DEC), now Office of Environment and Heritage (OEH); and,
- From the Minister for Planning for the DA2, DA3 and DA4 Consents.

Numerically, these consent conditions impose the same noise criteria for noise from internal movements within the PLDC site. Details of the acoustic consent conditions are provided in the Noise Assessment Report in Appendix B. Acoustic terminology is presented in Appendix C.

6.3.1.2 Internal Traffic Noise

Truck movements on internal haul roads within the PLDC scheme are covered by the existing EPL and DA2/DA3/DA4 consents criteria, including transportation of fill within the site. Under the proposed modification to these consents, these internal traffic movements would continue in order to transport the fill around the PLDC site, and therefore the overall number of internal truck movements would be similar after fill haulage commences.

Therefore, the additional noise and vibration impacts from internal traffic sources resulting from the importation of VENM/ ENM are considered to be negligible, and only impacts from external traffic sources will be considered as part of this assessment.

6.3.1.3 External Traffic Noise

Traffic noise impacts from public roads in NSW are assessed against the OEH's *Road Noise Policy* (RNP[2]), which provides guidelines for acceptable noise levels from new and existing roadways, and from developments which have the potential to create additional traffic on existing roadways.

The importation of VENM/ENM has been treated as a "land use with the potential to create additional traffic" for the purposes of setting noise criteria. The RNP criteria are given for two time periods – day (0700-2200) and night (2200-0700). All of the VENM/ENM haul traffic movements will occur during the day time period, and therefore discussion of noise criteria will be restricted to daytime noise levels only.

The appropriate noise criteria from the RNP for traffic noise from the importation of VENM are given below in Table 9.

Table 9 NSW Road Noise Policy

Road	RNP Category	Time Period	Daytime Criterion
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	15-hour	60 dB $L_{Aeq,15hr}$

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

6.3.1.4 Vibration

Criteria for vibration are given by the OEH "Assessing Vibration" guideline[3] . As with the RNP, these criteria are non-mandatory goals for new developments. Vibration criteria are based on two components:

- Maintaining human comfort of building occupants
- Preventing damage to a building and its contents

The human comfort vibration criterion is significantly below the building damage vibration criterion, and therefore achieving the human comfort condition generally results in the building damage condition being met.

For intermittent vibration sources, such as road and rail traffic, the concept of a 'vibration dose value' (VDV) has been adopted. For residences, the acceptable VDV range is as follows:

2 NSW Office of Environment and Heritage *Road Noise Policy (July, 2011)*

3 NSW Department of Environment and Conservation (2006) – *Assessing Vibration: a technical guideline*

- Preferred value: 0.2 m/s$^{1.75}$
- Maximum value: 0.4 m/s$^{1.75}$

The OEH's vibration guidance is generally based on British Standard BS6472[4]. BS6472 and its Australian equivalent, Australian Standard AS2670.2[5]. These standards give a series of rating curves to assess human exposure to vibration levels, and provide further guidance on acceptable vibration levels. Table 2 of AS2670.2 recommends that daytime continuous or intermittent vibration levels in residential receivers should not exceed Curve 4 of AS2670.2. Refer to Appendix B for more details.

6.3.1.5 Traffic Noise Survey Methodology

A baseline traffic noise survey was conducted between the 9th and 17th May 2012 at three measurement locations, corresponding closely to Receivers 1, 2 and 3. Unattended noise loggers were used to conduct statistical noise measurements over the course of the survey, measuring the L_1, L_{10}, L_{eq}, and L_{90} parameters over 15-minute time periods.

The unattended noise measurements were supplemented by attended noise measurements of the traffic noise levels at the measurement locations. Roadside measurements were also conducted to measure source noise levels from the existing haul trucks using Old Castlereagh Road, with several truck pass-bys being recorded and the single-event noise exposure level (SEL) for a haul truck being measured for use in noise predictions.

The noise loggers were located in the vicinity of each noise-sensitive receiver, with the location selected to minimise the influence of other non-traffic noise sources at the receiver.

Logger and receiver locations and the average weekday noise measurements for each logger location are presented in Appendix B.

The logger locations were typically at a different distance from the carriageway than the nearest noise-sensitive receiver, and therefore the measured traffic noise levels was corrected to the distance from the road to the receiver. Additionally, a 2.5 dB(A) façade correction must be applied when assessing noise levels at a residence.

6.3.1.6 Traffic Noise Predictions Methodology

Noise levels were predicted for traffic across the proposed years of operation (2014-2018) for the scenario with and without the additional VENM/ENM haulage trucks.

Traffic volumes for the approved quarry + VENM haulage scenario and for the proposed additional VENM/ENM scenario were based on 476 additional VENM/ENM haul trucks movements per day (2015/2016 and 2016/2017), reducing to 238 VENM/ENM haul truck movements in 2017/2018. Each traffic

[4] British Standard BS6472.2 (1992) *Guide to evaluation of human exposure to vibration in buildings (1 to 80 Hz)*

[5] Australian Standard AS2670.2 (1990) – *Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz)*

"movement" for noise predictions is a single truck pass-by of a receiver. If trucks are operating "two-way" on a road segment then each truck will count as two "movements".

The full methodology for noise predictions including the traffic volumes used for prediction can be found in Appendix B.

6.3.2 Existing environment

6.3.2.1 Noise-Sensitive Receivers

A site survey was conducted between the 9th and 17th May 2012 to identify representative noise-sensitive receivers on the most-affected roadways around the PLDC site. Receiver locations were identified as being representative of the residences along a section of road, and were selected to be on a section of road where importation haulage trucks are proposed to be used.

The project noise-sensitive receivers (NSRs) are:

- **Receiver 1:** 1999 Old Castlereagh Road – Old Castlereagh Road, west of Castlereagh Road roundabout
- **Receiver 2:** 538 Cranebrook Road and The Lakes Church, 540 Cranebrook Road (Receiver 2A) – on Castlereagh Road, north of Andrews Road roundabout.
- **Receiver 3:** Lot 5, Cranebrook Village– Castlereagh Road, north of Cranebrook Road; and Cranebrook Road.
- **Receiver 4:** 74 Church Lane (faces Castlereagh Road)
- **Receiver 5:** receivers on The Northern Road (typically ~50 m from the road edge)
- **Receiver 6:** receivers on Andrews Road (typically ~ 30 m from the road edge and protected by a noise bund)

The locations of receivers 1-4 are shown in Figure 11 below. Additional receivers (Receiver 5 and Receiver 6, not shown on Figure 11) have been used to assess noise impacts from VENM/ENM movements on The Northern Road and Andrews Road, respectively; however due to the greater traffic volumes on these road segments the relative impact of PLDC traffic movements is expected to be reduced compared to the other receivers.

Figure 11 Overview of Receiver Locations

6.3.2.2 Existing Traffic Noise

Additional VENM/ENM traffic is likely to have the greatest acoustic impact on the roads immediately adjacent to the Penrith Lakes Scheme. At locations further from the PLDC site, the presence of traffic from other sources means that the additional traffic noise impact from the VENM/ENM haul trucks is likely to be negligible.

Figure 9 and Figure 10 (in the Traffic Assessment, Section 6.2) presents the proposed VENM/ENM haul truck movements on the road segments surrounding the PLDC site for Trucks approaching from both the north and south respectively.

The most affected roads are likely to be Old Castlereagh Road and Castlereagh Road, both of which form part of the PLDC site boundaries, and Cranebrook Road.

Old Castlereagh Road forms the access route for heavy vehicle traffic to and from the former Holcim plant and the Fine Sand plant, while Castlereagh Road and Cranebrook Road carry through traffic between Penrith and Windsor.

Noise levels at the noise sensitive receivers have been calculated, and are given in Appendix B.

Table 10 Measured and Predicted Existing Traffic Noise Survey Measurements at Noise Sensitive Receivers, dB re 20 μPa

Receiver	Parameter	Approximate Distance from Carriageway Edge	Façade-Corrected Average Weekday Noise Level	Criterion	Existing Levels Meet Criterion?
1	$L_{Aeq,15hr}$	31 m	58 dB	60 dB	Yes
2	$L_{Aeq,15hr}$	25 m	64 dB	60 dB	No
2A	$L_{Aeq,15hr}$	16 m	66 dB	60 dB	No
3	$L_{Aeq,15hr}$	19 m	71 dB	60 dB	No
4	$L_{Aeq,15hr}$	80 m	57 dB	60 dB	Yes
5	$L_{Aeq,15hr}$	50 m	59 dB	60 dB	Yes*
6	$L_{Aeq,15hr}$	30 m	59 dB	60 dB	Yes*

* Just under criterion; treated as being exceeding the criterion as discussed below

Measured and predicted levels show that measured existing road traffic noise levels currently exceed noise criteria at all receivers except for those on Old Castlereagh Road (Receiver 1) and Castlereagh Road north of Cranebrook Road (Receiver 4). Receivers 5 and 6 (The Northern Road and Andrews Road) are just under the noise criteria. In this circumstance, the RNP and its predecessor the ECRTN allows for a 2 dB(A) 'relative increase' criterion to be applied since existing noise levels are almost at the absolute 60 dB(A) criterion.

As such, the applicable criteria from the RNP are generally that noise from the VENM/ENM operations should not increase the existing noise levels by more than 2 dB(A).

With respect to Old Castlereagh Road and Castlereagh Road north of Cranebrook Road, VENM/ENM truck movements should not give rise to an exceedance of the 60 dB(A) criterion.

6.3.2.3 Haul Truck Pass-By Measurements

Several measurements of haul truck pass-bys were made by the edge of the carriageway of Old Castlereagh Road during the site visit on 20 February 2008. These measurements are still considered relevant to this updated assessment since the truck types used for haulage to/from PLDC are unlikely to change significantly. They were made at a distance of approximately 2.5 m from the carriageway edge, from trucks travelling on both sides of the carriageway.

Table 11 Haul Truck Pass-By Noise Survey Measurements, dB re 20 µPa

Carriageway Side	Number of Trucks	SEL	L_{max}
Near	5	88-93 dB	87-93 dB
Far	5	87-91 dB	86-90 dB
Average of both sides	10	92 dB	90 dB

6.3.2.4 Additional Pre-VENM Logging

A follow-up noise survey was undertaken in August 2013 in order to check baseline traffic noise levels on the PLDC road network immediately prior to the commencement of VENM haulage. This data can be used to check the calibration of the traffic noise models.

Four consecutive weeks of background monitoring with no VENM importation were measured from 9 August 2013 to 6 September 2013. The logging locations were generally similar to the logger locations from the previous 2008 and 2012 traffic noise surveys, with some changes (refer to Appendix B for locations).

6.3.3 Impact Assessment

6.3.3.1 Traffic Noise Impacts

Predicted noise levels, including a 2.5 dB facade reflection, are given for each of the proposed years of operation in Table 12 below.

Table 12 Traffic Noise Predictions, 2012-2015 - dB re 20 µPa

	Receiver	Level ($dBL_{Aeq, 15hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
2014/2015	1	61 dB	-	-	-
	2	63 dB	-	-	-
	2A	64 dB	-	-	-
	3	72 dB	-	-	-

	Receiver	Level ($dBL_{Aeq, 15hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
	4	57 dB	-	-	-
	5	60 dB	-	-	-
	6	60 dB	-	-	-
2015/2016	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	64 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	61 dB	2 dB increase	Yes
2016/2017	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	65 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	61 dB	2 dB increase	Yes
2017/2018	1	56 dB	58 dB	60 dB(A)	Yes
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	65 dB	2 dB increase	Yes
	3	71 dB	72 dB	2 dB increase	Yes
	4	59 dB	59 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	60 dB	2 dB increase	Yes

*Marginal exceedance of 1 dB(A).

The maximum expected traffic flow from VENM/ENM haulage of 476 truck movements is predicted to meet the road noise criteria for all road segments.

Noise levels for 2015/2016 are expected to be approximately the same as 2014/2015 for all road segments. This is because the additional VENM/ENM traffic is offset by the cessation of export truck movements from PLDC.

For 2018, noise levels on some road segments are predicted to decrease, due to the cessation of the approved VENM haulage traffic in 2018.

Depending on PLDC's operational requirements, the VENM/ENM traffic will likely use multiple access points to the PLDC site (refer to Figure 7). The noise predictions above have been based on this based on 'typical' noise predictions

where VENM/ENM haul trucks are assumed to be divided evenly between the three site entrances.

For the typical scenario, VENM/ENM haul traffic is predicted to comply with the RNP criteria for receiver locations on all road segments.

The only road segment where receiving the full number of VENM/ENM trucks ('worst case' scenario) would significantly affect overall noise levels is Old Castlereagh Road. Receivers along this road are of double-brick façade construction with window shutters as a result of noise mitigation from previous PLDC haulage projects[6]. This construction will likely result in a façade traffic noise reduction of 15 dB(A) or higher.

Under an extreme 'worst-case' scenario where all 476 truck movements use Old Castlereagh Road, the external noise level at the receivers on this road segment would be 64 dB $L_{Aeq,15hr.}$ With the façade construction providing ~15 dB(A) noise reduction, this would result in an internal noise level of ~49 dB $L_{Aeq,15hr.}$ NSW road noise criteria are typically based on lightweight dwelling constructions which provide ~10 dB(A) traffic noise reduction – i.e. the criterion of 60 dB $L_{Aeq,15hr}$ (external) is equivalent to ~50 dB $L_{Aeq,15hr}$ (internal).

Hence the façade upgrades to these dwellings provided by previous PLDC projects would result in internal noise levels equivalent to the RNP criteria under the 'worst case' VENM/ENM haulage scenario.

Historically, truck numbers along Old Castlereagh Road were significantly higher than the proposed VENM/ENM haulage.

Hence, even under the (unlikely) 'worst case' traffic scenario, internal noise levels for receivers on Old Castlereagh Road would comply with the equivalent RNP noise criteria. Under a typical operation scenario where truck numbers are divided between the various PLDC site entries, external and internal noise levels on Old Castlereagh Road would comply with the RNP criteria.

Hence noise impacts on receivers on Old Castlereagh Road are assessed as being negligible from the proposed VENM/ENM haulage.

To illustrate the change in predicted noise levels with changing traffic flows, the following figures graph the predicted traffic noise levels for Old Castlereagh Road for each year from 2012 to 2018 under the two scenarios ("existing approved operation", including VENM haulage, and "proposed VENM/ENM haulage"), as shown in Figure 12.

6 Advised by PLDC

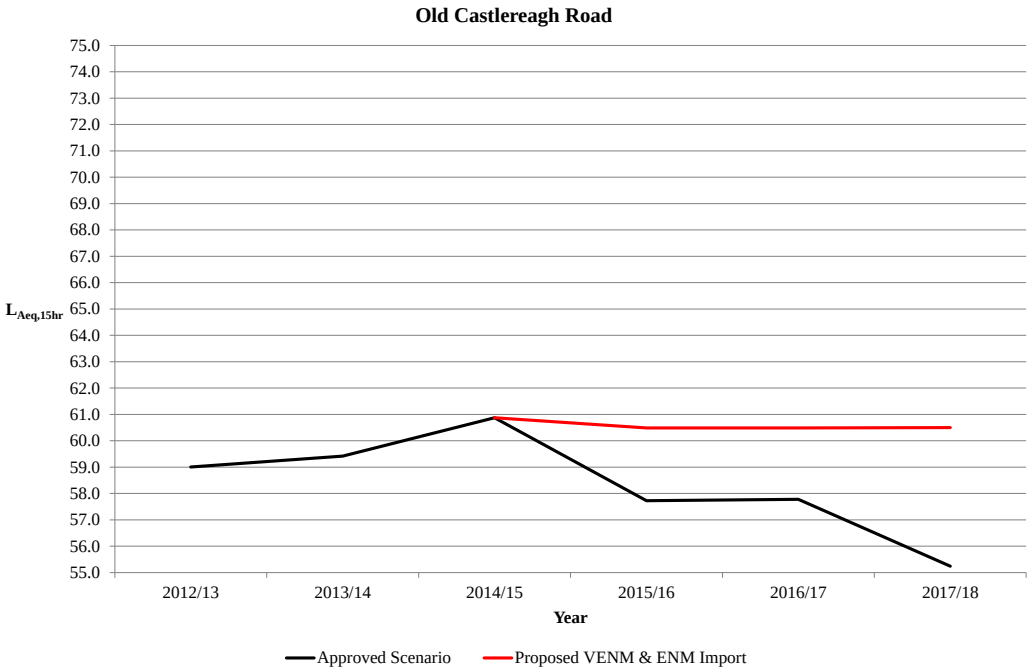

Figure 12 Predicted Noise Levels, Old Castlereagh Road, 2012-2018

6.3.3.2 Vibration Impacts

Groundborne vibration levels from road traffic are typically minimal, because the pneumatic tyres of vehicles act to isolate the mass of the vehicle from the road surface. Therefore, the vibration impact from the VENM/ENM haul traffic is expected to be minimal.

Further, no significant increase in the maximum vibration levels at surrounding receivers is expected – these receivers are already exposed to vibration from existing heavy vehicle traffic, and the additional VENM/ENM traffic will increase the number of vibration events but is not expected to increase the magnitude.

6.3.3.3 Analysis of results

The noise and vibration impact of the proposed modifications to the DA2, DA3 and DA4 consents to allow importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to the Penrith Lakes Scheme over 2015-2018 has been assessed against the relevant licence conditions and OEH guidance for noise and vibration.

Additional noise and vibration impacts from internal traffic movements are expected to be minimal, with external traffic (i.e., not on the PLDC site) being the only significant source of noise resulting from the importation of VENM/ENM.

Traffic noise levels were predicted using the Calculation of Road Traffic Noise (CoRTN) methodology, calibrated against results from an unattended traffic noise survey and attended measurements of existing haul truck pass-by noise on Old Castlereagh Road.

Noise levels for a typical VENM/ENM haul truck scenario (approximately 476 truck movements per day divided between the three site entries) were assessed. In

addition, a further 'worst case' scenario was considered for all haul trucks using the worst-affected road segment (Old Castlereagh Road), which has infrastructure that is better suited to handle larger volumes of trucks than the other entrances.

Receivers on Old Castlereagh Road have been upgraded with architectural facade treatments and upgraded ventilation in order to allow glazing to remain closed as part of previous PLDC projects. These existing mitigation measures mean that internal noise levels under the 'worst case' haulage scenario (where all haul trucks use Old Castlereagh Road) will be equivalent to the external RNP noise criteria.

Based on current trends, the 'background' traffic on Castlereagh Road and Cranebrook Road will increase with time, and the relative impact of the VENM/ENM haul traffic is predicted to decrease on these roads.

For Old Castlereagh Road, the VENM/ENM haul traffic is essentially 'prolonging' historically-high heavy vehicle numbers on this road, and vehicle numbers (and noise levels) will reduce once the VENM/ENM haulage ceases.

Vibration levels at nearby receivers were assessed using a conservative methodology based on previous Arup Acoustics measurements of vibration levels from large internal haul trucks on the PLDC site.

To control the traffic noise impact of the VENM/ENM traffic, administrative measures are recommended, such as dividing the overall daily haul traffic between several access locations to reduce the traffic noise impact on any one road segment. A NMP will be implemented for the VENM/ENM haulage to document the traffic noise management procedures.

The overall noise impact of the VENM/ENM haul traffic is expected to be low, and administrative measures are expected to be effective in controlling this noise impact to acceptable levels and meet the relevant noise criteria.

Predicted vibration levels at surrounding receivers are below the recommended criterion of Curve 4 of AS2670.2, and the estimated VDV is predicted to be below 0.2 $m/s^{1.75}$ and therefore the vibration impact of the VENM/ENM haul traffic is expected to be minimal and meet the relevant vibration criterion.

6.3.4 Mitigation Measures

- PLDC proposes to control traffic noise impacts from the VENM/ENM haulage by managing the number of haul truck movements on each road segment. Further detail on noise monitoring and management under the Environmental Protection Licence is provided in Appendix B.
- A Traffic Noise Management Plan for the VENM/ENM haulage operation would need to be been prepared prior to commencement of operation, and traffic noise levels on Castlereagh Road, Cranebrook Road and Old Castlereagh Road should be measured before and after commencement of VENM/ENM haulage to quantify the increase in traffic noise due to the haulage operation.

The impact of the modification on Noise and Vibration is considered to be low

6.4 Air Quality

6.4.1 Existing Environment

6.4.1.1 Climate conditions

Data relating to meteorological conditions was obtained from the Bureau of Meteorology recorded at the Penrith Lakes Automatic Weather Station (AWS). The AWS is located approximately 250m to the north of the SIRC Warm Up Lake and has been recording data since 1995. Wind roses presenting plots of wind speed versus direction were reviewed for data collected at 9am and 3pm for each month of the year. An annual summary based on data from 1995 to 2010 of the 9am and 3pm wind data is presented in the wind roses in Appendix C and described in further detail below.

The wind roses for 9am indicate that wind in the vicinity of the site is dominated by strong south to south westerly winds from early autumn to winter. Northerly winds increase in frequency and strength from spring to summer with strong westerlies also evident in the warmer months. The most common light winds (representing worst case dispersion conditions) are northerlies or southerlies occurring throughout the year.

The wind roses for the 3pm data indicate that the afternoon winds are significantly stronger than the morning and mostly come from the west all year round. The most frequent winds during the summer months are south easterlies, with the winter months highly variable. Light winds sometimes occur from the north or the south mostly in winter.

Wind speed and direction on site are also measured by an anemometer located at the south west site. Aggregated data from this monitoring location from 2003 to 2005 indicates that winds are most frequent from the south and southwest and strongest from the south.

Mean temperature at the AWS ranges from 5.5°C in July to 30.8°C in January. Annual average rainfall at the AWS is recorded as 712.5mm with the mean monthly rainfall occurring in February (131.6mm) and the minimum in August (26.0 mm).

6.4.1.2 Sensitive Receivers

Existing sensitive receivers with respect to air quality include the residents to the immediate east of the site and residents on the escarpment to the north of the site. The closest sensitive receiver to the site is Cranebrook Village (refer to Figure 13).

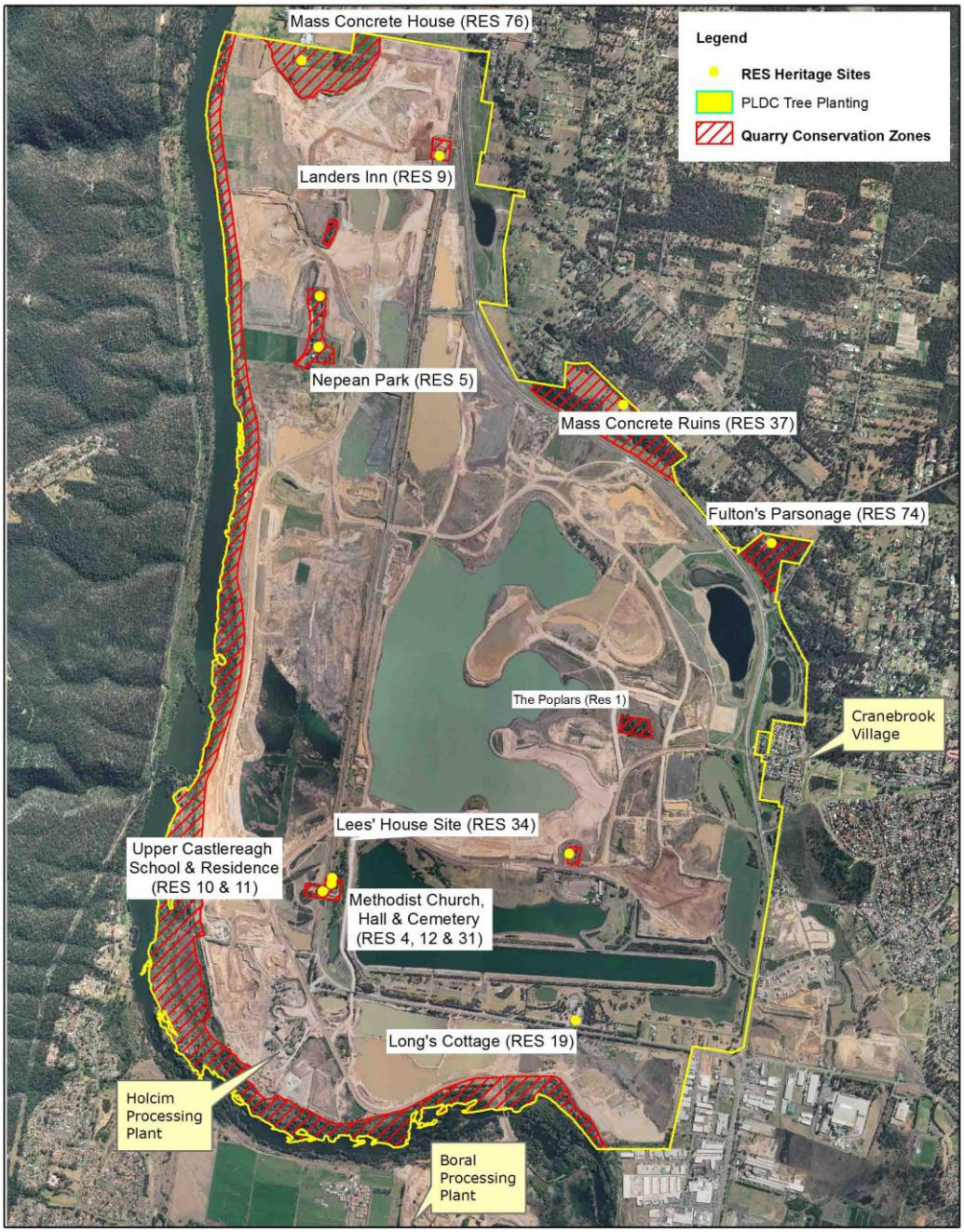

Figure 13 Sensitive Receivers to east of site including Cranbrook village

6.4.1.3 Existing Air Quality

The existing air quality at the site is currently affected by:

- Dust generating activities such as ground disturbance during extraction and land remediation, vehicle movements along the internal unsealed haul roads and wind erosion; and,
- Vehicle emissions from on-site traffic and the local road network.

Dust Generating Activities

The majority of quarry extraction across the Scheme has been completed however; land remediation works are to occur throughout the period of importation.

A network of roads exists within the Scheme, as evident in Figure 14, which are comprised of unsealed access roads for general site access, as well as haulage roads predominantly used by machinery and large vehicles. The existing approvals allow for as many vehicle movements on internal roads as operations require, and therefore these internal movements need not be considered by this application for modification. In any case, the requirement to import fill material would not greatly increase the number or distance of internal truck movements.

Air quality within the Scheme boundaries and adjacent to the site has been monitored by PLDC during operation of the Scheme. The air quality monitoring locations are shown in Figure 14. The quarry excavation and remediation works undertaken by PLDC are subject to air quality targets and monitoring for particulate pollution (dust) under the various development consents and the Scheme's Environmental Protection Licence (EPL). The air quality criteria are consistent with NSW OEH guidelines (including Action for Air and the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales). These requirements ensure that air quality at sensitive receivers, located both within and adjacent to the Scheme, are protected from adverse effects of dust generation during works.

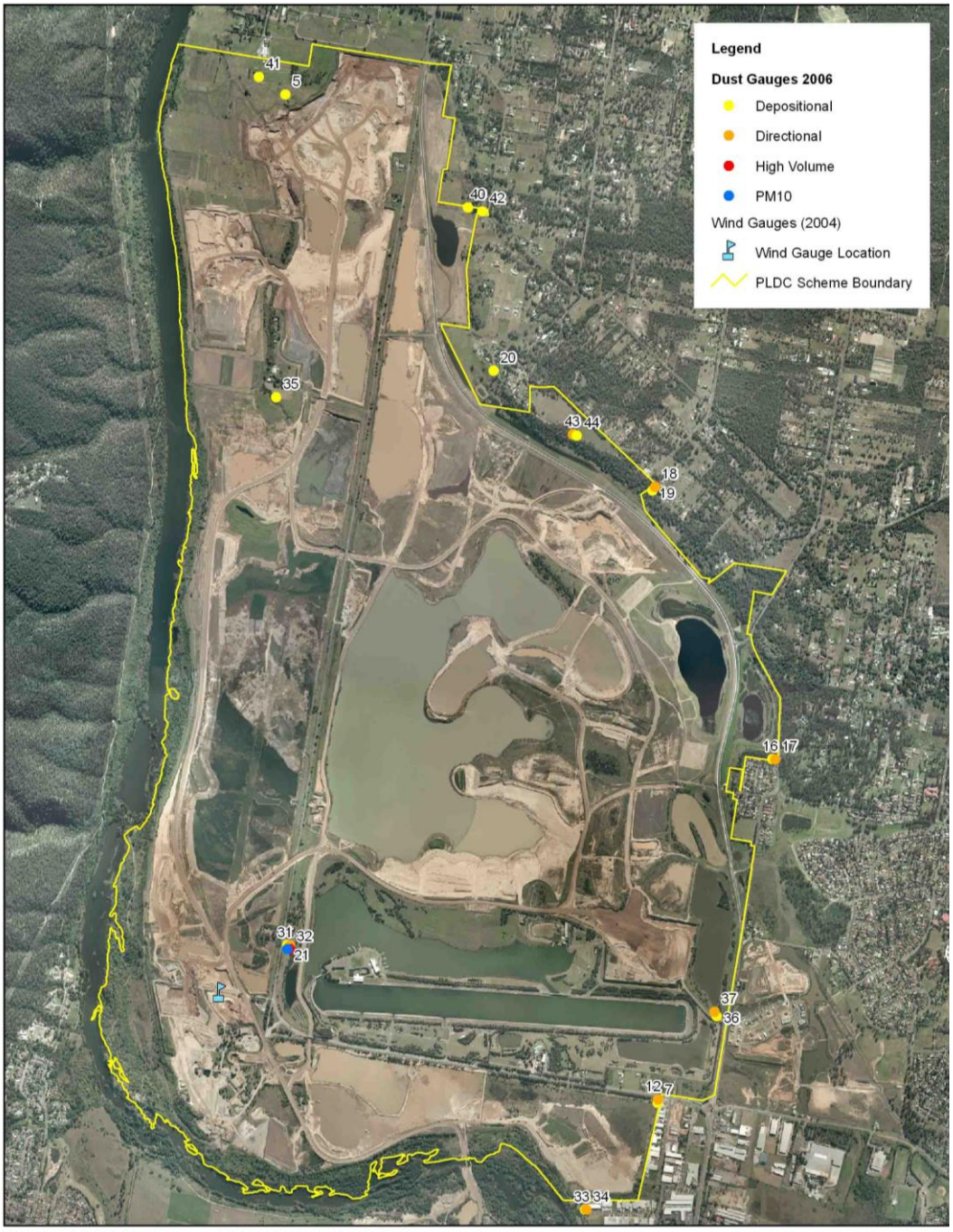

Figure 14 Air Quality Monitoring Locations

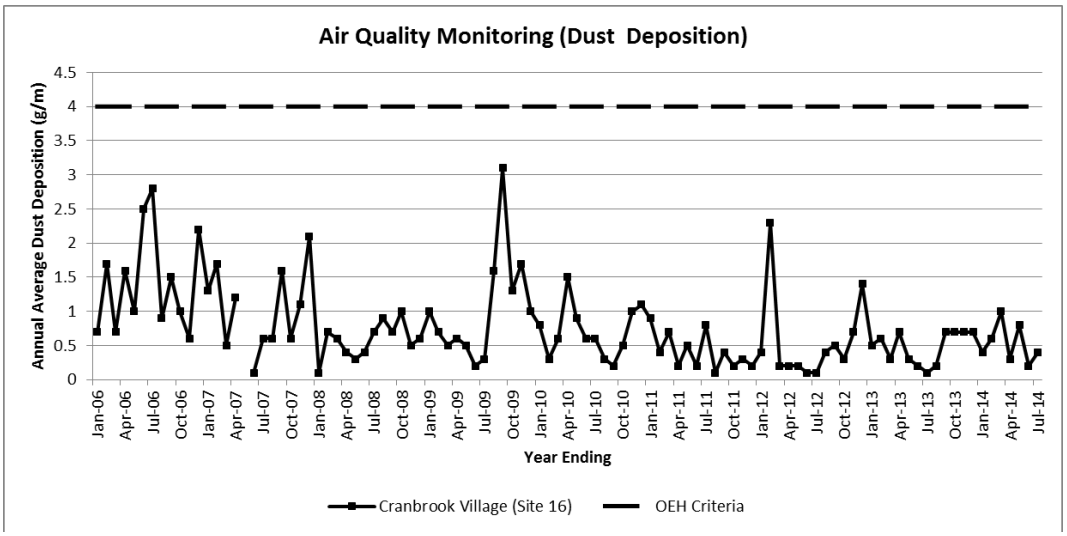

Figure 15: Dust Deposition Results (Cranebrook Village)

The results displayed in Figure 15 show that deposited dust has remained below the criterion from January 2006 to June 2014. The results are presented from Site 16 as it is located near the most sensitive receivers, that is, the residential areas, along the site boundary. Note that the large spike in September 2009 was due to the large dust storm in Sydney.

Monitoring for PM_{10} for the purposes of the Scheme is undertaken at one location at the Uniting Church located in the south west corner of the Scheme, significantly distant from the sensitive receivers. PM_{10} concentrations recorded at this location have been consistently well below the respective criterion since 2006 (refer to Figure 16). The PM_{10} monitoring site is significantly distant from sensitive receivers therefore the PM_{10} monitoring data will not be used in the assessment of effects in Section 6.5.2.

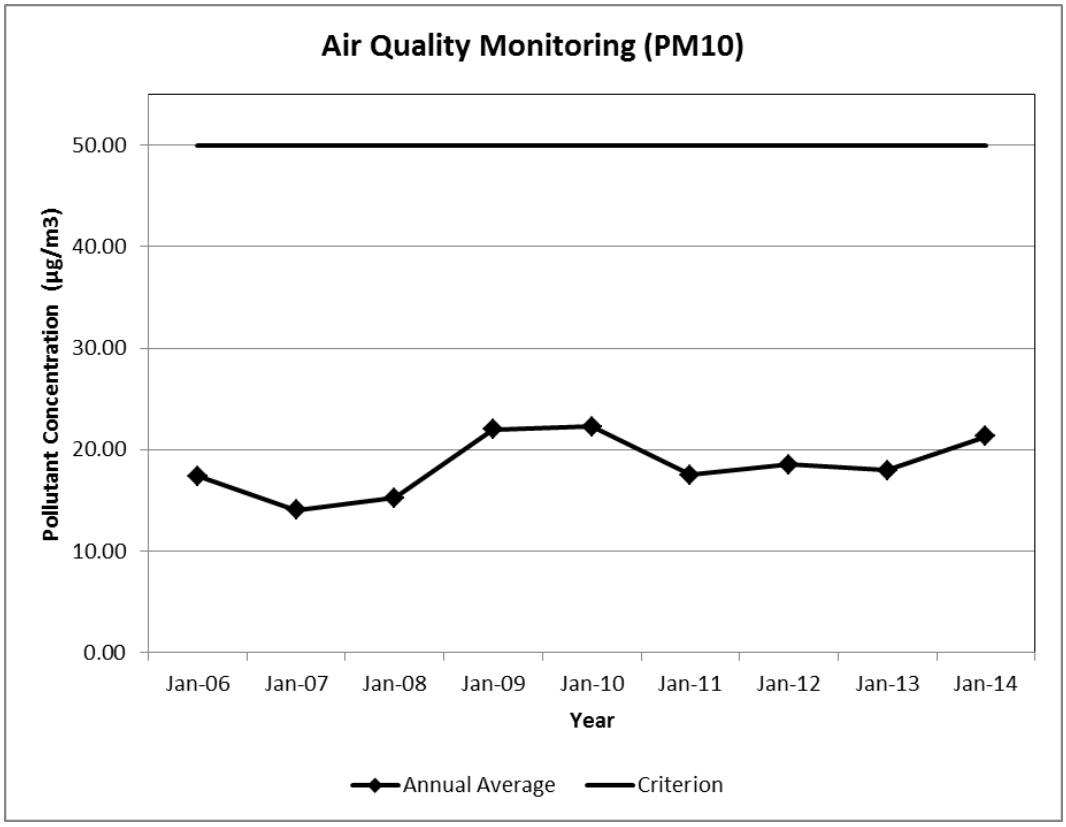

Figure 16 Annual Average of PM_{10} Monitoring data

Vehicle Emissions

Other air pollutants may be present within the vicinity of the site as a result of onsite traffic and traffic on the local road running north south along the eastern boundary of the site. Air pollutants associated with vehicle emissions typically include oxides of nitrogen (NOx), carbon dioxide (CO2), particulates (including PM_{10}) and hydrocarbons.

The air quality impacts from traffic on Castlereagh Road were assessed as part of the impact assessment for the road realignment in 2004 by Holmes Air Sciences to determine whether the Castlereagh Road realignment would result in any unacceptable concentrations of air pollutants adjacent to the road. The impact assessment determined the likely concentration adjacent to the road for three scenarios:

- 2006 upon commissioning of the road,
- 2016 without increased traffic from urban development within the Scheme; and
- 2016 with increased traffic from PLDC urban development within the Scheme.

The estimated 2016 concentrations (without increased traffic from urban development at the Scheme) for CO, NOx and PM_{10} have been used in this assessment as a baseline as the most representative data for these pollutants. This is considered to be a conservative assumption as a portion of the pollutants is likely to have come from non-road sources. These estimated levels are well below the guideline levels for all scenarios as presented in Table 13.

Table 13: Air Quality Impacts from Vehicle Emissions along Castlereagh Road

Pollutant	Averaging Period	Concentration adjacent to road (2016-without development)	Background Level	Guideline Level
CO	1 hour	1.4 µg/m³	1.25 µg/m³ (a)	30 mg/m³ (c)
NOx	1 hour	4.3 µg/m³	41 µg/m³ (a)	246 µg/m³ (c)
PM_{10}	24 hour	10.2 µg/m³	18.6 µg/m³ (b)	50 µg/m³ (d)
Deposited dust	Yearly Average	N/A	N/A	4 g/m

(a) Based on regional air quality data for Western Sydney
(b) Background concentrations have been recorded consistently below the 50 ug/m3 criterion on site (see PM_{10} reading for January 2012 in Figure 16 above).
(c) NSW OEH Action for Air goal
(d) National Environment Protection (Ambient Air Quality) Measure (NEPM) goal

The baseline pollutant concentrations at the actual site and the surrounding residential areas attributable to vehicle emissions along Castlereagh Road therefore are likely to be less than the predicted maximum concentrations and the guideline values by almost an order of magnitude for all relevant pollutants.

6.4.2 Impact Assessment

The main source of air pollution arising from this modification will be increased vehicle emissions, (including CO, NOx and PM_{10}) generated adjacent to the road and an increased potential for dust emissions generated within the Scheme.

6.4.2.1 VENM/ENM Trucks on Public Road

The baseline conditions indicate that the air pollutant concentrations adjacent to the roadside are well below the guideline criteria.

The traffic assessment estimates 3% increase per year in vehicles movements along the key surrounding roads from 2015 to 2018. As the existing quarrying operations will cease in early-mid 2015 before the proposed commencement of importation of VENM/ENM (as seen in Figure 6) the overall traffic volume from the Penrith Lakes site would decrease overtime. Therefore this air quality assessment has assumed a worst case of a 3% increase in overall traffic would apply until 2018 with an additional one-off increase of 5% factored in as a result of the approved VENM importation which commenced in 2014.

While this assumption is conservative, it is a useful first pass screening test to indicate whether the increase in heavy vehicle traffic may result in an exceedance of the criteria (refer to Table 14).

Table 14 Predicted Air Quality Impacts from Vehicle Emissions until 2018.

Pollutant	Averaging Period	Worst case predicted concentration adjacent road (2018)	Background Level	Guideline Level
CO	1 hour	1.6 µg/m³	1.25 µg/m³	30 mg/m³
NOx	1 hour	4.9 µg/m³	41 µg/m³	246 µg/m³
PM_{10}	24 hour	11.7 µg/m³	18.6 µg/m³	50 µg/m³

Table 14 demonstrates that the predicted levels of vehicle emissions do not exceed the air quality criteria for CO, NO_x, PM_{10} for the time period of 2015 to 2018 at nearest sensitive receivers.

6.4.2.2 VENM/ENM Trucks within the Scheme

VENM/ENM truck movements within the Scheme will be limited to the extent practicable. The VENM/ENM trucks will deliver fill material directly to the required locations. Any other transportation of fill within the Scheme will be undertaken by PLDC's own haul trucks. VENM/ENM trucks are therefore not likely to increase dust generation within the Scheme.

6.4.2.3 Construction Plant and Equipment

Construction plant and equipment for moving the VENM/ENM will be sourced from within the Scheme and maintained to high standards by PLDC contractors, such that exhaust emissions are controlled.

6.4.2.4 Road network upgrade

Prior to the commencement of the VENM/ENM importation, the road network adjacent to Gate 3 (Castlereagh Road north of Cranbrook Road intersection) (refer to Figure 7) would be upgraded to provide auxiliary left turn treatment for northbound traffic turning onto the site. Construction related air emissions are likely to be negligible during these works due to the minor and short term nature of the works.

6.4.3 Environmental Management Measures

In order to ensure that the air quality impacts remain negligible, PLDC will employ the following management measures, which are already required under the existing DA2, DA3 and DA4 and EPL operating at the Scheme.

- The dust deposition gauges located within the site, as well as at Cranebrook Village will continue to monitor compliance at the Scheme. The results will be incorporated within PLDC programme of environmental reporting.
- The interior roads will be suitably maintained, including watering where necessary to minimise dust generation, on internal roads and work areas, with water sourced from the nearest stand pipe.
- Rehabilitation of lands will stabilise soil surfaces and prevent dust generation.

- All vehicles within the site have a maximum internal speed limit of 60km/hour.
- No additional management directives on top of these existing conditions are required.

The impact of the modification on Air Quality is considered to be low

6.5 Soils, water and landform

6.5.1 Existing Environment

6.5.1.1 Geology and Soils

Prior to quarrying operations at the Scheme, the natural subsurface profile across the Scheme comprised overburden soils of sandy and silty clays and clayey sands, extending to depths of 5m to 8m, overlying sand and gravel materials extending to a depth of about 10m to 12m. Underlying the sand and gravel is shale bedrock. This profile can generally be applied to the site.

The proposed imported fill materials are from various sites around Metropolitan Sydney and can be described as potentially clay shale or sandy clay depending on the site of the source. Before importation, the VENM/ENM would be subject to compliance with the Penrith Lakes Technical Specifications requirements and once at the site the VENM/ENM will undergo ongoing testing for quality assurance, as described below in Section 6.5.3.

6.5.1.2 Groundwater

The groundwater table across most of the Scheme area is located approximately 6m to 9m below the ground surface. The groundwater generally lies in the sand and gravel deposit immediately above the impermeable shale or sandstone bedrock, which carries water across the Scheme area to the west. Groundwater is depleted by natural aquifer drainage to the Nepean River to the west and, to a lesser extent, by evaporative losses associated with lakes in previously extracted areas.

6.5.1.3 Surface Water Features

Figure 17 shows the major surface water features of the Scheme and the locations of water quality monitoring currently undertaken. The detention basins on the east of the site are part of a closed system that runs into the Sydney International Regatta Centre (SIRC) Lakes. The aim of the detention basins is to drop out sediment and associated nutrients prior to the water flowing into the SIRC lakes namely the Rowing and Warm-up Lakes in the south of the Scheme. These two lakes are open for public use through the venue of the SIRC, which is managed by OEH.

The current main source of water to the Scheme is from the upper catchments of approximately 850ha urban/rural residential land. Additional water enters the system through 'dewatering' operations of the quarry pits across the Scheme.

The lakes flow paths are as follows:

1. Water from external catchment flows in to the Stilling Pond from the east.

2. Water from the Stilling Pond flows over a fixed crest weir into the North Pond.

3. North Pond flows into the Middle Basin (through a pipe and fixed crest weir arrangement).

4. Middle Basin flows into Final Basin through a 3m by 1.8m box culvert under McCarthy's Lane.

5. Water from Cranebrook Road and McCarthy's Lane flows into the Final Basin via open channels.

6. McCarthy's Creek catchment flows into the Final basin via a twin 1.65m reinforced concrete pipe structure.

7. Lugard Street catchment spills into the Final Basin via a 1.65m reinforced concrete pipe structure.

8. Local catchment drainage enters the Final basin through four sets of 0.3m reinforced concrete pipe structures.

9. Final Basin flows into Rowing Lake via a 3m by 1.8m box culvert with a flow regulating, manually operated sluice gate.

10. Rowing Lake and Warm-up Lake are the one water body with an island running east west through the centre, these lakes flow into Lake A (via a 1.5m diameter reinforced concrete structure (with trash racks).

11. PWS draws water from the Warm-up Lake and cycles the water back into the Lake.

12. Lake A is the end of the system (Main storage area).

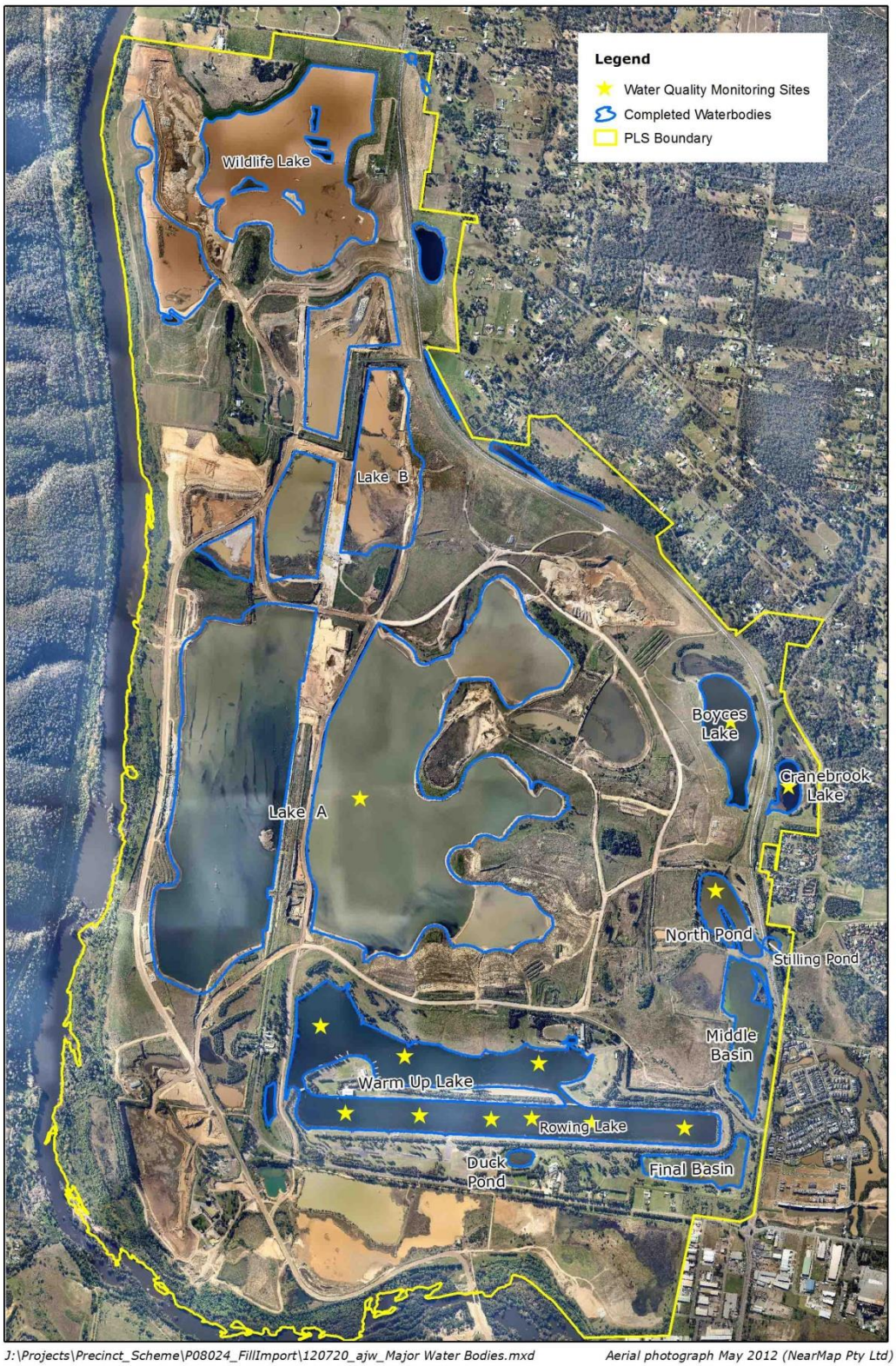

Figure 17 Major water features within the Scheme

6.5.1.4 Contamination

A limited amount of excavations across the site were filled prior to the operation of PLDC and therefore the contamination potential of this previous fill material is largely unknown. It is considered likely that the excavations were filled with material sourced from within the Scheme which historically had been used as farmland. Since the inception of PLDC as an overarching body, filling has been conducted subject to internal quality assurance procedures.

Borelogs in these areas were collected by Coffey Geosciences as part of the Stage One Urban Lands investigation (Coffey, 2003) and during the preliminary geotechnical investigations for the 2004 small scale dynamic compaction trial. These logs indicate that the fill depth extends to approximately 12m below ground level. The soil logs indicate mostly sandy or silty clay with some river gravel reported from the surface to 4m below ground level. No visual or olfactory signs of contamination were reported in these logs. It is considered that there is a very low risk of contamination at the site by previous usage.

6.5.1.5 Acid Sulphate Soils

The site is sufficiently distant from the coast such that acid sulphate soils will not affect the proposal. Acid sulphate soils maps were consulted and did not show any potential acid sulphate soils at the site.

6.5.2 Impact Assessment

It is a natural consequence of importing fill that this will change the soil characteristics of the site. However, the controls in place ensure that the fill will meet the geotechnical and contamination criteria for the site, and the stringent testing of soil prior to transport from the source of the VENM/ENM will ensure that it is unlikely that contaminants would be introduced to the Scheme site from the fill. Although the fill is unlikely to contain enough organic matter to provide nutrients to the vegetation being established, the fill is not intended to be used as top soil, and therefore the nutrient characteristics of the fill are not an issue. If the assigned control measures which are described below, are implemented there will be minimal effect on soils and geology, and no risk of contamination.

There is some potential for additional sediment to enter the waterway system with an increase in the complexity of transport. Increased sediment in the system may lead to increased turbidity, TDS and TSS, as well as associated impacts on ecosystem health.

6.5.3 Environmental Management Measures

Soil and Landform

Using imported VENM/ENM as opposed to fill material sourced from site will change the characteristics of the soil present; however the strict controls in place ensure that this substitution will not create a negative impact. The control processes are described below.

Every part of any material delivered to the Penrith Lakes Scheme Site must meet and satisfy the requirements of and be delivered with supporting environmental information certifying to PLDC that the material is VENM or ENM as defined in the *Protection of the Environment Operations Act* 1997. Validation and certification of the material must be undertaken by a suitably qualified environmental consultant in accordance with NSW OEH Waste Classification Guidelines using industry accepted procedures and NATA register laboratories (for sample analysis) being an environmental consultant acceptable to PLDC.

To ensure no contamination or corruption of the material occurs en route between the source and PLDC, the source company must provide the following information:

- Site Address (Street, Suburb).
- Description of previous land use and current land use and details of any demolition work (e.g. residential, service station, supermarket etc) at every site where the material is sourced.
- Brief Description of proposed works (e.g. excavation of basement car park, footings tunnel etc) which has provided or will provide the material.
- Material type and approximate quantity of VENM/ENM.
- For VENM, certificate certifying to PLDC that if the material is VENM, it must contain no material that is not VENM including topsoil, building rubble, fill etc.
- For ENM, certificate certifying to PLDC that if the material is ENM and meets the requirements of the *Excavated Natural Material Exemption* 2012 under Part 6, Clause 51 and 51A of the POEO (Waste) Regulation 2005.
- Source of material on the Site and approximate depth(s) (e.g. all material below 300mm depth).

A statement in the report certifying that material to be received is VENM/ENM must contain certification as to the following:

- Laboratory analysis results included for the material to be delivered to the Site (Minimum of 3 samples required for residential sites from which the material is sourced/Minimum of 10 samples required for large sites from which the material is sourced plus duplicates for VENM).
- Map of sample locations of the site from which the material is sourced (Field Sketch or Indicated on Engineering Plan).
- Full description of material(s) to be delivered – either described in the report of Bore logs attached.

- Laboratory Reports and Certificates for the material to be delivered attached and completed as part of the certification report (including Lab Quality Control).
- The materials to be supplied are not Potential Acid Sulfate soils

Field Screening, Sampling and Analysis of materials

- Description of any Field Screening undertaken (if any) of the Site from which the material is sourced.
- Samples provided of the material to be delivered must be discrete (not composite) by the environmental consultant.
- Samples of the material to be delivered must be appropriately preserved and forwarded to a laboratory approved by PLDC.

The Analysis Undertaken on VENM/ENM to be delivered to the Site must include:

- Priority Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)
- Organochlorine Pesticides (OCPs)
- Petroleum Hydrocarbons (TPH)
- Benzene, Toluene, Ethylbenzene, Xylene (BTEX Compounds)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Polychlorinated Biphenyls (PCB's)

PLDC will undertake:

- Material tracking by recording: the source(s) of material generation, including site address(s), the total amount of material generated per site and transport and receipt dockets that ensure total amount of material generated at the source site is consistent with the total amount received at PLDC.
- Validation inspections and sampling at the PLDC site to 'check' that imported materials meet either VENM or ENM. The sampling frequency can be flexible given this environmental control is simply a validation process.

Water

Erosion control is required to reduce the potential for additional sediment to enter waterways. Erosion and Sediment Control (ESC) is already undertaken as part of the DA2, DA3 and DA4 existing conditions of consent. In addition to previous consent conditions, stabilisation measures as described in the industry standard Landcom Manual *Managing Urban Stormwater: Soils and Construction* (Volume 1 Edition 4) will be put in place. If these measures are implemented and adhered to, effects of the modification would be negligible.

Human and environmental exposure to soil will be minimised during work in accordance with the PLDC Occupational Health Safety and Environmental Management System.

The impact of the modification on Soil, Water and Landform is considered to be low

7 Statement of Commitments

This section documents measures proposed to avoid, minimise, manage, mitigate, offset and/or monitor impacts identified in the environmental assessment.

	Environmental Management or Mitigation Measure	Phase
1.	**Scope and Compliance**	
1.1	PLDC will carry out the importation of VENM/ENM in general accordance with this Environmental Assessment, including the Statement of Commitments.	All
2	**Communication and Consultation**	
2.1	PLDC will continue to be responsive to the community's expectations and requests. In particular, PLDC will: • continue to maintain a complaints register for the site; • follow up each complaint received by identifying the cause of the issue at the site and taking appropriate action; and • respond to the complainant in a timely and efficient manner regarding the cause of the complaint and how the issue has been resolved.	All
3	**Traffic and Access**	
3.1	A number of management measures are to be implemented during the importation period to further mitigate this impact. These are listed below: • Vehicle approach and departure routes to the site will be restricted to major arterial roads such as the M2, M4 & M7 Motorways, The Northern Road, Mulgoa Road and Cranebrook Road • The road network adjacent to gate 3 (Castlereagh Road north of Cranebrook Road intersection) will be upgraded to provide an auxiliary left turn treatment for northbound traffic and right turn treatment for southbound traffic turning into the site (refer to Appendix I for the preliminary design). • The majority of the VENM/ENM truck movements are expected to occur outside of the commuter peak hours.	During VENM/ENM Importation
4	**Noise and Vibration**	
4.1	A Traffic Noise Management Plan (TNMP) for the VENM/ENM haulage operation will be prepared, and traffic noise levels on Castlereagh Road, Cranebrook Road and Old Castlereagh Road will be measured before and after commencement of haulage to quantify the increase in traffic noise due to the haulage operation	Pre-VENM/ENM Importation
5	**Air Quality**	

	Environmental Management or Mitigation Measure	Phase
5.1	PLDC will employ the following air quality management measures, which are already required under the existing DA2, DA3 and DA4 and EPL operating at the Scheme; • The dust deposition gauges located within the site, as well as at Cranebrook Village will continue to monitor compliance at the Scheme. The results will be incorporated within PLDC programme of environmental reporting. • The interior roads will be suitably maintained, including watering where necessary to minimise dust generation, on internal roads and work areas, with water sourced from the nearest stand pipe. • Rehabilitation of lands will stabilise soil surfaces and prevent dust generation. • All vehicles within the site have a maximum internal speed limit of 60km/hour.	During VENM/ENM Importation
6	**Soils, Water and Landform**	
6.1	PLDC will ensure that any material delivered to the Penrith Lakes Scheme Site meets and satisfy the requirements of and be delivered with supporting environmental information certifying to PLDC that the material is Virgin Excavated Natural Material or Excavated Natural Material as defined in the *Protection of the Environment Operations Act 1997*.	During VENM/ENM Importation
6.2	PLDC will ensure validation and certification of the material be undertaken by a suitably qualified environmental consultant in accordance with NSW OEH Waste Classification Guidelines using industry accepted procedures and NATA register laboratories (for sample analysis) being an environmental consultant acceptable to PLDC.	During VENM/ENM Importation
6.3	PLDC will ensure no contamination or corruption of the material occurs en route between the source and PLDC, as the source company must provide the following information: • Site Address (Street, Suburb). • Description of previous land use and current land use and details of any demolition work (e.g. residential, service station, supermarket etc) at every site where the material is sourced. • Brief Description of proposed works (e.g. excavation of basement car park, footings tunnel etc) which has provided or will provide the material. • Material type and approximate quantity of VENM/ENM. • For VENM, certificate certifying to PLDC that if the material is VENM, it must contain no material that is not VENM including topsoil, building rubble, fill etc. • For ENM, certificate certifying to PLDC that if the material is ENM and meets the requirements of the *Excavated Natural Material Exemption 2012* under Part 6, Clause 51 and 51A of the POEO (Waste) Regulation 2005. • Source of material on the Site and approximate depth(s) (e.g. all material below 300mm depth).	During VENM/ENM Importation

	Environmental Management or Mitigation Measure	Phase
6.4	A statement in the report certifying that material to be received is VENM/ENM must contain certification as to the following: • Laboratory analysis results included for the material to be delivered to the Site (Minimum of 3 samples required for residential sites from which the material is sourced/Minimum of 10 samples required for large sites from which the material is sourced plus duplicates for VENM). • Map of sample locations of the site from which the material is sourced (Field Sketch or Indicated on Engineering Plan). • Full description of material(s) to be delivered – either described in the report of Bore logs attached. • Laboratory Reports and Certificates for the material to be delivered attached and completed as part of the certification report (including Lab Quality Control). • The materials to be supplied are not Potential Acid Sulphate soils	During VENM/ENM Importation
6.5	Field Screening, Sampling and Analysis of materials • Description of any Field Screening undertaken (if any) of the Site from which the material is sourced. • Samples provided of the material to be delivered must be discrete (not composite) by the environmental consultant. • Samples of the material to be delivered must be appropriately preserved and forwarded to a laboratory approved by PLDC.	During VENM/ENM Importation
6.6	The Analysis Undertaken on VENM/ENM to be delivered to the Site must include: • Priority Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc) • Organochlorine Pesticides (OCPs) • Petroleum Hydrocarbons (TPH) • Benzene, Toluene, Ethylbenzene, Xylene (BTEX Compounds) • Polycyclic Aromatic Hydrocarbons (PAHs) • Polychlorinated Biphenyls (PCB's)	During VENM/ENM Importation
6.7	PLDC will undertake: • Material tracking by recording: the source(s) of material generation, including site address(s), the total amount of material generated per site and transport and receipt dockets that ensure total amount of material generated at the source site is consistent with the total amount received at PLDC. • Validation inspections and sampling at the PLDC site to 'check' that imported materials meet either VENM or ENM. The sampling frequency can be flexible given this environmental control is simply a validation process.	During VENM/ENM Importation
6.8	In addition to previous consent conditions, erosion and sediment control including stabilisation measures as described in the industry standard Landcom Manual Managing Urban Stormwater: Soils and Construction (Volume 1 Edition 4) will be implemented.	Pre-VENM/ENM Importation

	Environmental Management or Mitigation Measure	Phase
6.9	PLDC will minimise human and environmental exposure to soil during work in accordance with the PLDC Occupational Health Safety and Environmental Management System.	During VENM/ENM Importation
7	**Flora and Fauna**	
7.1	PLDC will ensure that existing management and rehabilitation measures as per the original development application and consents are implemented, including implementation of the Castlereagh Biodiversity and Natural Heritage Conservation Master Plan, which provides detailed policy and strategic direction to support the sustainability targets for the Scheme.	During VENM/ENM Importation
8	**Indigenous Heritage**	
8.1	PLDC will ensure that if any new or unknown Indigenous sites or relics are uncovered during the proposed Project, work affecting those sites or relics will cease immediately and the material will be assessed by Aboriginal stakeholders and OEH, in accordance with current consent conditions.	During VENM/ENM Importation
9	**Non-Indigenous Heritage**	
9.1	The conservation management plan (CMP) for the Scheme identifies appropriate conservation management measures to ensure that items of historical value are maintained. PLDC will ensure that sufficient buffers are established between any heritage item and the surrounding activities. Management will be undertaken in accordance with the CMP for the Scheme	During VENM/ENM Importation
10	**Landscape and Visual**	
10.1	PLDC will undertake other measures for mitigating visual impacts described in DA2, DA3 and DA4 consents where appropriate.	During VENM/ENM Importation

8 Justification and Conclusion

8.1 Justification of the Proposed Modification

Under SEPP (PLS) 1989, a project must be justified in terms of environmental, site suitability and social considerations. These are discussed below.

8.1.1 Site Suitability

The Penrith Lakes Scheme has been the site of extensive extraction operations since the establishment of Penrith Lakes Development Corporation in 1980. These operations have gradually come to a close and quarrying operations should cease in early-mid 2015. For rehabilitation of the site to occur, fill is required, which cannot be sourced internally, as originally intended. Thus, the issue of site suitability is essentially redundant.

8.1.2 Social Considerations

The proposed modification represents a critical stage in achieving rehabilitation at the Scheme and providing a landform of a standard suitable for parkland or other future development. While the full extent of future development is not yet defined, the proper rehabilitation of the site allows greater flexibility in its future use and ability to deliver social outcomes to the region in terms of both direct employment and community use of the land.

8.1.3 Environmental Considerations

The environmental systems within the vicinity of the site are largely artificial and cannot be described as pristine natural environments. Despite this, PLDC has made a significant investment in the rehabilitation of these areas. The landform creation planned for the site will greatly enhance the value of the site and of surrounding threatened habitat through the planting of local native species, use of stepping stones and establishment of ecological corridors.

The environmental impacts of the proposed modification extends mostly to traffic and noise impacts which will not persist beyond the period of this proposal and are able to be managed to within acceptable limits.

8.2 Conclusion

PLDC propose to import an additional 5 million tonnes of VENM/ENM (up to a ‘worst case’ maximum of 2 million tonnes per year) to provide fill material for the rehabilitation and creation of landform for future parkland areas within the Penrith Lakes Scheme. Availability of VENM/ENM in the Sydney Metropolitan Area would determine the rate of importation (up to a ‘worst case’ maximum of 2 million tonnes per year).

The VENM/ENM will be placed in areas where rehabilitation is currently permitted under three separate development consents DA2, DA3, DA4. The proposal seeks to modify these development consents under Section 75W of the EP&A Act.

This Environmental Assessment has been prepared to meet the requirements of Section 75W and the Director General Requirements in assessing the likely environmental impacts of modifying the previously approved development consent for fill importation. As presented in Table 6, all of the impacts are either low or negligible and relate mostly to increased external traffic movements and associated noise levels on the roads surrounding the Scheme.

Furthermore, the historic truck movements associated with quarrying activities at the Scheme have slowly been reducing over the last few years. The current truck movements therefore do not represent the level of noise and traffic impact that has been experienced by the surrounding community over the duration of quarrying operations.

Notwithstanding, there is a community expectation that external truck movements associated with quarrying activities will be coming to an end as the quarrying at the Scheme nears completion. PLDC therefore have an obligation to the surrounding community to ensure that the impacts of truck movement associated with the importation of VENM/ENM are minimised.

This EA has shown that mitigation measures would be implemented to ensure all impacts are kept within acceptable limits.

9 References

Relevant background information and environmental monitoring data essential to the preparation of this SEE has been identified from information made available by PLDC, are presented in Table 15.

Table 15: Relevant background information documents used in the preparation of this SEE.

Relevant Background Information
Statement of Environmental Effects for VENM Importation (Arup, 2008)
Site Development Plans
DA1 Consent
DA2 Consent and modifications
DA3 Consent and modifications
DA4 Consent and modifications
Rowing Lake DA
Pioneer Plant DA
SEE for Dynamic Compaction (Arup 2006)
PLDC Two Year Reports; 2003 – 2005 and 2005 – 2007
Dust and noise monitoring data
Ongoing consultations with relevant personnel from PLDC and DP&I
Castlereagh Biodiversity and Natural Heritage Conservation Master Plan, Draft Report (Total Catchment Management Services Pty Ltd, 2008)
Penrith Lakes Heritage Strategy (Godden Mackay Logan, 2007)
Relevant Legislation (see Section 2)

Appendix A

Consent Conditions for DA2, DA3 and DA4

Notice of Modification

Section 96(2) of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning, I modify the development consent referred to in Schedule 1, as set out in Schedule 2.

Chris Wilson
Executive Director

Sydney, 4th July 2009

SCHEDULE 1

The development consent (DA 86/2720) granted by the Minister for Planning and Environment on 24 February 1987, for the Penrith Lakes Scheme.

SCHEDULE 2

1. Insert the following after (e) in "APPLICATION":

   (f) Modification Application DA2 MOD 3 and accompanying SEE titled *Penrith Lakes Development Corporation, Importation of VENM* dated 22 December 2008, including the response to submissions dated 12 May 2009.

   Note: All references to VENM is this consent mean Virgin Excavated Natural Material, as defined in the Protection of the Environment Operations Act 1997.

2. Insert the following after condition 36B:

   36BB. The Applicant shall ensure that the development described in DA2 MOD3 complies with the hours of operation set out in Table 2:

Monday to Friday	Saturdays	Sundays and Public Holidays
7.00am to 6.00pm	7.00am to 1.00pm	No work

Table 2 – Hours of Operation

3. Delete the words "in MOD 87-6-2005 and in MOD 123-10-2006" in condition 36D, and replace with "in MOD 87-6-2005, MOD 123-10-2006 and in DA2 MOD3".

4. Insert the following after condition 46:

   46A. All VENM transport to and from the site and the M4 Motorway shall be via the approved route as shown in Figure 1 below and described in the *VENM Importation Statement of Environmental Effects: Response to Submissions*. No trucks shall use Castlereagh Road south of Old Castlereagh Road or Mulgoa Road to access or egress the site.

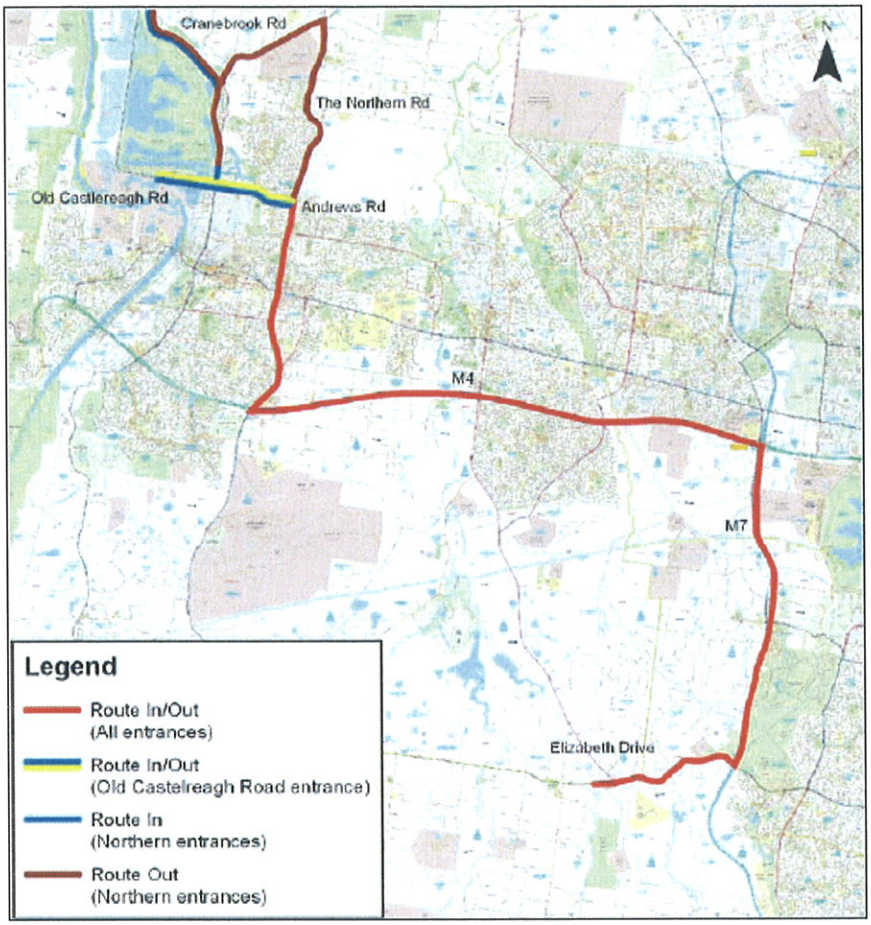

Figure 1 – Approved VENM Transport Route

5. Insert the following after condition 49:

49A. Prior to the commencement of importation of VENM using the northern most and second northern most access point, the Applicant shall upgrade the site entrances on Castlereagh Road to the north of Cranebrook Road to provide:

- AUL (auxiliary lane left turn treatment) for northbound traffic turning left into the site;
- 'no right turn' signage for all southbound vehicles travelling on Castlereagh Road into the second most northern access, and for all southbound non-resident vehicles on Castlereagh Road into the northern most access; and
- advance warning signs,

to the satisfaction of the Roads and Traffic Authority.

<u>Road Haulage</u>

49B. The Applicant shall ensure that:

(a) all loaded vehicles entering or leaving the site are covered; and

(b) all loaded vehicles leaving the site are cleaned of materials that may fall on the road, before they leave the site.

49C. The importation of VENM shall be limited to 3 million tonnes over a 3 year period from the date of approval of the Traffic Noise Management Plan (referred to in Condition 63(d)).

6. Insert the following after condition 63(c):

(d) Prior to the commencement of importation of VENM the Applicant shall submit a Traffic Noise Management Plan prepared in consultation with the Department of Environment and Climate Change, and to the satisfaction of the Director-General of the Department of Planning. The plan must include:

- an investigation and description of all reasonable and feasible measures to reduce traffic noise; and
- a program to monitor traffic noise and respond to complaints.

Notice of Modification

Section 96(2) of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning, I modify the development ~~consent~~ referred to in Schedule 1, as set out in Schedule 2.

Chris Wilson
Executive Director

Sydney, 4th June 2009

SCHEDULE 1

The development consent (DA 3) granted by the Minister for Urban Affairs and Planning in April 1994, for the development of the Penrith Lakes Scheme.

SCHEDULE 2

1. Delete **"Development Application"** and the words immediately thereafter and replace with:

Development Application:	Development for the purposes of implementing the Penrith Lakes Scheme as defined in Schedule 1 of the *Sydney Regional Environmental Plan No. 11 – Penrith Lakes Scheme*, as described in Development Application 3 and the Statement of Environmental Effects (SEE) dated April 1994, and subsequently modified by: • Modification Application and associated documents dated 18 April 1995; and • Modification Application DA 3 MOD 2 and the accompanying SEE titled "*Importation of VENM*" dated December 2008, including the response to submissions dated 12 May 2009.

2. Insert the following after the second bullet points in conditions 30(i) and 31:

*	importation of VENM	-	7.00am to 6.00pm Monday to Friday,
		-	7.00am to 1.00pm Saturday

3. Insert the following at the end of condition 30(i):

Note: All references to VENM is this consent mean Virgin Excavated Natural Material, as defined in the Protection of the Environment Operations Act 1997.

4. Insert the following after condition 40:

40A. All VENM transport to and from the site and the M4 Motorway shall be via the approved route as shown in Figure 1 below and described in the *VENM Importation Statement of Environmental Effects: Response to Submissions*. No trucks shall use Castlereagh Road south of Old Castlereagh Road or Mulgoa Road to access or egress the site.

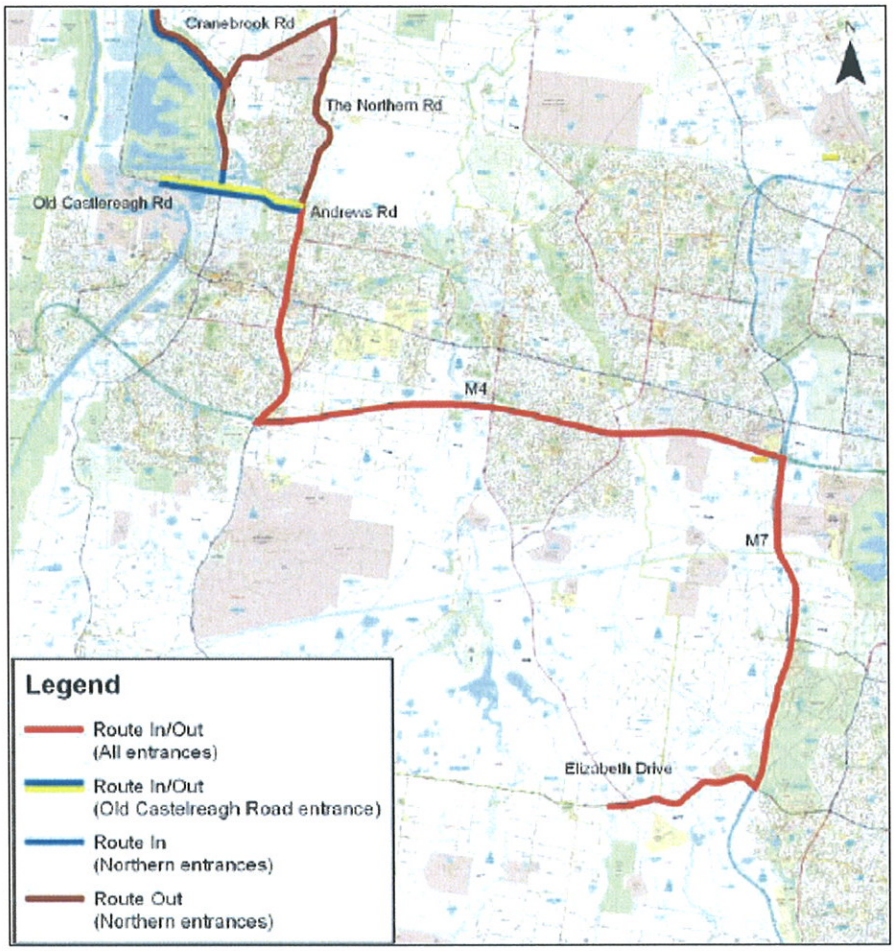

Figure 1 – Approved VENM Transport Route

5. Insert the following after condition 41:

41A. Prior to the commencement of importation of VENM using the northern most and second northern most access point, the Applicant shall upgrade the site entrances on Castlereagh Road to the north of Cranebrook Road to provide:

- AUL (auxiliary lane left turn treatment) for northbound traffic turning left into the site;
- 'no right turn' signage for all southbound vehicles travelling on Castlereagh Road into the second most northern access, and for all southbound non-resident vehicles on Castlereagh Road into the northern most access; and
- advance warning signs,

to the satisfaction of the Roads and Traffic Authority.

<u>Road Haulage</u>

41B. The Applicant shall ensure that:

(a) all loaded vehicles entering or leaving the site are covered; and

(b) all loaded vehicles leaving the site are cleaned of materials that may fall on the road, before they leave the site.

41C. The importation of VENM shall be limited to 3 million tonnes over a 3 year period from the date of approval of the Traffic Noise Management Plan (referred to in Condition 57(d)).

6. Insert the following after condition 57(c):

(d) Prior to the commencement of importation of VENM the Applicant shall submit a Traffic Noise Management Plan prepared in consultation with the Department of Environment and Climate Change, and to the satisfaction of the Director-General of the Department of Planning. The plan must include:

- an investigation and description of all reasonable and feasible measures to reduce traffic noise; and
- a program to monitor traffic noise and respond to complaints.

Notice of Modification

Section 96(2) of the *Environmental Planning & Assessment Act 1979*

As delegate for the Minister of Planning, I modify the development consent referred to in Schedule 1 as set out in Schedule 2.

Chris Wilson
Executive Director

Sydney, 4th July 2009

SCHEDULE 1

The development consent (DA 4) granted by the Minister for Urban Affairs and Planning on 9 September 1998, for the Penrith Lakes Scheme.

SCHEDULE 2

1. Delete ***"proposed development"*** and replace with:

   proposed development: Development as described in the development application identified as DA 4 and its supporting papers for the purposes if implementing the Penrith Lakes Scheme as defined in Schedule 1 of *Sydney Regional Environmental Plan No. 11 – Penrith Lakes Scheme* on land described in, and identified on the plan, attached at Schedule B, and subsequently modified by:
   - Modification Application and accompanying noise assessment dated June 2004, and prepared by Wilkinson Murray Pty Ltd;
   - Modification Application and accompanying SEE dated March 2005, and prepared by Arup Pty Ltd (which was subsequently modified by the supplementary noise information prepared by Arup Pty Ltd, and dated 22 August 2005); and
   - Modification Application DA4 MOD 3 and accompanying SEE titled *Penrith Lakes Development Corporation, Importation of VENM* dated 22 December 2008, including the response to submissions dated 12 May 2009.

2. Delete the definitions for "the consent authority", "the Director General", "EPA", "the Minister", "NPWS" and "DEC" in the Definitions section and replace with:

   a) the consent authority means the Minister for Planning
   c) the DECC means the Department of Environment and Climate Change
   d) the Director-General means the Director-General of the Department of Planning, or delegate
   e) the Minister means the Minister for Planning
   k) the RTA means the Roads and Traffic Authority
   l) VENM means Virgin Excavated Natural Material, as defined in the *Protection of the Environment Operations Act 1997*

3. Delete all references to "DEC", "EPA" and "NPWS" and replace with "DECC".

4. Delete all references to "Department of Urban Affairs and Planning" and replace with "Department of Planning".

5. Delete the table in condition 30 of schedule A, and replace with:

Sand and gravel extraction, including haulage to processing plants	5.00am to 9.00pm, Monday to Friday; 5.00am to 7.00pm, Saturday.
Overburden stripping and rehabilitation	7.00am to 7.00pm, Monday to Saturday;
Importation of VENM	7.00am to 6.00pm, Monday to Friday; 7.00am to 1.00pm, Saturday

6. Delete the table in condition 31 of Schedule A, and replace with:

Sand and gravel extraction, including haulage to processing plants	7.00am to 6.00pm, Monday to Friday; 7.00am to 1.00pm, Saturday.
Overburden stripping and rehabilitation	7.00am to 5.00pm, Monday to Friday; 7.00am to 1.00pm, Saturday.
Importation of VENM	7.00am to 6.00pm, Monday to Friday; 7.00am to 1.00pm, Saturday

7. Insert the following after condition 42 of schedule A:

42A. All VENM transport to and from the site and the M4 Motorway shall be via the approved route as shown in Figure 2 below and described in the *VENM Importation Statement of Environmental Effects: Response to Submissions*. No trucks shall use Castlereagh Road south of Old Castlereagh Road or Mulgoa Road to access or egress the site.

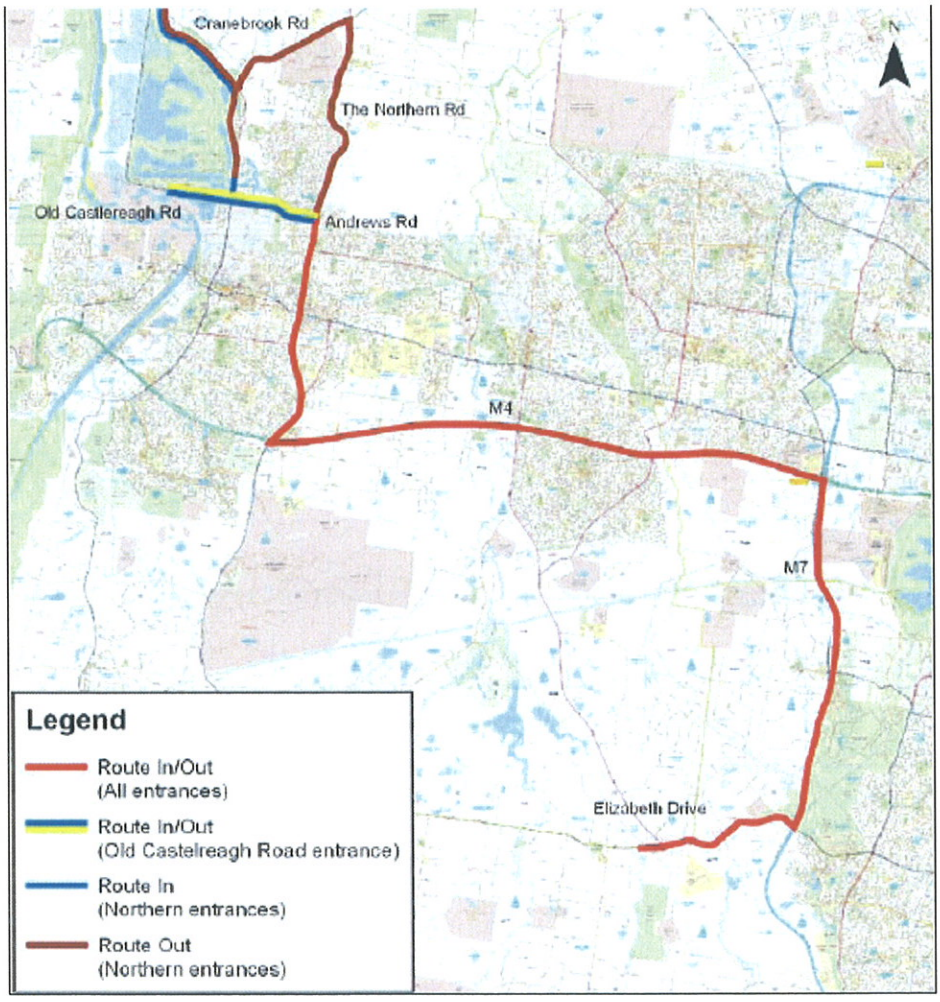

Figure 2 – Approved VENM Transport Route

8. Insert the following after condition 48 of schedule A:

48A. Prior to the commencement of importation of VENM using the northern most and second northern most access point, the Applicant shall upgrade the site entrances on Castlereagh Road to the north of Cranebrook Road to provide:

- AUL (auxiliary lane left turn treatment) for northbound traffic turning left into the site;
- 'no right turn' signage for all southbound vehicles travelling on Castlereagh Road into the second most northern access, and for all southbound non-resident vehicles travelling on Castlereagh Road into the northern most access; and
- advance warning signs,

to the satisfaction of the RTA.

Road Haulage

48B. The Applicant shall ensure that:

(a) all loaded vehicles entering or leaving the site are covered; and

(b) all loaded vehicles leaving the site are cleaned of materials that may fall on the road, before they leave the site.

48C. The importation of VENM shall be limited to 3 million tonnes over a 3 year period from the date of approval of the Traffic Noise Management Plan (referred to in Condition 65(d) of schedule A).

9. Insert the following after condition 65(c) of schedule A:

(d) Prior to the commencement of importation of VENM the Applicant shall submit a Traffic Noise Management Plan prepared in consultation with DECC, and to the satisfaction of the Director-General. The plan must include:

- an investigation and description of all reasonable and feasible measures to reduce traffic noise; and
- a program to monitor traffic noise and respond to complaints.

Appendix B

Assessment of Noise and Vibration Impacts

Penrith Lakes Development Corporation

Importation of VENM and ENM

Section 75W Application: Assessment of Noise and Vibration Impacts

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1 Introduction

Penrith Lakes Development Corporation (PLDC) currently has approval via modification of approvals DA2, DA3 and DA 4 for the site to import up to 3 million tonnes of Virgin Excavated Natural Material (VENM) via road haulage.

PLDC propose to further modify DA2, DA3 and DA4 for the importation of an additional 5 million tonnes of VENM and Excavated Natural Material (ENM) in early–mid 2015 to fulfil the landform requirements as set out in the 2 year plans for the Scheme, previously approved by the Department of Planning & Infrastructure in 1990, 2000, 2001 and 2013.

As such, PLDC propose to modify DA2, DA3 and DA4 as follows:

- Importation of ENM as well as VENM: the ENM would be subject to the strict import protocols including geotechnical and environmental sampling, testing and certification
- Increase the volume of the material to be imported to include an additional 5 million tonnes for a total of 8 million tonnes (3 tonnes previously approved for importation).
- Allow VENM and ENM to be sourced from excavation sites anywhere in the Sydney Metropolitan Area and surrounding areas using the public road network and legal road trucks for haulage to Penrith.
- Commence the importation of the additional 5 million tonnes of VENM and ENM in early –mid 2015 when current quarry operations cease.

PLDC intend to cease quarry operations on the site in early –mid 2015 and would commence the additional importation / haulage on the surrounding road network at Penrith when the current quarry operations wind down.

It should be noted that the anticipated truck movements from the additional importation of VENM and ENM will be less than the current annual truck movements from the sand and gravel operations at the Scheme.

Arup has been commissioned by Penrith Lakes Development Corporation (PLDC) to prepare an Environmental Assessment (EA) in order to assess the potential environmental effects associated with the updated timeframe of the previous consent granted for the importation of VENM to the Penrith Lakes Scheme.

This EA is to accompany an application to modify the existing consents to Development Application 2 (DA2), Development Application 3 (DA3), and Development Application 4 (DA4). The EA and modified Development Applications are to be lodged by PLDC to the Minister for determination under Section 75W of the *Environmental Planning and Assessment Act* 1979.

This report contains an assessment of the noise and vibration impacts resulting from the proposed modification of importation of VENM, in accordance with appropriate assessment criteria set by the NSW Office of Environment and Heritage (OEH). This assessment is subsequent to an original Statement of Environmental Effects for the project undertaken in 2008 for the original modification that was approved in 2009, and a revised EA for haulage of VENM undertaken in 2012 and has been amended based on updated traffic data.

Given the relatively short timeframe between the previous assessment and this current assessment, no additional noise measurements have been conducted as the previous 2012 noise survey and subsequent noise monitoring following the commencement of VENM haulage is considered to adequately capture the existing road traffic noise environment on the road network adjacent to the Penrith Lakes scheme.

1 Criteria

1.1 Operational Noise Criteria

There are two sets of conditions in respect of noise emitted from within the PLDC site:

- one from the EPL issued by the Department of Environment and Conservation (DEC), now Office of Environment and Heritage (OEH), and
- from the Minister for Planning for the DA2, DA3 and DA4 Consents.

Numerically, these consent conditions impose the same noise criteria for noise from internal movements within the PLDC site. Details of the consent conditions are given below. Acoustic terminology is presented in Appendix D.

1.1.1 DEC Conditions

The DEC, in issuing Licence No. 002956, set the following conditions in respect of noise emitted from the development:

L6.1 Noise from the premises must not exceed the following noise emission criterion for the duration specified:

a) L_{AMAX} – 70 dB(A) at any time;

b) $L_{A10,\ 15minutes}$ – 65 dB(A) for any continuous 4 weeks at any residential premises specified in L6.2;

c) $L_{A10,\ 15\ minutes}$ – 60 dB(A) for any continuous 3 months at any residential premises specified in L6.2;

d) $L_{A10,\ 15\ minutes}$ – 55 dB(A) for any continuous 2 years at any residential premises specified in L6.2; and

e) Less than 55 dB(A) for the remainder of the time.

L6.2 Noise from the premises is to be measured at any point within one metre of the boundary of any residential premises, excluding residential premises on Castlereagh Escarpment, to determine compliance with condition L6.1.

1.1.2 Minister for Planning and Environment Conditions – DA2, DA3 and DA4 consent

The Minister for Planning and Environment, as the consent authority, set the following conditions in the consent to DA2, DA3 and DA4, in respect of noise

emitted from the development. Extra conditions within the DA2 consent are denoted by italics.

32) The Applicant shall not exceed the following maximum noise levels in those areas designated.

a) Cranebrook Village and Other Dwellings outside the Scheme area (but not on the Escarpment)

(i) **Maximum Noise Levels**

These criteria are the same as those given in L6.1 of the DEC conditions above.

(ii) The above absolute maximum may be exceeded as a result of construction of the noise control works, e.g. noise bunds.

(iii) In the area south of Cranebrook village all rehabilitation works shall be setback 20 metres from the residential area.

(iv) In the area north of Cranebrook village all rehabilitation works shall be setback 50 metres from residential areas.

b) Dwellings on the Castlereagh Escarpment

(i) Maximum Noise Levels

Noise levels as measured at any one dwelling on the Escarpment are not to exceed the following criteria.

Maximum Noise Limits (L_{A10})

Absolute maximum – 70 dB(A)

Greater than – 65 dB(A) for 3 months

Greater than – 55 dB(A) for 30 months

Less than – 55 dB(A) for remainder of time

(ii) All extraction and rehabilitation to take place a minimum of 200m from dwellings on the escarpment.

1.2 Internal Traffic Noise

Truck movements on internal haul roads within the PLDC scheme are covered by the existing DEC and DA2/DA3/DA4 consents criteria, including transportation of fill within the site. Under the proposed modification to these consents, these internal traffic movements are expected to continue in order to transport the VENM around the PLDC site, and therefore the overall number of internal truck movements is expected to be similar after VENM haulage commences.

Therefore, the additional noise and vibration impacts from internal traffic sources resulting from the importation of VENM are considered to be negligible, and only impacts from external traffic sources will be considered as part of this assessment.

1.3 External Traffic Noise

1.3.1 Road Noise Policy

Traffic noise impacts from public roads in NSW are assessed against the OEH's *Road Noise Policy* (RNP[1]), which provides guidelines for acceptable noise levels from new and existing roadways, and from developments which have the potential to create additional traffic on existing roadways.

The RNP criteria follow a 'non-mandatory performance-based approach', in that the criteria are given as targets for traffic noise from developments, while recognising that in some cases it may not be feasible to comply with the targets and a long-term noise mitigation strategy is more suitable.

The importation of VENM and ENM has been treated as a "land use with the potential to create additional traffic" for the purposes of setting noise criteria. The RNP criteria are given for two time periods – day (0700-2200) and night (2200-0700). All of the VENM and ENM haul traffic movements will occur during the day time period, and therefore discussion of noise criteria will be restricted to daytime noise levels only.

The appropriate noise criteria from the RNP for traffic noise from the importation of VENM are given below in Table 1.

Road	RNP Category	Time Period	Daytime Criterion
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	15-hour	60 dB $L_{Aeq,15hr}$

Table 1 NSW Road Noise Policy

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

See Appendix D for a glossary of relevant acoustic terminology.

1.4 Vibration

Criteria for vibration are given by the DECC "Assessing Vibration" guideline[2] . As with the RNP, these criteria are non-mandatory goals for new developments. Vibration criteria are based on two components:

1 NSW Office of Environment and Heritage *Road Noise Policy (July, 2011)*

2 NSW Department of Environment and Conservation (2006) – *Assessing Vibration: a technical guideline*

- Maintaining human comfort of building occupants
- Preventing damage to a building and its contents

The human comfort vibration criterion is significantly below the building damage vibration criterion, and therefore achieving the human comfort condition generally results in the building damage condition being met.

For intermittent vibration sources, such as road and rail traffic, the concept of a 'vibration dose value' (VDV) has been adopted. For residences, the acceptable VDV range is as follows:

- Preferred value: 0.2 $m/s^{1.75}$
- Maximum value: 0.4 $m/s^{1.75}$

The DECC's vibration guidance is generally based on British Standard BS6472[3]. BS6472 and its Australian equivalent, Australian Standard AS2670.2[4], give a series of rating curves to assess human exposure to vibration levels, and provide further guidance on acceptable vibration levels. Table 2 of AS2670.2 recommends that daytime continuous or intermittent vibration levels in residential receivers should not exceed Curve 4 of AS2670.2.

[3] British Standard BS6472.2 (1992) *Guide to evaluation of human exposure to vibration in buildings (1 to 80 Hz)*

[4] Australian Standard AS2670.2 (1990) – *Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz)*

2 Noise-Sensitive Receivers

A site survey was conducted as part of the previous VENM haulage assessment between the 9th and 17th May 2012 to identify representative noise-sensitive receivers on the most-affected roadways around the PLDC site. Receiver locations were identified as being representative of the residences along a section of road, and were selected to be on a section of road where VENM haulage trucks are proposed to be used.

The project noise-sensitive receivers (NSRs) are:

- **Receiver 1:** 1999 Old Castlereagh Road – Old Castlereagh Road, west of Castlereagh Road roundabout
- **Receiver 2:** 538 Cranebrook Road and The Lakes Church, 540 Cranebrook Road (Receiver 2A) – on Castlereagh Road, north of Andrews Road roundabout.
- **Receiver 3:** Lot 5, Cranebrook Village– Castlereagh Road, north of Cranebrook Road; and Cranebrook Road.
- **Receiver 4:** 74 Church Lane (faces Castlereagh Road)
- **Receiver 5:** receivers on The Northern Road (typically ~50 m from the road edge)
- **Receiver 6:** receivers on Andrews Road (typically ~ 30 m from the road edge and protected by a noise bund)

The locations of these receivers are shown in Figure 1 below:

Figure 1 Overview of Receiver Locations

Receiver 1 is located on Old Castlereagh Road, and is set back approximately 30 m from the edge of the carriageway, and is considered to be characteristic of the residential properties located on the northern side of Old Castlereagh Road, and will be exposed to traffic noise from any VENM haul trucks using the former Cemex/Fine Sand Plant access point.

Receivers 2 and 2A are located adjacent to the new alignment of Castlereagh Road, adjacent to the intersection with Nepean Street. It is unclear whether these receivers are now considered to be on the new Castlereagh Road alignment, as historically they were located on Cranebrook Road prior to the realignment.

These receivers are located approximately at the point where the posted speed limit on Castlereagh Road changes from 60 km/h to 80 km/h, and are located north of one of the proposed access point for VENM haul trucks, the former Pioneer Plant access. These receivers therefore will not be exposed to noise from any VENM haul trucks using this access point. However, the traffic flow at these receivers is considered to be representative for Castlereagh Road north of Andrews Road.

In future there are likely to be additional noise-sensitive receivers on Castlereagh Road north of Andrews Road. These receivers are located south of the Pioneer Plant access site and will be exposed to any noise from trucks using this access site. To account for these future receivers, noise levels at Receivers 2/2A have been predicted, including traffic movements to the Pioneer Plant access site, in order to model the noise exposure for all receivers along this road segment.

Receiver 3 is located on Cranebrook Road, near the intersection of Castlereagh Road and Cranebrook Road, and is set back approximately 20 m from Cranebrook Road. Noise levels at this receiver are dominated by traffic flows along Cranebrook Road. This location is therefore considered representative of other receiver locations aligning Cranebrook Road.

An additional receiver (Receiver 4, 74 Church Lane Castlereagh), which is set-back approximately 80 m from Castlereagh Road, has been introduced to assess noise from Castlereagh Road north of Cranebrook Road alone. This receiver is considered to be characteristic of the receivers along this road segment.

Additional receivers (Receiver 5 and Receiver 6) have been used to assess noise impacts from VENM/ENM movements on The Northern Road and Andrews Road, respectively; however due to the greater traffic volumes on these road segments the relative impact of PLDC traffic movements is expected to be reduced compared to the other receivers.

2.1 Truck Routes

Additional VENM and ENM traffic is likely to have the greatest acoustic impact on the roads immediately adjacent to the Penrith Lakes Scheme. At locations further from the PLDC site, the presence of traffic from other sources means that the additional traffic noise impact from the VENM/ENM haul trucks is likely to be negligible.

Figure 2 and Figure 3 present an overview of the proposed VENM/ENM haul truck movements on the road segments surrounding the PLDC site for Trucks approaching from both the north and south respectively.

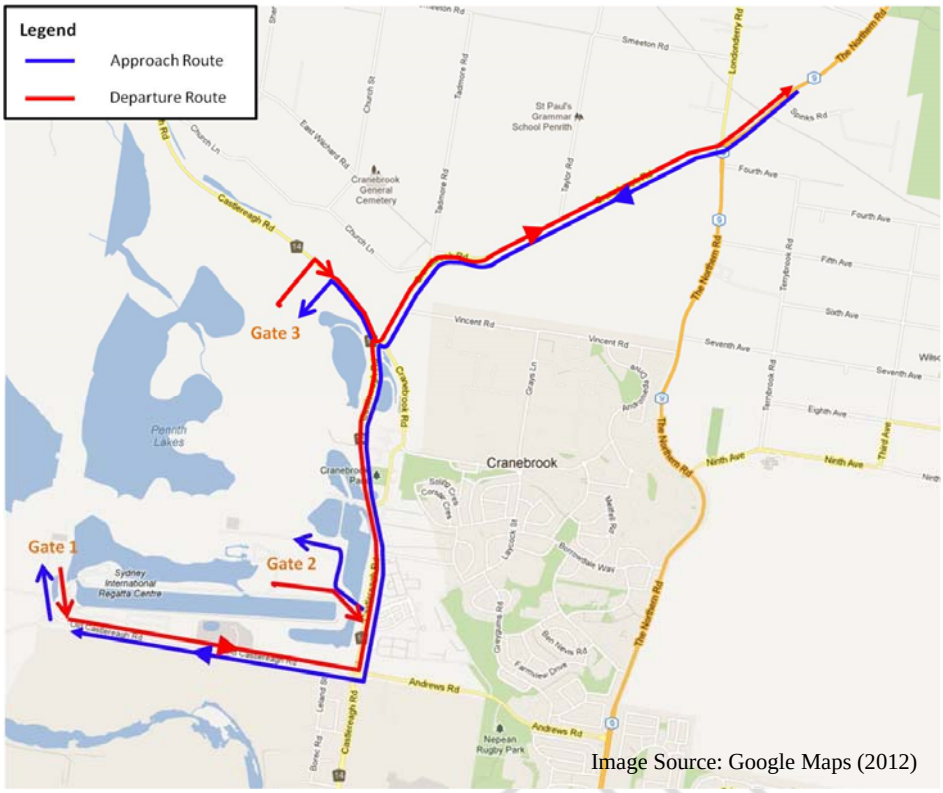


Figure 2 Vehicle Access Routes for Trucks Approaching from the North

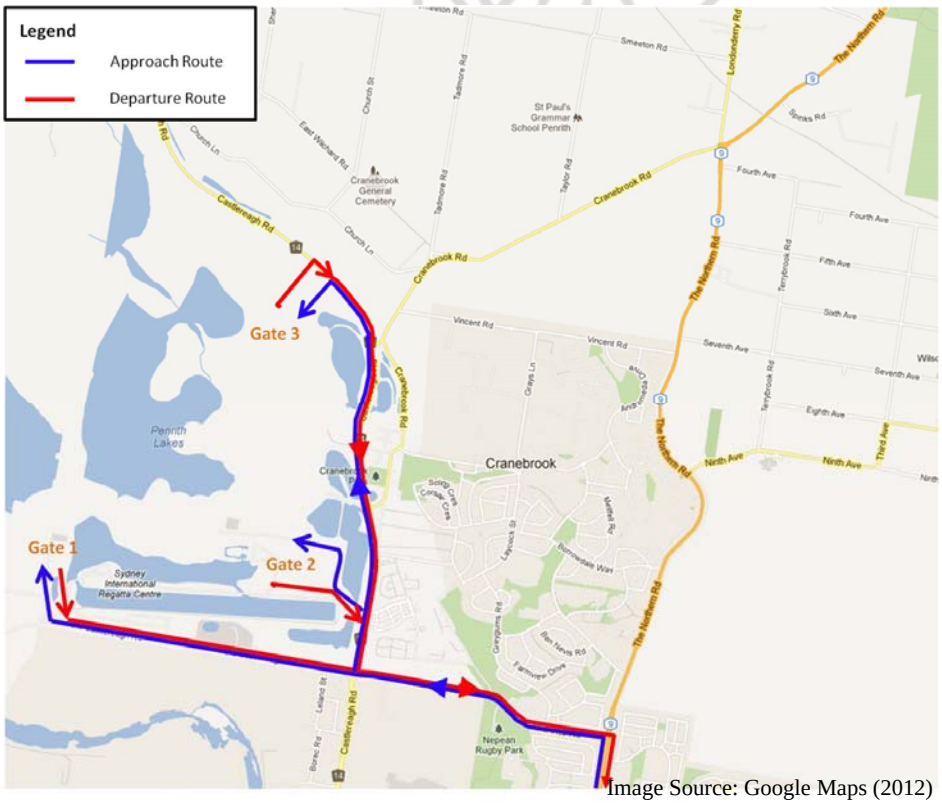


Figure 3 Vehicle Access Routes for Trucks Approaching from the South

The most affected roads are likely to be Old Castlereagh Road and Castlereagh Road, both of which form part of the PLDC site boundaries, and Cranebrook Road.

Old Castlereagh Road forms the access route for heavy vehicle traffic to and from the former Cemex plant and the Fine Sand plant, while Castlereagh Road and Cranebrook Road carry through traffic between Penrith and Windsor.

3 Traffic Noise Survey

3.1 Survey Methodology

A traffic noise survey was conducted between the 9th and 17th May 2012 at three measurement locations, corresponding closely to Receivers 1, 2 and 3. Unattended noise loggers were used to conduct statistical noise measurements over the course of the survey, measuring the L_1, L_{10}, L_{eq}, and L_{90} parameters over 15-minute time periods.

The unattended noise measurements were supplemented by attended noise measurements of the traffic noise levels at the measurement locations. Roadside measurements were also conducted to measure source noise levels from the existing haul trucks using Old Castlereagh Road, with several truck pass-bys being recorded and the single-event noise exposure level (SEL) for a haul truck being measured for use in noise predictions.

The noise loggers were located in the vicinity of each noise-sensitive receiver, with the location selected to minimise the influence of other non-traffic noise sources at the receiver.

Logger and receiver locations are shown in the figures below.

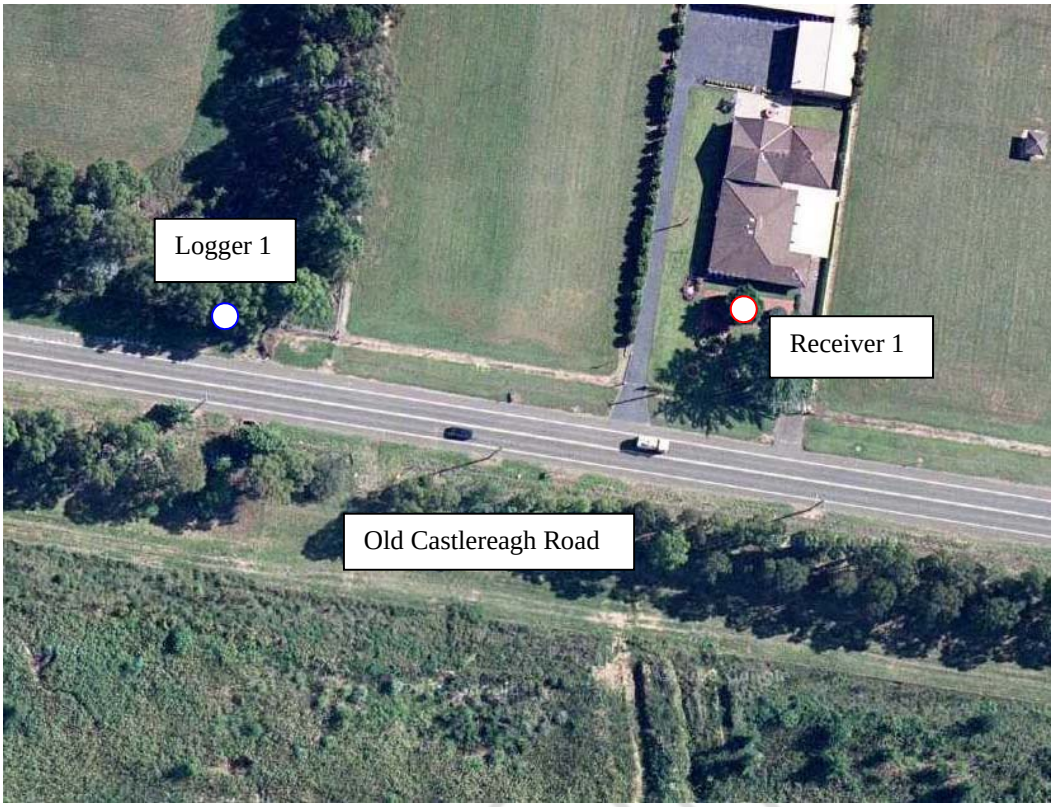


Figure 4 2012 Survey: Receiver 1 and Logger 1 Location Plan (Old Castlereagh Road)

Figure 5 2012 Survey: Receivers 2/2A and Logger 2 Location Plan (Castlereagh Road)

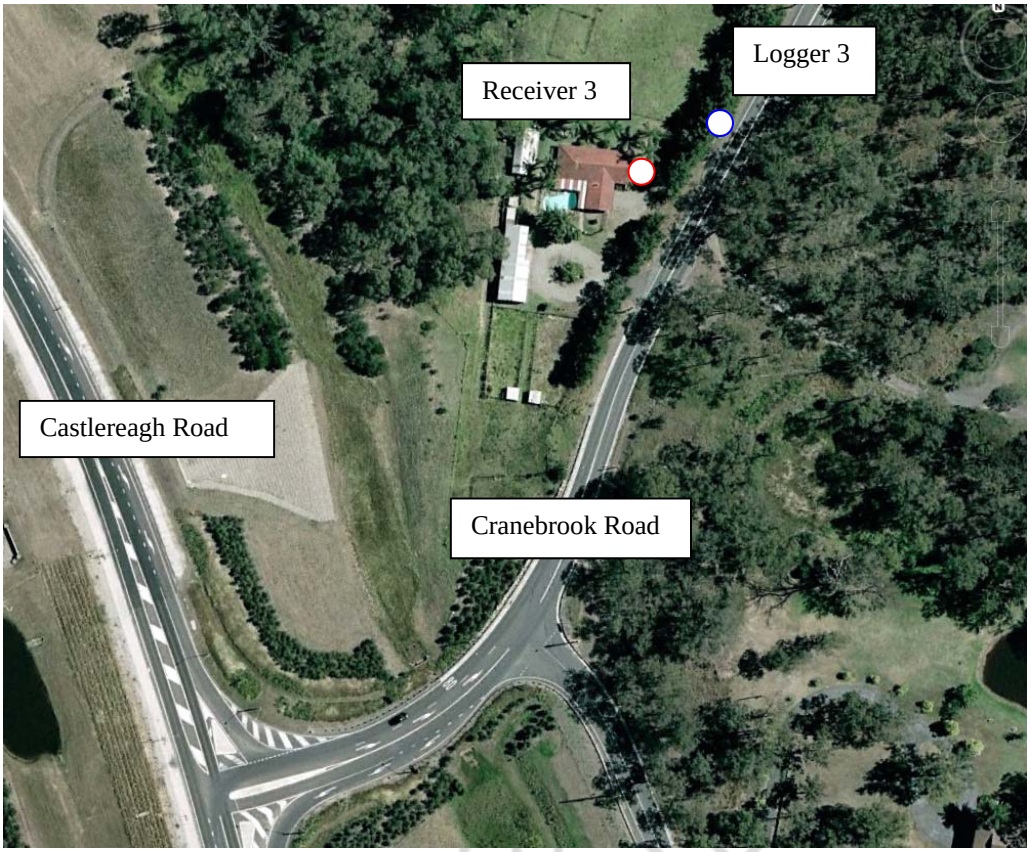


Figure 6 2012 Survey: Receiver 3 and Logger 3 Location Plan (Cranebrook Road)

Figure 7 2012 Survey: Receiver 4 Location Plan, 74 Church Lane (closer to Castlereagh Road)

3.2 Measured Data

Average weekday noise measurements for each logger location are presented in the figures below. Daily noise data is available on request.

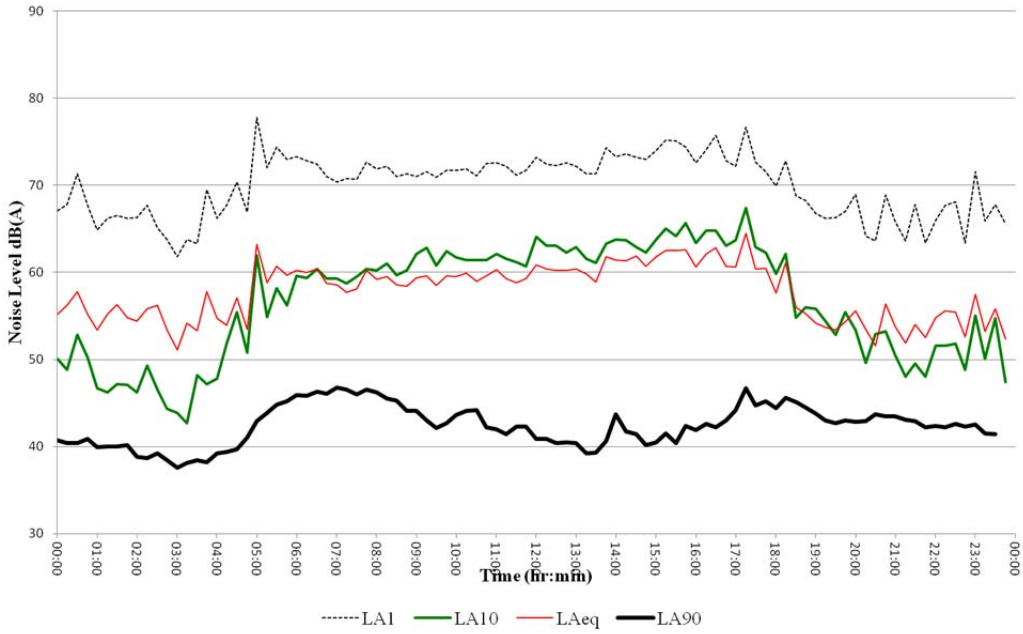


Figure 8 Average Weekday Noise Measurements, Logger 1 (Old Castlereagh Road),9 May 2012 - 17 May 2012.

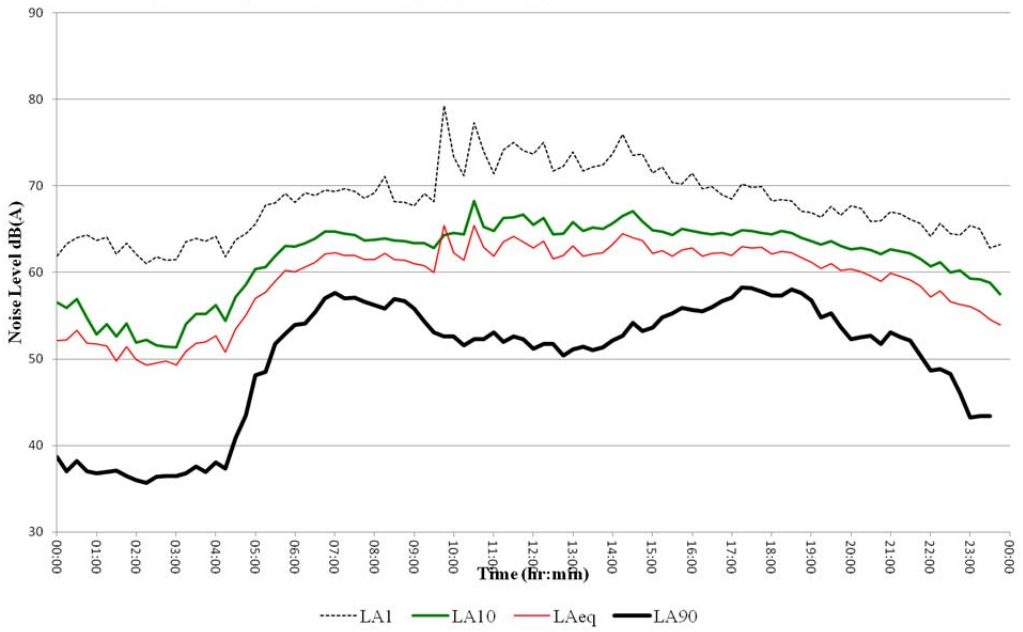


Figure 9 Average Weekday Noise Measurements, Logger 2 (Castlereagh Road), 9 May 2012 - 17 May 2012.

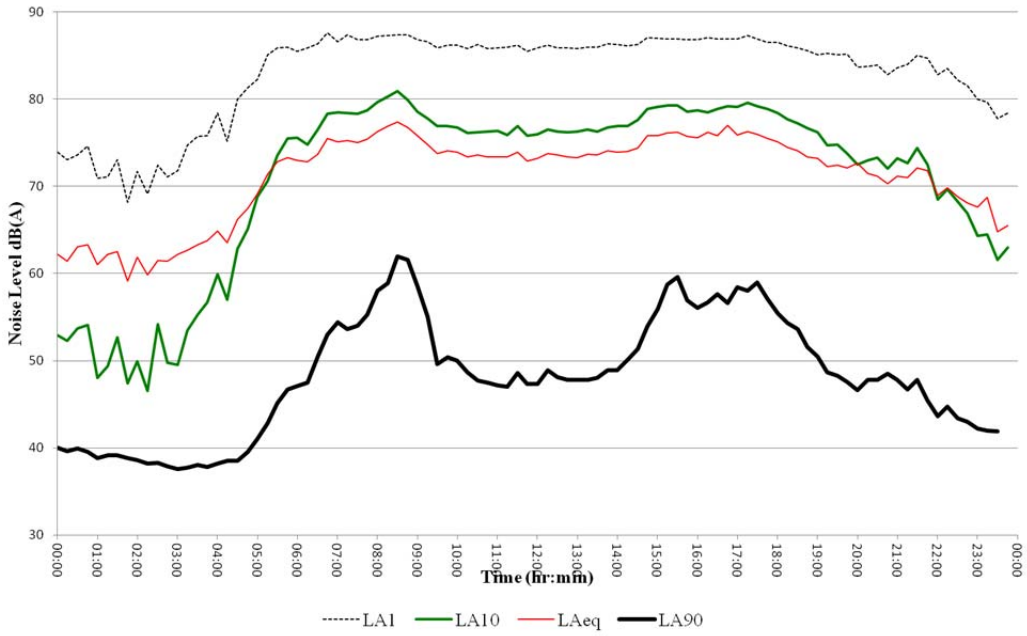


Figure 10 Average Weekday Noise Measurements, Logger 3 (Cranebrook Road), 9 May 2012 - 17 May 2012.

The logger locations were typically at a different distance from the carriageway than the nearest noise-sensitive receiver, and therefore the measured traffic noise levels was corrected to the distance from the road to the receiver. Additionally, a 2.5 dB(A) façade correction must be applied when assessing noise levels at a residence.

An overview of measured traffic noise levels is given below in Table 2. Noise levels at the noise sensitive receivers have been calculated, and are given in Table 3:

Table 2 Traffic Noise Survey Measurements, dB re 20 µPa

Logger Location	**Parameter**	**Approximate Distance from Carriageway Edge**	**Measured Average Weekday Noise Level**
1	$L_{Aeq,15hr}$	9 m	62 dB
2	$L_{Aeq,15hr}$	22 m	60 dB
3	$L_{Aeq,15hr}$	1.5 m	75 dB

Table 3 Measured and Predicted Existing Traffic Noise Survey Measurements at Noise Sensitive Receivers, dB re 20 µPa

Receiver	Parameter	Approximate Distance from Carriageway Edge	Façade-Corrected Average Weekday Noise Level	Criterion	Existing Levels Meet Criterion?
1	$L_{Aeq,15hr}$	31 m	58 dB	60 dB	Yes
2	$L_{Aeq,15hr}$	25 m	64 dB	60 dB	No
2A	$L_{Aeq,15hr}$	16 m	66 dB	60 dB	No
3	$L_{Aeq,15hr}$	19 m	71 dB	60 dB	No
4	$L_{Aeq,15hr}$	80 m	57 dB	60 dB	Yes
5	$L_{Aeq,15hr}$	50 m	59 dB	60 dB	Yes*
6	$L_{Aeq,15hr}$	30 m	59 dB	60 dB	Yes*

* Just under criterion; treated as being exceeding the criterion as discussed below

Measured and predicted levels show that measured existing road traffic noise levels currently exceed noise criteria at all receivers except for those on Old Castlereagh Road (Receiver 1) and Castlereagh Road north of Cranebrook Road (Receiver 4). Receivers 5 and 6 (The Northern Road and Andrews Road) are just under the noise criteria. In this circumstance, the RNP and its predecessor the ECRTN allows for a 2 dB(A) 'relative increase' criterion to be applied since existing noise levels are almost at the absolute 60 dB(A) criterion.

As such, the applicable criteria from the RNP are generally that noise from the VENM/ENM operations should not increase the existing noise levels by more than 2 dB(A).

With respect to Old Castlereagh Road and Castlereagh Road north of Cranebrook Road, VENM/ENM truck movements should not give rise to an exceedance of the 60 dB(A) criterion.

3.3 Haul Truck Pass-By Measurements

Several measurements of haul truck pass-bys were made by the edge of the carriageway of Old Castlereagh Road during the site visit on 20 February 2008. These measurements are still considered relevant to this updated assessment since the truck types used for haulage to/from PLDC are unlikely to change significantly. They were made at a distance of approximately 2.5 m from the carriageway edge, from trucks travelling on both sides of the carriageway.

Table 4 Haul Truck Pass-By Noise Survey Measurements, dB re 20 µPa

Carriageway Side	Number of Trucks	SEL	L_{max}
Near	5	88-93 dB	87-93 dB
Far	5	87-91 dB	86-90 dB
Average of both sides	10	92 dB	90 dB

3.4 Additional Pre-VENM Logging

A follow-up noise survey was undertaken in August 2013 in order to check baseline traffic noise levels on the PLDC road network immediately prior to the commencement of VENM haulage. This data can be used to check the calibration of the traffic noise models.

Four consecutive weeks of background monitoring with no VENM importation were measured from 9 August 2013 to 6 September 2013. The logging locations were generally similar to the logger locations from the previous 2008 and 2012 traffic noise surveys, with some changes:

- Logger 2 was located further to the north along Castlereagh Road to minimise the potential impact of pedestrian traffic on measured noise levels
- Logger 3 was located so as to measure noise from Castlereagh Road north of Cranebrook Road. In 2012 this logger was set up in a position where noise on Cranebrook Road was dominant.

Figure 11 – 2013 Survey: Receiver 1 and Logger 1 Location Plan (Old Castlereagh Road)

Figure 12 – 2013 Survey: Receivers 2/2A and Logger 2 Location Plan (Castlereagh Road)

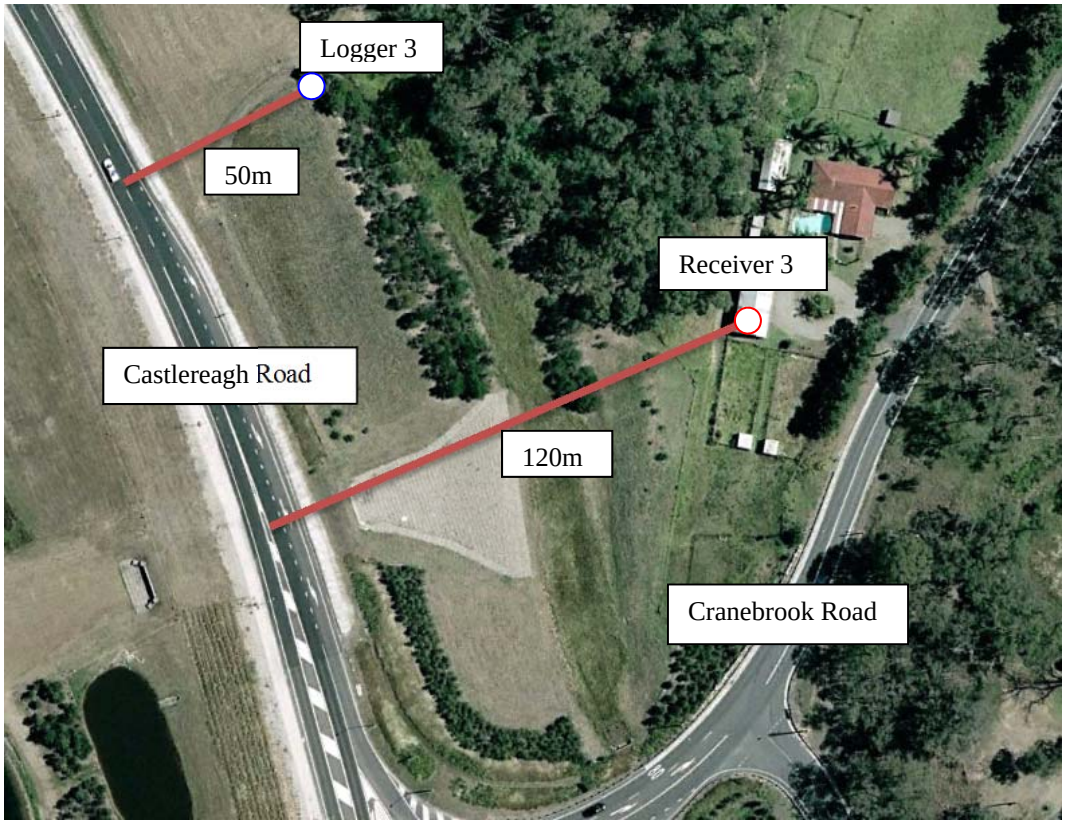


Figure 13 – 2013 Survey: Receiver 3 and Logger 3 Location Plan (Cranebrook and Castlereagh Roads)

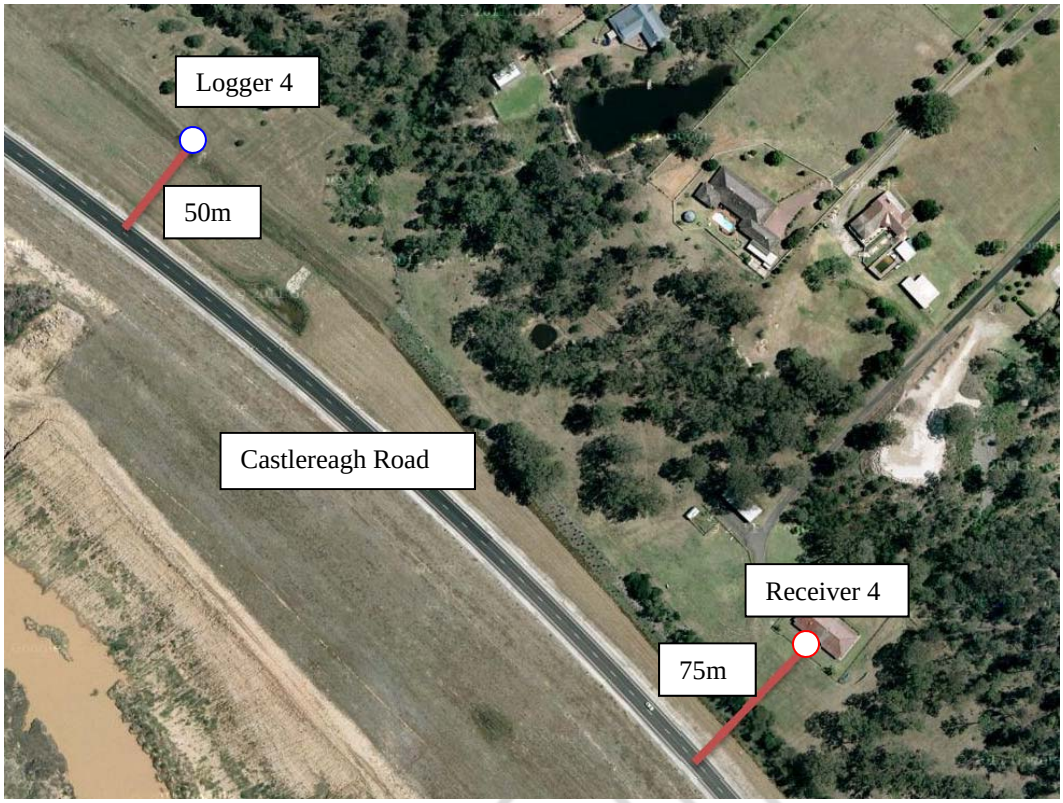


Figure 14 – 2013 Survey: Receiver 4 and Logger 4 Location Plan (Castlereagh Road)

4 Noise Predictions

This assessment is subsequent to an original Statement of Environmental Effects for the project undertaken in 2008 and the revised Environmental Assessment conducted in 2012 and has been amended based on updated noise and traffic monitoring data.

4.1 Methodology

Noise levels were predicted for traffic on across the proposed years of operation (2014-2018) for the scenario with and without the additional VENM/ENM haulage trucks.

Traffic noise levels were predicted using a combination of the CoRTN[5] traffic noise model, and the measured truck pass-by SEL levels (see Section 3.3). CoRTN is a widely-used prediction method for traffic noise from light vehicles, and is based on measured traffic noise levels in the UK. CoRTN has also been validated for Australian conditions, with studies showing that a correction factor of -1.7 dB(A) should be applied to the predicted CoRTN noise level for Australian road conditions[6].

A calibration study was conducted, comparing the predicted noise levels from CoRTN to the measured traffic noise levels from the logger survey.

Predicted CoRTN noise levels for Castlereagh Road were found to generally correlate well with the measured noise levels, although the difference between measured and CoRTN-predicted noise levels was greater for Cranebrook Road and Old Castlereagh Road (Receiver 3).

This is believed to be due to the greater proportion of heavy vehicles on Old Castlereagh Road and Cranebrook Road. CoRTN is based on measurements of traffic noise in the UK, with small “lorry”-type trucks, and is therefore likely to under-predict noise levels from the articulated semi-trailer heavy vehicles used for existing and future truck movements from the PLDC site.

For Old Castlereagh Road and Cranebrook Road only, CoRTN was used to predict traffic noise levels from light vehicles, with heavy vehicle noise levels being predicted using the measured truck pass-by SEL noise levels. This approach was found to correlate well with the measured noise levels from the unattended noise survey.

Because the 2012 and 2013 surveys use slightly-different logger locations, noise levels have been distance-corrected to receiver locations in order to demonstrate the calibration of the model.

5 United Kingdom Department of Transport (1988) – *Calculation of Road Traffic Noise*, Her Majesty’s Stationery Office

6 NSW Roads and Traffic Authority (1992) – *RTA Environment Manual, Volume 2*

Receiver	Parameter	2012 (Measured)	2012 (Predicted)	2013 (Measured)	2013 (Predicted)
1	$L_{Aeq,15hr}$	58 dB	59 dB	59 dB	59 dB
2	$L_{Aeq,15hr}$	64 dB	63 dB	64 dB	63 dB
2A	$L_{Aeq,15hr}$	66 dB	64 dB	65 dB	65 dB
3	$L_{Aeq,15hr}$	71 dB	71 dB	56 dB*	71 dB
4	$L_{Aeq,15hr}$	-	57 dB	57 dB	57 dB

Table 5 Acoustic CoRTN model calibration (free-field levels at logger)

*Note measured level is due to Castlereagh Road alone. Cranebrook Road is the dominant noise source at this receiver.

Predicted noise levels for the 2012 and 2013 Scenarios can be seen to be within 2 dB of measured levels. This validates the selection of the CoRTN model and the modelling methodology.

For Receiver 4 (74 Church Lane) and Receiver 6 (Andrews Road residential receivers), there is a significant height difference between the road segment and the receiver, and therefore where there is the potential for screening of the noise source. For this receiver, noise levels from the road segment were modelled using a “split-height” approach, accounting for the different source height of heavy vehicles compared to cars, and therefore resulting in different screening and ground effect values for each noise source.

Source heights of 1.5 m above the road surface for engine noise and 3.6 m above the road surface for exhaust noise were used for the split height modelling. The exhaust noise source was assumed to be 8 dB(A) lower than the engine noise source, following the guidance of the Transportation Noise Reference Book (TNRB)[7].

Traffic volumes were provided by Arup Transport Planning for the approved quarry + VENM haulage scenario and for the proposed additional VENM/ENM scenario, based on 476 additional VENM/ENM haul trucks movements per day (2015/2016 and 2016/2017), reducing to 238 VENM/ENM haul truck movements in 2017/2018.

Each traffic “movement” for noise predictions is a single truck pass-by of a receiver. If trucks are operating “two-way” on a road segment then each truck will count as two “movements”.

The VENM/ENM truck movements were assumed to be distributed evenly between the three site entrances. This results in the following distribution of the additional haul trucks on each road segment:

- Andrews Road 100%
- Castlereagh Road (north of Cranebrook Road) 33%
- Castlereagh Road (north of Andrews Road) 67%
- Cranebrook Road 100%
- The Northern Road 100%

[7] Nelson, P (ed)(1987), *Transportation Noise Reference Book*, Butterworths

The traffic volumes used for prediction are given for each year of proposed operation in Table 6 to Table 9 below. For reference, the following explanations are provided for each column heading:

- ADV – Average Daily Vehicles – Corresponds to the total number of vehicles calculated across the 15 hour period from 7:00 am to 10:00 pm.
- %HGV – Percentage of Heavy Goods Vehicles – the percentage of total number of vehicles that constitutes heavy vehicles (i.e. trucks).
- LV/Day – Light Vehicles per day – the component of total traffic that constitutes light vehicles (i.e. number of cars).
- HGV/Day – Heavy Goods Vehicles per day – the component of total traffic that constitutes heavy goods vehicles (i.e. number of trucks)

Segment	2014/15 (Existing Quarry + Approved VENM)[8]			
	Approved VENM Haulage			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1,747	14%	1,505	242
Andrews Road	8,805	13%	7,636	1,169
Castlereagh Rd near Nepean St	20,088	7%	18,623	1,466
Castlereagh Rd north of Cranebrook Rd	10,339	6%	9,722	618
Cranebrook Road	9,749	9%	8,901	848
The Northern Road	22,234	6%	20,952	1,282

Table 6 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2014/15

Segment	2015/16							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (476 total truck movements)			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1,625	5%	1,547	79	1,782	13%	1,547	236
Andrews Road	8,902	12%	7,846	1,056	9,378	16%	7,846	1,532
Castlereagh Rd near Nepean St	20,325	6%	19,135	1,190	20,642	7%	19,135	1,507
Castlereagh Rd north of Cranebrook Rd	10,462	5%	9,989	473	10,619	6%	9,989	630
Cranebrook Road	9,863	7%	9,146	717	10,339	12%	9,146	1,193
The Northern Road	22,883	6%	21,528	1,355	23,359	8%	21,528	1,831

Table 7 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2015/16

[8] 2014/2015 is the last year of operation of the quarry at PLDC and therefore baseline heavy vehicle numbers for subsequent years will be significantly reduced

Segment	2016/17							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (476 total truck movements)			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1,667	5%	1,588	79	1,824	13%	1,588	236
Andrews Road	9,139	12%	8,057	1,082	9,615	16%	8,057	1,558
Castlereagh Rd near Nepean St	20,865	6%	19,648	1,218	21,183	7%	19,648	1,535
Castlereagh Rd north of Cranebrook Rd	10,740	5%	10,257	484	10,898	6%	10,257	641
Cranebrook Road	10,125	7%	9,391	734	10,601	11%	9,391	1,210
The Northern Road	23,496	6%	22,105	1,391	23,972	8%	22,105	1,867

Table 8 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2016/17

Segment	2017/18							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (238 total truck movements)			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1,708	5%	1,630	79	1,787	9%	1,630	157
Andrews Road	9,375	12%	8,267	1,108	9,613	14%	8,267	1,346
Castlereagh Rd near Nepean St	21,405	6%	20,160	1,245	21,564	7%	20,160	1,404
Castlereagh Rd north of Cranebrook Rd	11,019	4%	10,524	494	11,097	5%	10,524	573
Cranebrook Road	10,387	7%	9,636	751	10,625	9%	9,636	989
The Northern Road	24,109	6%	22,681	1,428	24,347	7%	22,681	1,666

Table 9 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2017/18

The traffic data shows that the total number of heavy vehicle movements on surrounding roads peaks in 2014/2015 due to the existing quarry operations at PLDC. In subsequent years heavy vehicle numbers would reduce significantly. The proposed VENM/ENM haulage would effectively delay this significant reduction until after 2018.

Figure 15 presents the yearly changes in heavy vehicle movements associated with PLDC operation, which illustrates that traffic volumes (and therefore noise levels) associated with the VENM/ENM haulage project would actually in general be reduced compared to the 2014/2015 scenario, and would be reduced compared to the baseline (pre-VENM haulage) figure of ~870 vehicles per day for 2013/2014.

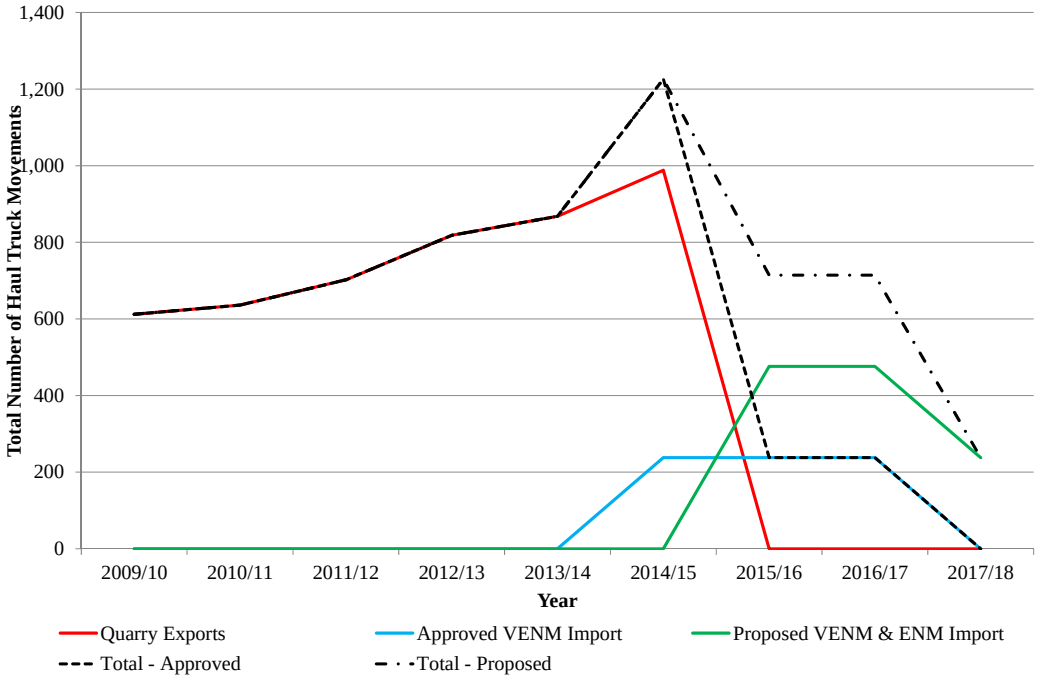


Figure 15 Existing and Proposed Heavy Vehicle Traffic Movements, PLDC

4.2 Predicted Noise Levels

Predicted noise levels, including a 2.5 dB facade reflection, are given for each of the proposed years of operation in

Table 10 below:

Table 10 Traffic Noise Predictions, 2012-2015 - dB re 20 μPa

	Receiver	Level ($dBL_{Aeq, 15hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
2014/2015	1	61 dB	-	-	-
	2	63 dB	-	-	-
	2A	64 dB	-	-	-
	3	72 dB	-	-	-
	4	57 dB	-	-	-
	5	60 dB	-	-	-
	6	60 dB	-	-	-
2015/2016	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	64 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	61 dB	2 dB increase	Yes
2016/2017	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	65 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	61 dB	2 dB increase	Yes
2017/2018	1	56 dB	58 dB	60 dB(A)	Yes
	2	63 dB	63 dB	2 dB increase	Yes
	2A	64 dB	65 dB	2 dB increase	Yes
	3	71 dB	72 dB	2 dB increase	Yes
	4	59 dB	59 dB	60 dB(A)	Yes
	5	60 dB	60 dB	2 dB increase	Yes
	6	60 dB	60 dB	2 dB increase	Yes

*Marginal exceedance of 1 dB(A); additionally this noise level is the same as the 2014/2015 traffic noise level (baseline).

The maximum expected traffic flow from VENM/ENM haulage of 476 truck movements is predicted to meet the road noise criteria for all road segments.

Noise levels for 2015/2016 are expected to be approximately the same as 2014/2015 for all road segments. This is because the additional VENM/ENM traffic is offset by the cessation of export truck movements from PLDC.

For 2018, noise levels on some road segments are predicted to decrease, due to the cessation of the approved VENM haulage traffic in 2018.

To illustrate the change in predicted noise levels with changing traffic flows, the following figures graph the predicted traffic noise levels for each year from 2012 to 2018 under the two scenarios ("existing approved operation", including VENM haulage, and "proposed VENM/ENM haulage").

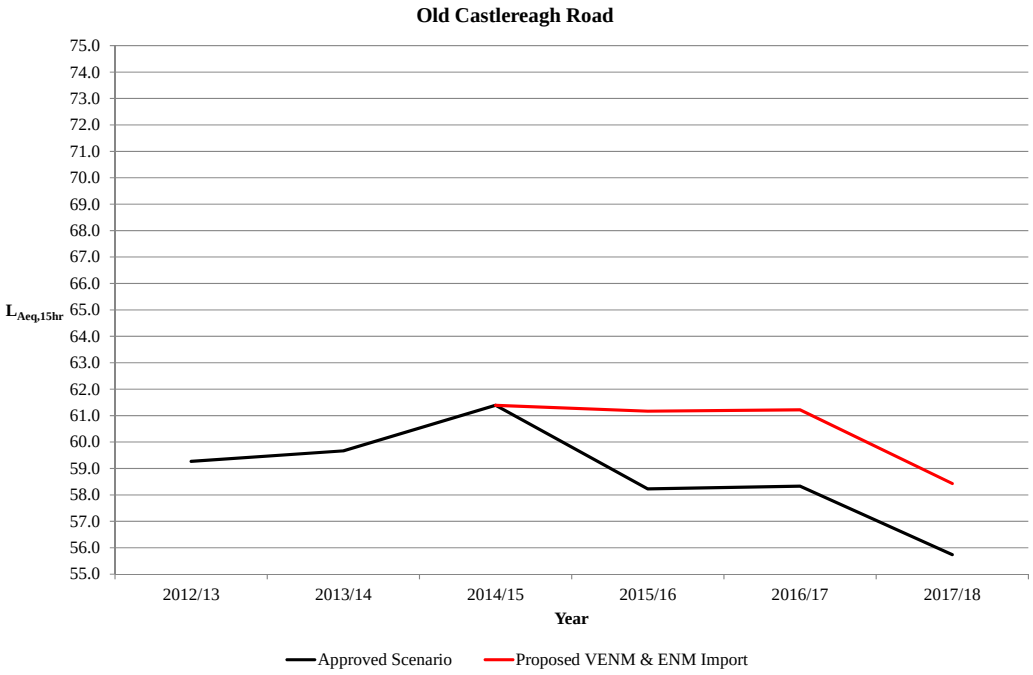


Figure 16 Predicted Traffic Noise Levels, 2012-2018, Old Castlereagh Road

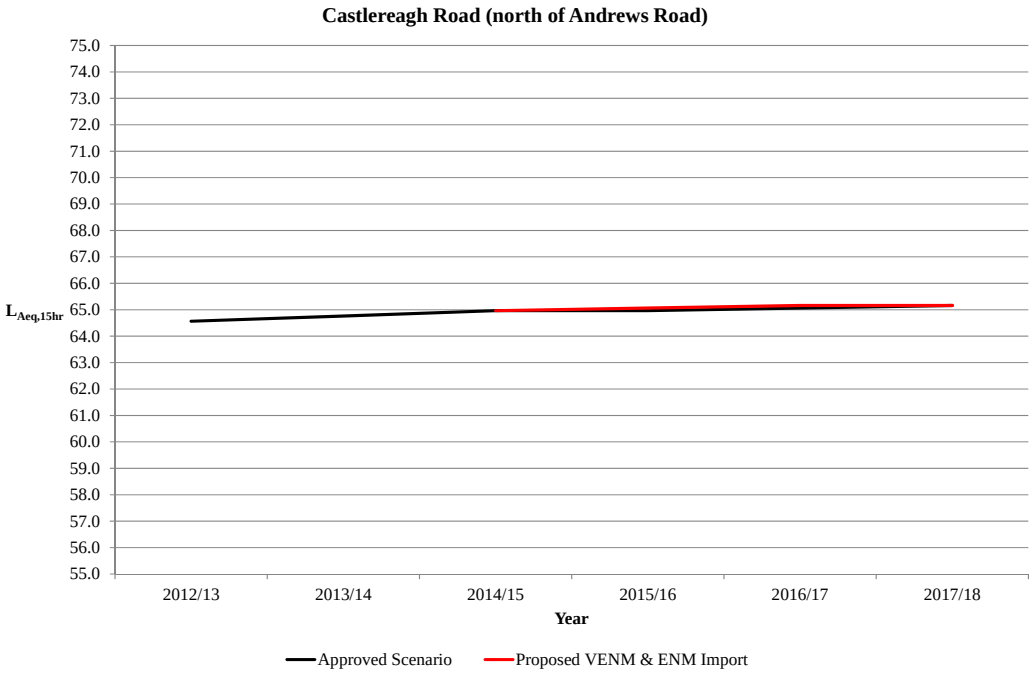


Figure 17 Predicted Traffic Noise Levels, 2012-2018, Castlereagh Road (north of Andrews Road) (Receiver 2A)

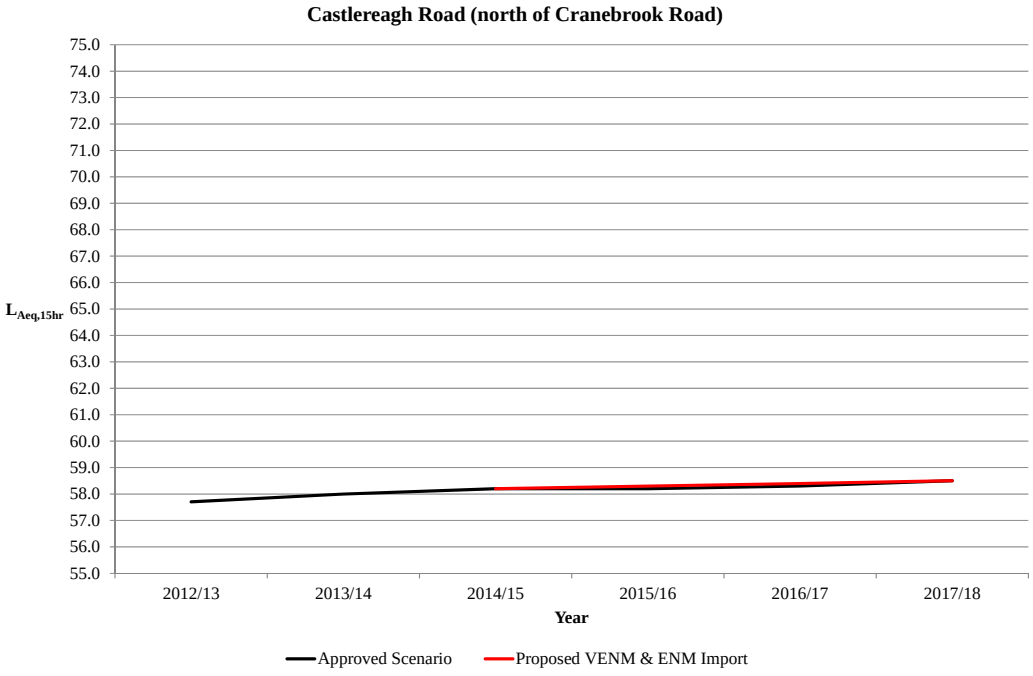


Figure 18 Predicted Traffic Noise Levels, 2012-2018, Castlereagh Road (north of Cranebrook Road)

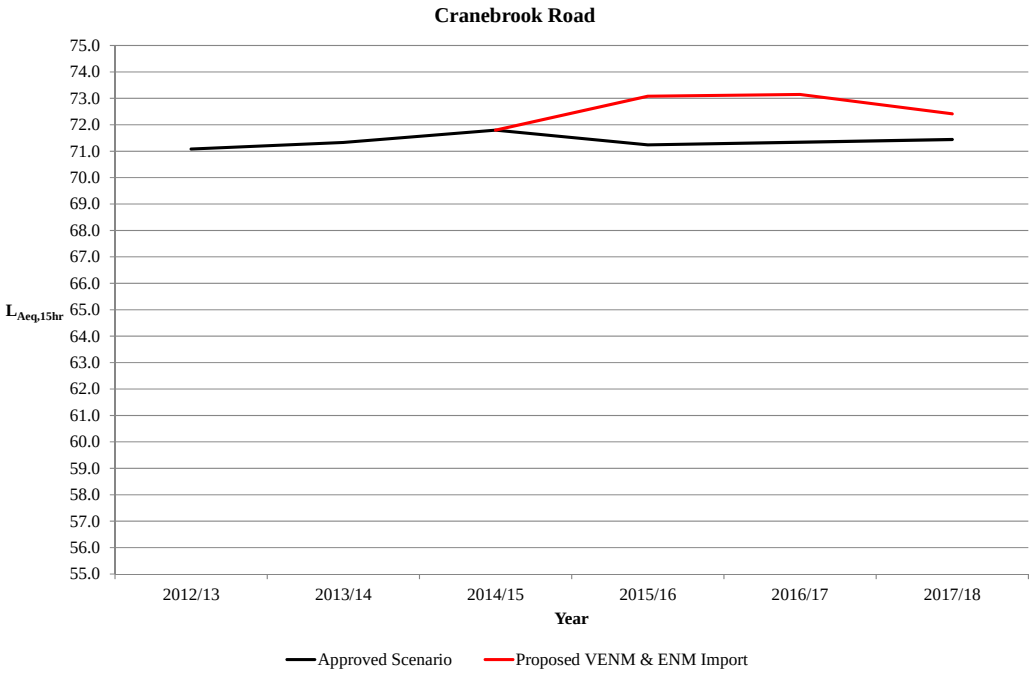


Figure 19 Predicted Traffic Noise Levels, 2012-2018, Cranebrook Road

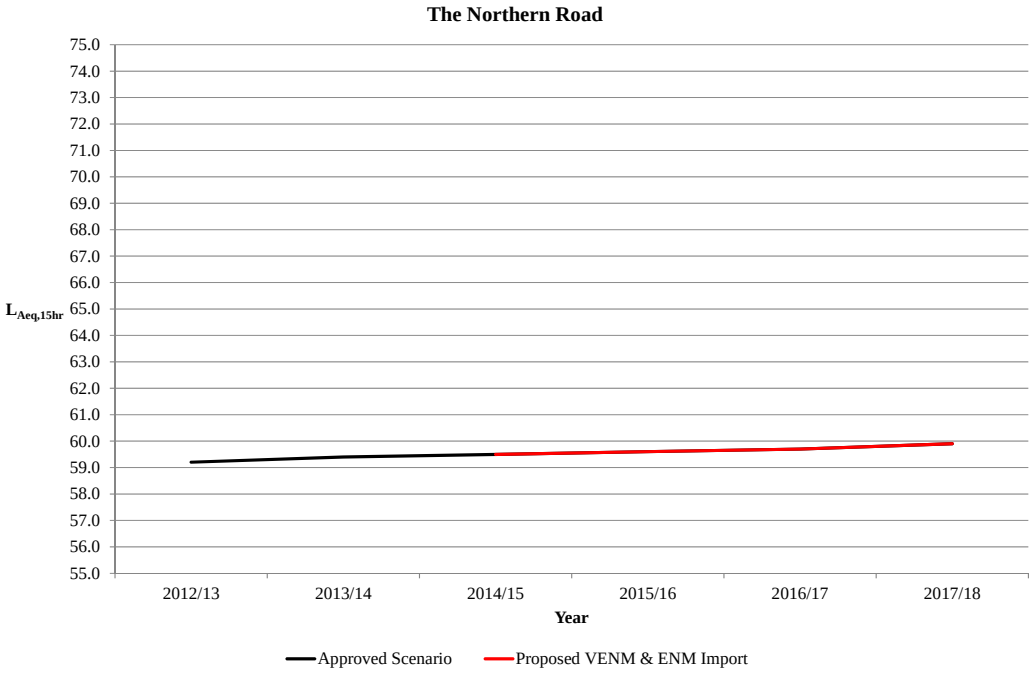


Figure 20 Predicted Traffic Noise Levels, 2012-2018, The Northern Road

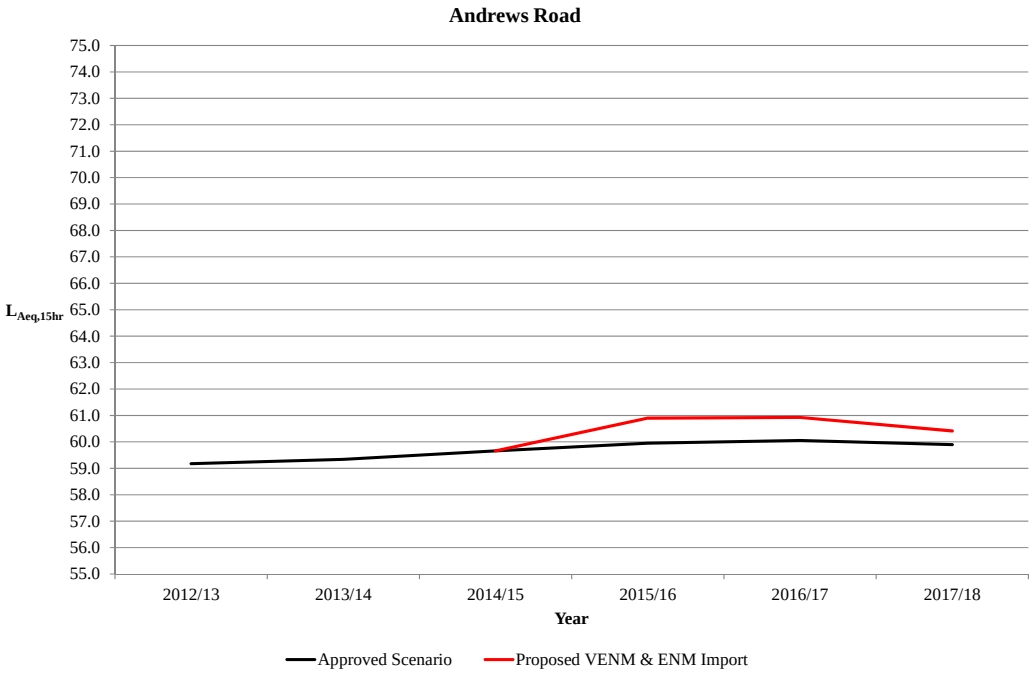


Figure 21 Predicted Traffic Noise Levels, 2012-2018, Andrews Road

5 Assessment of Effects

5.1 Traffic Noise

Depending on PLDC's operational requirements, the VENM/ENM traffic will likely use multiple access points to the PLDC site. The noise predictions above have been based on this based on 'typical' noise predictions where VENM/ENM haul trucks are assumed to be divided evenly between the three site entrances. (See Section 2.1 for the haulage route maps.)

For the typical scenario, VENM/ENM haul traffic is predicted to comply with the RNP criteria for receiver locations on all road segments.

The only road segment where receiving the full number of VENM/ENM trucks ('worst case' scenario) would significantly affect overall noise levels is Old Castlereagh Road. Receivers along this road are of double-brick façade construction with window shutters as a result of noise mitigation from previous PLDC haulage projects[9]. This construction will likely result in a façade traffic noise reduction of 15 dB(A) or higher.

Under an extreme 'worst-case' scenario where all 476 truck movements use Old Castlereagh Road, the external noise level at the receivers on this road segment would be 64 dB $L_{Aeq,15hr.}$ With the façade construction providing ~15 dB(A) noise reduction, this would result in an internal noise level of ~49 dB $L_{Aeq,15hr.}$NSW road noise criteria are typically based on lightweight dwelling constructions which provide ~10 dB(A) traffic noise reduction – i.e. the criterion of 60 dB $L_{Aeq,15hr}$ (external) is equivalent to ~50 dB $L_{Aeq,15hr}$ (internal).

Hence the façade upgrades to these dwellings provided by previous PLDC projects would result in internal noise levels equivalent to the RNP criteria under the 'worst case' VENM/ENM haulage scenario.

Historically, truck numbers along Old Castlereagh Road were significantly higher than the proposed VENM/ENM haulage.

Hence, even under the (unlikely) 'worst case' traffic scenario, internal noise levels for receivers on Old Castlereagh Road would comply with the equivalent RNP noise criteria. Under a typical operation scenario where truck numbers are divided between the various PLDC site entries, external and internal noise levels on Old Castlereagh Road would comply with the RNP criteria.

Hence noise impacts on receivers on Old Castlereagh Road are assessed as being negligible from the proposed VENM/ENM haulage.

5.1.1 Traffic Noise Management Plan

It is understood that PLDC proposes to control traffic noise impacts from the VENM/ENM haulage by managing the number of haul truck movements on each road segment.

A Traffic Noise Management Plan for the VENM/ENM haulage operation would need to be been prepared prior to commencement of operation, and traffic noise

9 Advised by PLDC

levels on Castlereagh Road, Cranebrook Road and Old Castlereagh Road should be measured before and after commencement of VENM/ENM haulage to quantify the increase in traffic noise due to the haulage operation.

5.2 Vibration from Haul Trucks

Groundborne vibration levels from road traffic are typically minimal, because the pneumatic tyres of vehicles act to isolate the mass of the vehicle from the road surface. Therefore, the vibration impact from the VENM/ENM haul traffic is expected to be minimal.

Further, no significant increase in the maximum vibration levels at surrounding receivers is expected – these receivers are already exposed to vibration from existing heavy vehicle traffic, and the additional VENM/ENM traffic will increase the number of vibration events but is not expected to increase the magnitude.

As a conservative estimate, indicative predictions have been made using maximum vibration pass-by levels from internal haul traffic, measured on the PLDC site by Arup Acoustics as part of a previous project. The haul trucks measured were significantly larger than the haul trucks (e.g. semi-trailers) likely to be used for the VENM/ENM haulage, and therefore the measured vibration levels are expected to be conservative.

Measured vibration levels at approximately 50 m distance from the haul trucks were in the range 0.05-0.08 mm/s PPV (approximately 0.04-0.06 mm/s RMS), as an overall vibration level. The nearest receiver (2A) is approximately 16 m distance from the carriageway edge, and is therefore approximately 19.5 m from the haul trucks (the traffic source line is typically taken as being 3.5 m from the carriageway edge).

The vibration levels at this distance have been estimated by applying a distance correction, although changes in the ground composition (such as a change from one soil type to another) can affect the vibration propagation.

VDV levels from the VENM/ENM traffic have been estimated using the procedure of the Assessing Vibration guideline, based on these maximum levels from internal haul truck pass-bys. The predicted VDV levels are expected to be conservative, as they are based on maximum vibration levels from the pass-by rather than the energy-average vibration levels.

Predicted vibration levels at the nearest receiver are approximately 0.328-0.526 mm/s PPV (0.232-0.372 mm/s RMS). As these are overall vibration levels, it is not known which frequency band contains the peak value. However, Curve 4 of AS2670.2, which forms the vibration criterion, has as its minimum value (for frequencies above 8 Hz) of 0.398 mm/s RMS, and therefore the VENM/ENM traffic is predicted to meet Curve 4 in all frequency bands.

With 120 VENM/ENM trucks/day, these vibration levels are predicted to produce a maximum VDV of 0.16 $m/s^{1.75}$. This is below the recommended level for residential receivers of 0.2 $m/s^{1.75}$, and therefore it is considered likely that the overall VDV (i.e. from existing and VENM/ENM traffic) is within the acceptable range of 0.2-0.4 $m/s^{1.75}$ given by the DECC.

Therefore, the predicted vibration levels from haul traffic, using a conservative prediction method, meet the DECC guidance for human comfort, and therefore the

VENM/ENM haul traffic is expected to have a minimal vibration impact on the receivers on Old Castlereagh and Castlereagh Roads.

6 Conclusions

The noise and vibration impact of the proposed modifications to the DA2, DA3 and DA4 consents to allow importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to the Penrith Lakes Scheme over 2015-2018 has been assessed against the relevant licence conditions and OEH guidance for noise and vibration.

Additional noise and vibration impacts from internal traffic movements are expected to be minimal, with external traffic (i.e., not on the PLDC site) being the only significant source of noise resulting from the importation of VENM/ENM.

Traffic noise levels were predicted using the Calculation of Road Traffic Noise (CoRTN) methodology, calibrated against results from an unattended traffic noise survey and attended measurements of existing haul truck pass-by noise on Old Castlereagh Road.

Noise levels for a typical VENM/ENM haul truck scenario (approximately 476 truck movements per day divided between the three site entries) were assessed. In addition, a further 'worst case' scenario was considered for all haul trucks using the worst-affected road segment (Old Castlereagh Road), which has infrastructure that is better suited to handle larger volumes of trucks than the other entrances.

Receivers on Old Castlereagh Road have been upgraded with architectural facade treatments and upgraded ventilation in order to allow glazing to remain closed as part of previous PLDC projects. These existing mitigation measures mean that internal noise levels under the 'worst case' haulage scenario (where all haul trucks use Old Castlereagh Road) will be equivalent to the external RNP noise criteria.

Based on current trends, the 'background' traffic on Castlereagh Road and Cranebrook Road will increase with time, and the relative impact of the VENM/ENM haul traffic is predicted to decrease on these roads.

For Old Castlereagh Road, the VENM/ENM haul traffic is essentially 'prolonging' historically-high heavy vehicle numbers on this road, and vehicle numbers (and noise levels) will reduce once the VENM/ENM haulage ceases.

Vibration levels at nearby receivers were assessed using a conservative methodology based on previous Arup Acoustics measurements of vibration levels from large internal haul trucks on the PLDC site.

To control the traffic noise impact of the VENM/ENM traffic, administrative measures are recommended, such as dividing the overall daily haul traffic between several access locations to reduce the traffic noise impact on any one road segment. A NMP will be implemented for the VENM/ENM haulage to document the traffic noise management procedures.

The overall noise impact of the VENM/ENM haul traffic is expected to be low, and administrative measures are expected to be effective in controlling this noise impact to acceptable levels and meet the relevant noise criteria.

Predicted vibration levels at surrounding receivers are below the recommended criterion of Curve 4 of AS2670.2, and the estimated VDV is predicted to be below 0.2 $m/s^{1.75}$ and therefore the vibration impact of the VENM/ENM haul traffic is expected to be minimal and meet the relevant vibration criterion.

Appendix C

Glossary of Acoustic Terminology

C1 Glossary of Acoustic Terminology

'A'-WEIGHTED SOUND LEVEL dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

DECIBEL

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

MAXIMUM SOUND LEVEL, L_{max}

The maximum sound level is the maximum weighted sound pressure level experienced during the measurement period.

PEAK PARTICLE VELOCITY (PPV)

Peak Particle Velocity is the parameter most often used for the quantification of groundborne and structure-borne vibration. It is the maximum positive or negative magnitude of vibration in a defined direction caused by the passage of a wave front during a specified interval. Particle velocity is used in most cases because this parameter has been found to correlate best with the onset of structural damage. It can also be used to provide some guidance on disturbance to people and the sensitivity of equipment and processes to vibration.

SOUND EXPOSURE LEVEL (SEL)

The Sound Exposure Level or Single Event Noise Exposure Level, denoted SEL or L_{AE}, is a measure of the total amount of acoustic energy contained in an acoustic event. The SEL is the constant sound pressure level that would produce in a period of one second the same amount of acoustic energy contained in the acoustic event.

SOUND POWER AND SOUND PRESSURE

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index, which allows for this variation. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, eg. $dBL_{A10,\ 5min}$ or $dBL_{A90,\ 8hr}$.

$L_{A90(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 90% of the time. This is also often referred to the background noise level. For the purposes of this report the duration interval (T) shall be 15 minutes.

$L_{A10(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 10% of the time. This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

VIBRATION

Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing structureborne noise or human comfort issues respectively. Vibration amplitude may be quantified as a peak value, or as a root mean squared (rms) value.

Vibration amplitude can be expressed as an engineering unit value eg $1mms^{-1}$ or as a ratio on a logarithmic scale in decibels: Vibration velocity level, L_V (dB) = 20 log (V/V_{ref}),

where the preferred reference level, V_{ref}, for vibration velocity = 10^{-9} ms^{-1}.)

The decibel approach has advantages for manipulation and comparison of data.

Appendix D

Wind Roses at Penrith Lakes

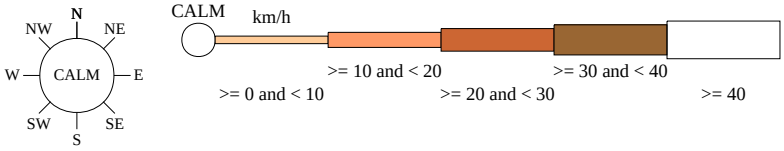
Rose of Wind direction versus Wind speed in km/h (15 Sep 1995 to 30 Sep 2010)

Custom times selected, refer to attached note for details

PENRITH LAKES AWS

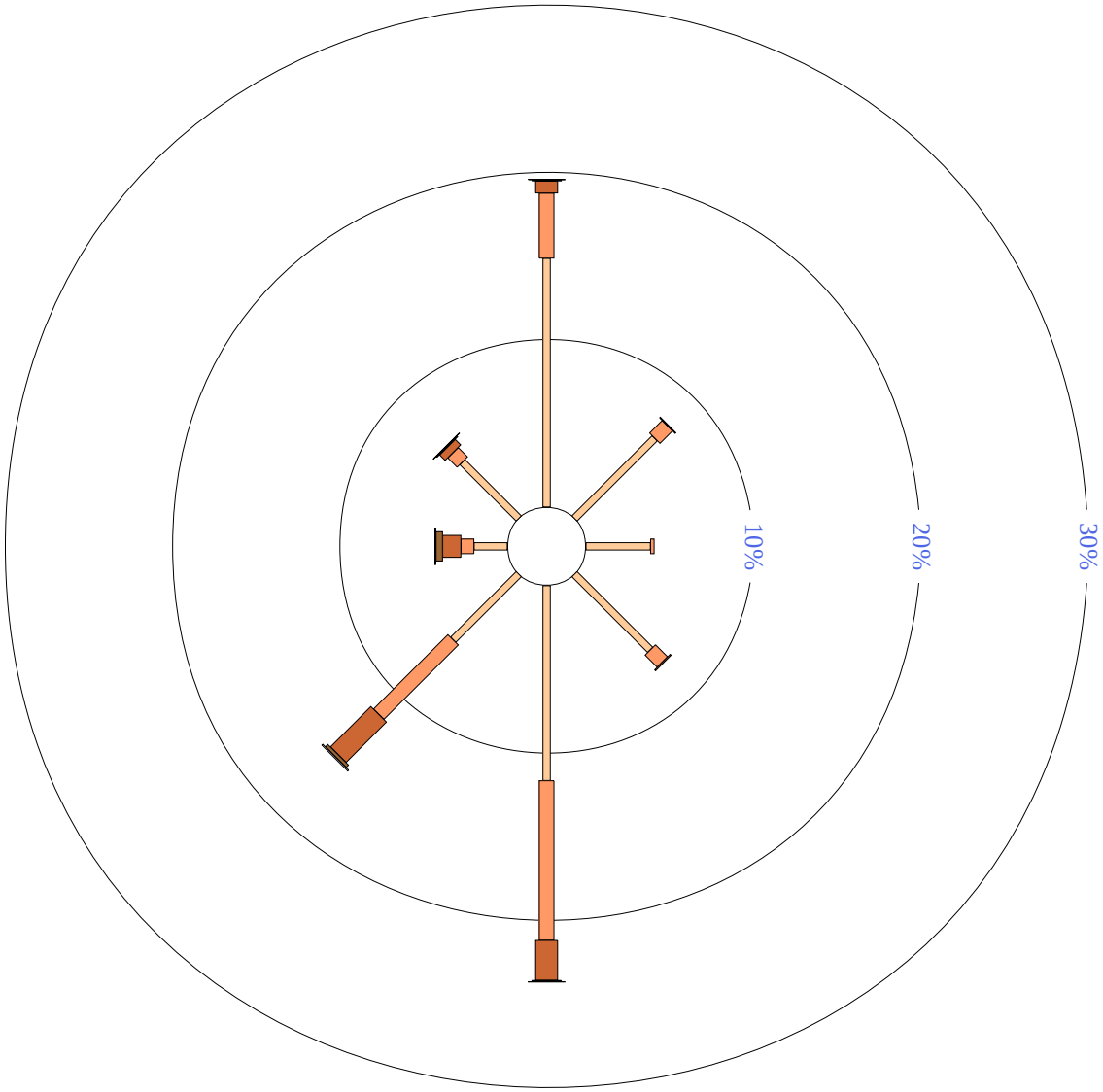
Site No: 067113 • Opened Aug 1995 • Still Open • Latitude: -33.7195° • Longitude: 150.6783° • Elevation 24.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
5256 Total Observations

Calm 12%



Rose of Wind direction versus Wind speed in km/h (15 Sep 1995 to 30 Sep 2010)

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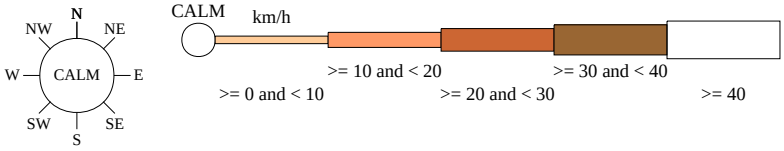
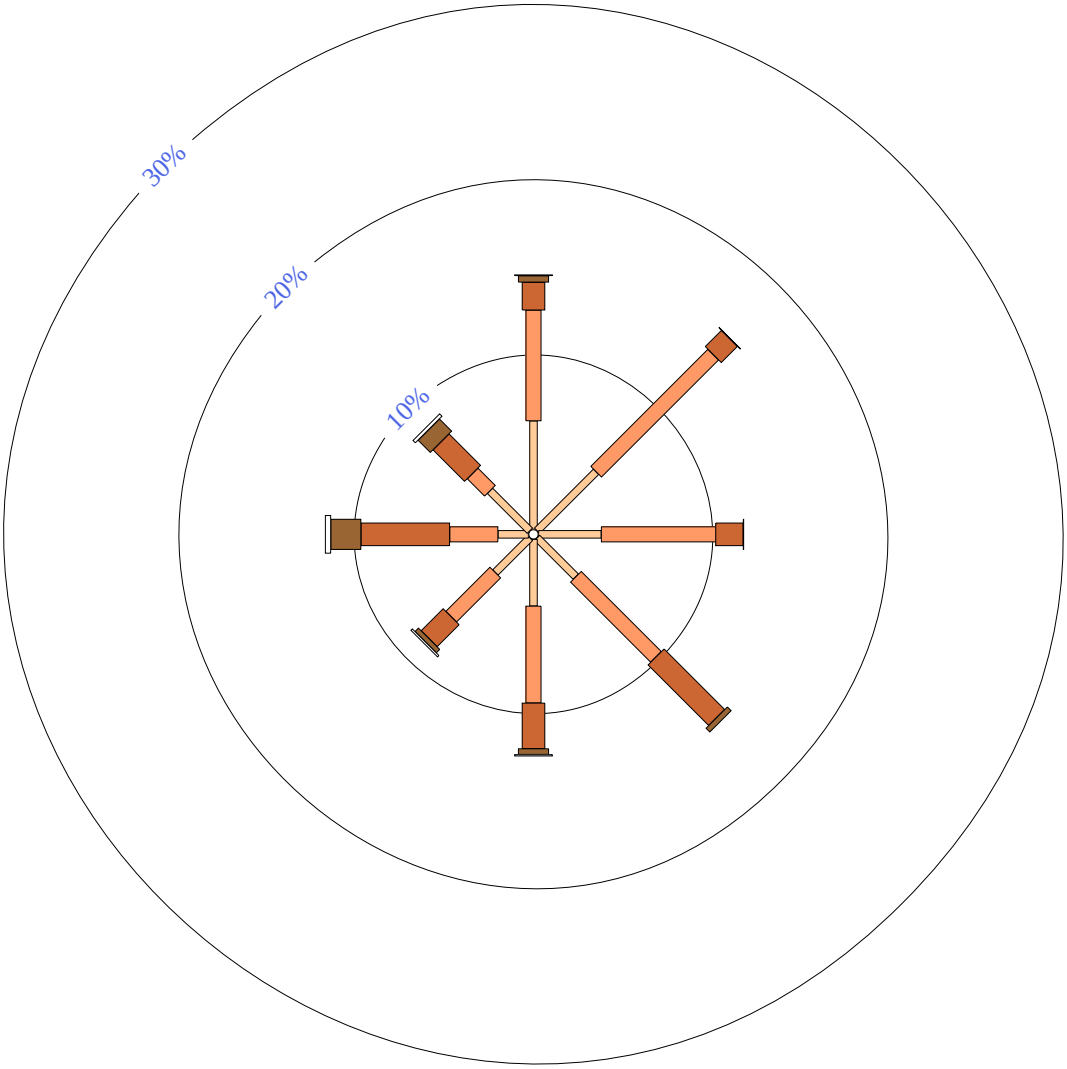


3 pm
5235 Total Observations

Calm 1%



Appendix E

Flora and Fauna Assessment

E1 Flora and Fauna

E1.1 Baseline Conditions

The existing flora and fauna values of the site are greatly reduced from original pre settlement levels. The site contains few native species of flora and is largely dominated by introduced species, in particular grasses and shrubs. This is in contrast to the rich ecological communities which bound the site, such as the endangered ecological Cumberland Plain communities on the Cranebrook escarpment and along the Nepean River floodplain.

Penrith Lakes has developed a Biodiversity Strategy to assist in delivering the sustainability targets for the Scheme. The preliminary sustainability targets for land and biodiversity rehabilitation will be further developed as the plans for the Scheme are refined and will form a part of the Penrith Lakes sustainability reporting framework for the sites' development and management. Included in the sustainability targets are the following specific targets which relate to flora and fauna:

- Protection and enhancement of existing biodiversity;
- Vegetation corridors should link the Core Conservation areas across the site;
- 95% of planting of non-food producing land to be indigenous species; and
- At least 30% of the land areas (for conservation) should be in fully structured woodland.

Both aquatic and terrestrial native plant species endemic to the Castlereagh Floodplain have been planted across the site as part of a rehabilitation program. PLDC has engaged Muru Mittigar Aboriginal Education Centre to provide vegetation that is both indigenous to the local area and representative of the endangered ecological Cumberland Plain communities including Cumberland Plain Woodland, Castlereagh Swamp Woodland, River-flat Eucalypt Forest, Shale Gravel Transition Forest, Shale Sandstone Transition Forest and Sydney Freshwater Wetlands. Muru Mittigar has sought permission from the Department of Environment and Conservation to collect and propagate this material.

Following the importation of VENM and rehabilitation of the Scheme it is envisioned that the site will be revegetated to a significant extent and will once again contain viable ecological habitat. Of equal or greater importance, the Scheme will also be able to act as an ecological corridor, linking currently isolated ecological habitats with intact communities. So while ecological values on the site are currently low, the likelihood of extensive revegetation and remediation in the future requires that existing native flora and fauna should be treated as valuable and should be protected where possible.

E1.2 Assessment of Effects

As VENM is required for the rehabilitation of the Scheme, and revegetation will occur once the development is finished, the effects of the proposed modification contribute to a positive impact. It is important that any existing native flora and fauna are protected during the redevelopment process, in order to maintain the existing biological value of the site. The creation of ecological corridors, stepping

stones and core conservation areas would enhance the viability of threatened communities surrounding the site, and help increase the genetic stability and diversity of populations. Careful selection of species, to ensure endemic native species, further improves the future value of the site.

E1.3 Management Measures

Existing management and rehabilitation measures as per the original development application and consents are to be implemented, including implementation of the Castlereagh Biodiversity and Natural Heritage Conservation Master Plan, which provides detailed policy and strategic direction to support the sustainability targets for the Scheme.

The impact of the modification on Flora and Fauna is considered to be negligible

Appendix F

Indigenous Heritage Assessment

F1 Indigenous Heritage

Oral histories of the area talk about the escarpment and the associated lagoons as forming an important meeting or gathering place for different clans of the Darug People. Evidence from archaeological studies carried out by PLDC in partnership with the Aboriginal community, supports the idea that large gatherings occurred in this area.

Due to extensive market garden farming and quarrying prior to PLDC activities on site the topsoil layer has been significantly disturbed greatly compromising the integrity of archaeological discoveries. Regardless, PLDC have employed a routine monitoring program involving members of the local Aboriginal Darug community, to oversee all stripping of topsoil across the Scheme.

This modification proposal will not result in the disturbance of any additional top soils.

If any new or unknown Indigenous sites or relics are uncovered during the proposed Project, work affecting those sites or relics will cease immediately and the material will be assessed by Aboriginal stakeholders and OEH, in accordance with current consent conditions.

The impact of the modification on Indigenous Heritage is considered to be negligible

Appendix G

Non-Indigenous Heritage

G1 Non-Indigenous Heritage

G1.1 Baseline Conditions

Retained within the Penrith Lakes Scheme are a number of conservation zones which range from local to national significance. These sites are indicative of early colonial (1806 – 1900's) contact and non-Indigenous heritage. Contained within these sites are items of significance such as slab timber cottage, pise rammed earth dwellings, mass concrete cottages, examples of industrial moveable heritage and important examples of early colonial landscape plantings.

PLDC maintain a register of items of European Heritage within the Scheme. Although all heritage items are considered significantly distant from haulage routes, those in closest proximity include:

- Upper Castlereagh School & Residence
- Upper Castlereagh Methodist Church and Hall
- Methodist Cemetery
- Allen Long's Cottage
- Lander's Inn
- MJ Fulton's House
- Mass Concrete House
- For a more detailed description of these items and their historical significance, refer to Appendix G2G2.

G1.2 Assessment of Impacts

These heritage items are significantly distant, and the levels of vibration from the haulage routes low enough that the impact of traffic induced vibration is likely to be negligible. However, a minimum curtilage of 15m will still be implemented as a protection measure. Impacts internally will be no different as a result of importing VENM. The same volume of material will be transported within the site therefore impacts are largely confined to external haul roads. Furthermore, the impact as a result of fill trucks will be no different from those associated with quarry activity operating since the 1980's. As the existing internal haulage routes will still be used, the appropriate curtilages will already be in place, and heritage items within the scheme are not predicted to be adversely affected.

G1.3 Environmental Management Measures

The conservation management plan (CMP) for the Scheme identifies appropriate conservation management measures to ensure that items of historical value are maintained. From these management measures the only significant measure for this Project is that sufficient buffers are established between any heritage item and the surrounding activities. Management will be undertaken in accordance with the CMP for the Scheme.

The impact of the modification on Heritage is considered to be negligible

G2 Items of Heritage Significance

G2.1 Upper Castlereagh School and Residence (RES 10, RES 11)

Historical Context

The Upper Castlereagh Public School was built in 1879 on part of the 100 acres granted to Edward Field in 1803. By 1825, the 100 acre property had possibly increased to 105 acres, as during this period, Edward Field and his son, Edward Field junior, were each farming 40 acres and Jacob Russell was farming 25 acres of the Field's property At some point between 1822 and 1825, 23 acres was sold to John Purcell , who later sold to John Bowman. The remainder was inherited by his son William Field after Edward Junior's death in 1825. By 1867 John Jackson owned the now 80 acre 'Field' allotment.

John Jackson sold the 2 acres in the southeast corner of the property to the Council of Education for the purpose of building a school and residence, for a sum of £50. A further quarter acre was purchased from the neighbouring Mrs Gormans for £10 in order to make the school site 'square'.

Building

Upper Castlereagh Public School was built in 1879, and designed for a maximum of 67 students. It is a small, single-storey, dark red brick faced, Gothic Revival building with a steep garbled roof. Of a simple rectangular hall layout, it had a main entrance porch attached, typical of both the period, and the architect, George Allen Mansfield. The residence was a 3 room building, and both were complete by 1879 for £950. The residence was designed as a simple mid-Victorian painted brick cottage with a hipped roof, two chimneys and a front verandah. From 1883 Charles Paul, the schoolmaster at the time, complained of damp and instigated repairs. This scenario, however, was repeated in 1892, and again in July 1894 further repair requests were made, but were not carried out until September 1985, a month after his death. Charles had attributed his poor health to the damp problems of his home. His successor immediately requested a washhouse which was approved swiftly, but not built until 1898 at the same time as a weather shed. In 1900, the schoolmaster of that time, Edward Robertson, sketched extensions to the residence to be built alongside the existing dining room and sitting room, at a right angle to the front verandah. In 1907 new windows were installed into the northern wall, and later the verandah was enclosed. Sometime in the mid-1900's a dining room was built, and in 1930 a concrete floor was added, along with a new bathroom.

Current state

The buildings are currently set in a level grassy area with some mature trees and light undergrowth. The associated Methodist Church, Hall and cemetery still exist to the east, behind which is a major PLDC haul road and the Sydney International Regatta Centre. To the west are the Blue Mountains.

The School building is in a state of extreme disrepair. The gutter was an early replacement, and the roof shingles had been replaced by corrugated iron, however approximately a quarter of the roof sheeting is now missing, exposing the roof structure and interior to water damage. Timber portions are rotting, absent or

suffering from termite damage and portions of the rear annex are fallen or displaced. However, the roof structure itself appears to be structurally sound and the building's brickwork remains in good condition with no evident cracks.

The Schoolmaster's Residence appears to be in good condition, with no visible damage or deterioration. Repairs are needed but the building and its later additions appear to be structurally sound.

The school operated until 1975, and was offered for lease in 1989. It opened as Castlereagh Learning Centre in 1991. The schoolmaster's quarters are believed to have been used up until the early 1980's. The current owner of the buildings is the Department of Community Services.

Heritage value These items have been declared to be of high historical, social, aesthetic and scientific significance at a State and local level. Upper Castlereagh School and Residence were built on a section of Portion 54, about 4km north of Penrith, on part of the 100 acres granted to farmer Edward Field in 1803. The school was designed by George Allen Mansfield, who was appointed as architect for the Council of Education in 1867 and built on 2 acres purchased from John Jackson, and a ¼ acre purchased from Mrs Gormans.

The buildings are an important part of the Upper Castlereagh Village Group, which consists of the School, Residence and War Memorial to the west as well as the Methodist Church, Hall and Cemetery to the east. The building is an example of early education in Castlereagh, and the school precinct is an example of 96 years of development and uninterrupted function (1879-1975).This combined with the first Wesleyan School show 111 years of education in Australia.

The site has research potential, and thus its continued maintenance and preservation is important. Although the site is not suitable for general schooling, it has been recommended that the future use should remain related to education. Possibilities include an office for TAFE, with particular classes, such as flower arranging. If this is not possible then retail or café type establishments may be considered.

G2.2 Upper Castlereagh Methodist Church and Hall (RES 4 & RES12)

Historical Context

John Lees was granted 90 acres along the Nepean River in 1804, which he cleared for farming and to build a home. As his farm prospered Lees drank increasingly, although he became a Christian after receiving a snake bite around 1811-12. A founder of Wesleyanism within Australia, in 1815 he paid for a slab building to be attached to his home, where Church gatherings could take place. Samuel Leigh a Wesleyan minister told by Macquarie to leave Sydney for attempting to create a sect was welcomed by Lees to minister from the chapel attached to his home.

From here there is some disagreement between historians as to the sequence of events, and church building. However, it is generally accepted that in 1817, a weatherboard chapel was constructed, funded by Lees, and on a portion of property fronting Castlereagh Road which he donated to the church. Officially opened on the 7th October 1817 by Samuel Leigh, this is often referred to as the 'first Wesleyan chapel', despite the existence of the earlier chapel beside Lees' house. One contrasting accounts believe that the 1817 date refers to the chapel

attached to Lees' cottage, and that the weatherboard chapel was constructed by 1820.

By 1832 the weatherboard chapel was described to have been in a dilapidated state.' John Lees died on the 28th August 1836 and was buried in the Church of England Cemetery in Castlereagh. In 1840, the weatherboard Wesleyan church was reportedly destroyed by fire.

A third more formal Methodist Church of gothic design was built nearer to the road in 1847 of white stuccoed brick, and at a cost of £450. A Sunday School was built in 1873 next to the Church, and the hall was used as a school the Wesleyan Common School, or Castlereagh Wesleyan Denominational School. This was in use until Upper Castlereagh Public School was built. Samuel Roseby, the final teacher at the Wesleyan Common School requested in December 1878 to take charge of the new school and residency immediately due to the 'unsuitability' of facilities at the Wesleyan Common School and in the following year became the first teacher of the Upper Castlereagh Public School.

A cemetery adjacent to the hall was opened in 1836, although this has been debated due to claims that the first burial did not take place until 1848.

Building

The Methodist Church, built in 1847 on a section of Portion 71, is a symmetrical white stuccoed brick building of Early Gothic design. It features a corrugated gable roof, gothic arched windows on the northern and southern facades; with sandstone sills and timber stiles of which several panes remain intact. While the roof sheeting and render have been replaced, the timber floor appears to be original, although the annex/porch was a later addition and a modern plasterboard ceiling with standard cornice was installed. Either side of the porch bricked window, arches are found which correspond in shape and size to windows within the nave.

Of significant value is collection of original box pews, alongside an ornamentally carved central pulpit, communion rail and a fret-worked harmonium. Very few churches in New South Wales have retained these items, so their good condition combined with their rarity, makes this a valuable heritage item.

The Methodist Hall, previously known as the hall for the Sabbath School of Methodistical Sobriety, is a small, late Georgian/early Victorian timber framed weatherboard structure which originally served as the Wesleyan School from the 1840's until the Upper Castlereagh School was built in 1878. It features a high pitched hipped roof with a small bell enclosure clad with corrugated iron. The iron sheeting which has been replaced, and the hall now possesses a modern NSW quad type gutter. The current doors are a modern reproduction of the originals, and the hall also features three double hung sash windows on the northern and southern sides, each with four panes, which have mostly been replaced. On the northern side there is a more recent annex and verandah with timber posts and a boarded valance, with the southern end enclosed to form the kitchen. The timber flooring was replaced early and the interior walls and ceiling are the original wide beaded timber boards with a simple cornice. A stage was added in the 1940's.

Current State

The Methodist Church and Hall are set on a level grassed area with some mature trees and light undergrowth. To the west is the Blue Mountains escarpment. Being in the southwest corner of the quarry, a main haulage road exists between the items and Sydney International Regatta Centre which lies to the east. The Methodist Church is in excellent condition with no visible structural issues or water damage. This is largely due to the continuance of its original function, and the associated care and maintenance undertaken. The chapel has been re-rendered, although much of the original fabric remains intact. A damp-proof course was inserted after previous condition surveys were undertaken. The corrugated iron roof, drainage systems, wall finishes, timberwork and joinery are in good condition.

The Methodist Hall has also been well maintained and is in good condition with no structural issues or visible water damage. Much of its original fabric, elements and detailing survive intact. Recent external cladding has extended down to ground level, and therefore new ventilation openings need to be cut into the cladding to prevent dampness and the likelihood of termites and fungi.

Both items are currently owned by Uniting Church, and form part of the Penrith Parish. This arrangement should be continued, and the church and hall should be conserved as a part of the Methodist and Upper Castlereagh Village Group.

Heritage Significance

Numbered 1727 Castlereagh Road, the Methodist Church and Hall form an important part of the Upper Castlereagh Village Group, which also includes the cemetery and the Upper Castlereagh School and Schoolmaster's Residence. Combined these items display the centre of the previous village on Castlereagh Road, as well as the development of a denominational community in early Australia.

These items have been deemed of high historical, aesthetic, social and scientific significance at a State and local level. This is partially due to their relationship with John Lees, the original 90 acre grant recipient, who was a founder of Australian Methodism, as well as the continuity of their use for over 150 years, demonstrating the development of the area from early colonial days to present. The buildings themselves are in excellent condition and proximity to other important historical items, which increase its aesthetic value, as well as its rarity. The Church itself is early Victorian “Rural Gothic” design, and possesses a well preserved interior. The site is deemed to have high research potential.

G2.3 Methodist Cemetery

Historical Context

In 1804 John Lees was granted 90 acres on the banks of the Nepean River, which he cleared before building a home and establishing a farm. Lees drank proportionally with the increasing success of his farm, before converting to Wesleyanism around 1811-12 after receiving a snake bite. It is believed that the earliest Wesleyan meetings in the district occurred in Lees’ house. In 1817 John Lees gave the Wesleyan community an acre of his property, fronting Castlereagh Road for a church. Over time, three churches were built here, of which only the third Wesleyan Church remains, a white stuccoed brick building. A Sunday

School was also built which is almost certainly the weatherboard Wesleyan Common School (Hall) built in 1864. The cemetery, said to be opened in 1836 was laid out adjacent to the hall, however this date is debated given claims that the first burial did not occur until 1848.

John Lees death occurred on the 28th August 1836 and he was buried in the Church of England Cemetery in Castlereagh. In 1839 his wife Mary passed away, and was buried beside him. In 1921 John Lees' headstone was relocated to the Methodist cemetery along with the remains of the couple.

Building

90 monuments survive in the cemetery, dating in age from 1848 to 2003. The headstone of John Lees, founder of the Church, is dated 1836 and was relocated to the cemetery from Castlereagh General Cemetery in 1921. Upright sandstone slabs dating from the mid to late nineteenth century are the most common type of grave marker in the cemetery, although those composed of marble slabs are also numerous. Most headstones are of simple Gothic design, although some monuments are quite elaborate. Decorative motifs are common and lead lettering is found attached to most marble or granite plaques. Grave furniture also extends to include cast and wrought iron palisade perimeters. These elements remain a large part of the visual quality of the cemetery.

The Methodist Cemetery would initially have been laid out with graves placed in alignment, and grouped, in a simple, formal layout. Family groups in the cemetery include those of Stanton, Parker, Sheene, Wright, Howell and Furness, with the most notable being the Colless family with the family plot, and ornaments located in the east portion of the cemetery, including a marble pedestal with urn surmount.

Current State

The Methodist Cemetery is set on a level grassed area in the southwest part of the quarry near the Methodist Church and the Hall, with scattered mature trees and light undergrowth in the surrounds. To the west is the Blue Mountains escarpment. The Sydney International Regatta Centre lies to the east, with a quarry haulage road between the lake and the property boundary. Opened in 1836 and it is one of the earliest Methodist parishes in New South Wales and with most monuments dating from the mid to late nineteenth century. The cemetery belongs to the Uniting Church of Australia and forms part of the Penrith Parish. The cemetery is in very good condition and presents a fine example of a nineteenth century rural parish cemetery. Most monuments are intact and the couple of broken headstones have been laid in relation to the associated grave. In the eastern and western parts of the cemetery are examples of headstones which are tilting or have cracked kerbing, indicating either compaction or drainage issues. A recent columbarium is located beside the Western fence.

There has been some natural degradation due to exposure to the weather which has worn the surface of headstones so that many inscriptions are no longer legible. Sandstone and marble are susceptible to erode and chemical breakdown in wind or rain. A detailed record of should be undertaken as soon as possible of surviving monuments and grave surrounds for heritage purposes. There have been no incidences of vandalism.

Also, at some graves there is no furniture is visible. Some grave furniture may also have been removed for the value of its material or for ease of maintenance.

The cemetery is well maintained, with frequent lawn mowing. Lawn mowing, for example, may have resulted in the damage of obscured low-lying grave furniture and perimeters.

Heritage Value

The Methodist Cemetery is located at 1727 Castlereagh Road on John Lees original land grant, beside the Methodist Church and Hall. The cemetery is significant for its portrayal of the emerging Methodism in the region, and the colony, but also because many inscriptions pre-date Civil Registration. This makes the site an important historical resource for determining genealogical links, biographical details and describing the history of local Methodist families. Together with the adjacent Methodist Church and Hall and the former Public School and Schoolmaster's Residence opposite, the Methodist Cemetery is an integral part of the remnants of the village of Upper Castlereagh.

The cemetery was deemed to be of high historical, aesthetic, social and scientific significance at a State and local level, providing important documentation of early Methodist settlement in the Castlereagh area. The cemetery contains a variety of grave markers, furniture and surrounds. While some of the graves are in need of repair and minor drainage problems exist much of their original fabric remains. The grave markers and other features of the cemetery display developments and variation in architectural and artistic styles and methods.

G2.4 Allen Long's Cottage

Historical Context

In 1804, William Chapman, a free settler, was granted1300 acres of land. Despite the suitability of the land for farming, Chapman never occupied or farmed the land, with only 32 acres had been cleared by 1820, and this by squatters. In 1828, blacksmith John McHenry bought the property having built a house, Lemongrove, on it the previous year (likely as a tenant). McHenry passed away in 1831 and his land was tenanted until the 1850's when his sons were old enough to farm the property. In 1860 the property was subdivided and sold. By 1873 there were several owners of portions of the original property, and by 1947 most of the original grant had been cleared for farming. Allen Long's federation-style house and outbuildings were built in the twentieth century opposite his former family home. Allen was the son of Jane Brownlow and Michael Long (1837-1926) who served as the Mayor of Penrith for a lengthy period.

Building

Long's House is a single storey, red-brown, double-bricked Federation-style dwelling. The guttering has been replaced and the roof has been reclad with green corrugated iron, although the three decorative chimneys remain. On the northern side a modern entrance with awning has been constructed. Internally are polished timber floors, plastered walls and pressed tin ceilings. To increase usable space for the café, an interior wall was removed and the verandah enclosed. A fully equipped kitchen has also been installed in the north-eastern corner of the house and a large corrugated iron rainwater tank added.

Current State

By the 1980s Long's House was used as the Gravel Company's office, and is currently situated in the Penrith Lakes Development Corporation's operational compound in the southern area of the Scheme. It is presently a café and tourist store run by the Muru Mittigar, as well as an office for a 'Work for the Dole' Scheme. The main Penrith Lakes Scheme office complex consisting of Allen Long's House and garden lies slightly north of Long's House, overlooking rehabilitated parkland and lakes. The two residential buildings are in excellent condition and their continued use as a café/tourist store and office facility ensures that they are maintained to high standards.

Although modifications such as the roof replacement of Long's House have occurred, a large portion of original fabric survives.

Heritage Significance

Situated on land granted to free settler William Chapman in 1804, Long's House was deemed to be of high historical, aesthetic, social and scientific significance at a local level. It provides evidence for the notion of colonial social discrimination between free settlers and emancipists, being by far the largest single grant portion within the valley. Although not rare within the Sydney region, the house is a fine example of a federation-style residence, built in the early twentieth century. It is a significant historic landscape item from this later settlement period, and is significant for its association with the Long family, particularly Allen Long's house. Allen was the son of Jane Brownlow and Michael Long a long-serving Mayor of Penrith. He built the house adjacent to the property where his family had previously lived. Through the Longs' strong association with the Castlereagh community Long's House and Allen Long's House contribute to the Scheme area's 'a sense of place'.

G2.5 Lander's Inn

Historical Context

The Landers Inn complex was built on an 80 acre land grant initially made to Robert Smith in 1803. Although there were five inns in Castlereagh, little is known about any of them because the inns tended to change names and ownership somewhat frequently. Despite this confusion, the first of the Castlereagh inns appears to have been Landers Oddfellow(s) Inn, which at some point was run by James Landers. The 'Welcome Inn' had been established on Smith's original grant, by 1841, owned by William Landers, James Landers' son. However, James Lander did not purchase the 80 acres of Smith's grant until March 1843, for which he paid £1300, two years after the Welcome Inn was said to have been built. James Landers was the publican of 'The Oddfellows Inn', here from 1844-1846 as recorded in the Publicans License Index. However, Michael Longs recollections detailed that Landers Oddfellow(s) Inn was not built until about 1864.

From 1885, Landers Inn had a number of short-term owners and in about 1930 was converted to a Californian bungalow style residence by removing the top storey and erecting extensions around the core of the older inn. The various outbuildings were left unaltered including the sandstone stable block, and there may have been a 'dump site' related to the inn.

Building

The Welcome Inn, later renamed Landers Oddfellow(s) Inn was a two-storey rendered brick building thought to have been established in 1841, although possibly as late as the 1860s. The lower floor retains a central hallway and five rooms, from the original layout and much of the joinery is cedar decorated in an early Victorian style. The windows are double hung sash with a single pane in the lower sash and five panes in the upper sash, sandstone sills, and appear to be original. The entrance faces west and the door appears to be original.

In the 1920s, the Inn was transformed into a Californian bungalow by removal of the upper level and the addition of a large hipped tile roof extending beyond the former external walls to cover a bricked verandah to the north, south and east of the building. A third construction phase consisted of a large brick extension with hipped tile roof on the western side of the residence, a southern verandah and double hung sash timber windows. The final works enclosed the southern section of the verandah.

The sandstone stables to the south are thought to have been from the same construction period, however, they may have had initially provided a different function, as inferred the unusual layout and barred windows.

Current State

Lander's Inn is currently situated on a level grassed area with paddocks to the north and south. Much of the land to the west has been quarried and the Blue Mountains and Nepean River lie beyond this. The residence is generally in fairly good condition except for a few cracks in the structure. Re-painting and re-plastering has been undertaken to combat the affects of rising damp. The former roof is hanging displaced above the front doorway.

The sandstone structure is in a state of extreme disrepair, although the surviving sandstone walls themselves appear to be structurally sound. The upper storey floor is rotting and unsafe, directly relating to the missing roof, the timber lintel over the east doorway has collapsed, and on the ground floor there only remains a small area of flagging. The collapsed lintel is supporting the only one of three sandstone courses remaining, although it has required propping so that the course does not fall and result in serious damage to the building. The remaining two timber lintels appear to be in good working order.

Heritage Significance

The Lander's Inn Complex, at 1240 Castlereagh Road, comprises of the former Inn, now bungalow, sandstone stables, gardens and rich archaeological resources. The Lander's Inn Group was determined to be of high historical, social, aesthetic and scientific significance at a State and local level. The Landers family were locally significant, and the complex has strong ties to their history, as well as to grantee Robert Smith. It displays aspects of its growth from an early nineteenth century convict stockade, stables then storage area and as an inn with its conversion to a Californian Bungalow residence and essentially ongoing alteration to present. The sandstone stables are visually prominent and aesthetically distinctive, and are important in defining the community's sense of place.

The current homestead encapsulates the relatively intact, mid nineteenth century inn, in a structurally sound condition. This is an extremely rare scenario,

providing a useful resource for documenting early construction materials and techniques as well as detailing the character of public houses, accommodation and services. The site is a wealth of potential archaeological remains and may include a well, rubbish pits possible and outbuilding remnants, with the stables also requiring further historical investigation. The building was potentially built around 1803 for use as a stockade or store used by the men who built Castlereagh Road, in which case the building would be extremely rare. Although generally unaltered, and still containing a large portion of original fabric, the stables building urgently requires repairs. The complex is currently owned by Penrith Lakes Development Corporation.

G2.6 MJ Fulton's House

Historical Context

William Cox was instructed to build a schoolhouse, church and parsonage as part of his Public Works programme on his arrival in Australia. Constructed in the township of Castlereagh, the works were finished by 1814 and comprised of two buildings; a church which doubled as a schoolhouse and a combined master's residence and parsonage costing a total of £100'.The school was Australia's first secondary school, and attended by young gentlemen. The Anglican Reverend Henry Fulton who travelled to Australia with Cox, continued to minister, as well as becoming the schoolmaster, and local magistrate. Claims exist that this land was first occupied in the 1860s and utilised for small-scale farming and dairying. However, if these ruins exist, they are considered distinct from Rev. Fulton's Parsonage (site) Henry Fulton and his wife Anne raised five children in the parsonage residence. Reverend Henry Fulton died in 1840, and was buried in Castlereagh Cemetery. The 40 acre property was granted to the Church of England in 1842 who remained the owners of the site until 1966 when they sold to Rio Pioneer Gravel Company.

Building

Fulton's Parsonage site remains are reportedly located on a section of Portion 99, 40 acres of glebe land adjoining the town of Old Castlereagh. The site is said to contain the vestiges of a two-storey brick parsonage with a separate kitchen and a number of outbuildings, including a coach-house and a stable.

Current State

There is no visible evidence of Fulton's Parsonage. There is some sandstone rubble adjacent to a narrow creek, which may be the only physical remains of the parsonage or associated outbuildings. The site itself is now a conservation area situated on the hillside, on Cranebrook Escarpment.

Heritage Significance

Fulton's Parsonage site was deemed to be of high historical, aesthetic, social and scientific significance at a State and local level. The site is of social significance to the local community, the Anglican Church, and descendents of the Fulton family.

Although only the approximate location of the archaeological site is known, it is considered highly likely to contain evidence on the settlement of Old Castlereagh from c.1814 onwards. Surface remains are no longer visible, however subsurface

remains including structural features, artefacts, stratigraphic deposits, refuse pits, perhaps a well, and possibly evidence of garden furrows may be present. Subsurface remains of this type would be extremely rare and associated with one of the earliest settlements in Australia.

G2.7 Mass Concrete House

Historical Context

The mass concrete ruin is situated on part of 38 acres initially purchased in 1874 by Joseph Daniel Single. A well-known figure in the Nepean community, Single was involved in several philanthropic works and associations, eventually becoming the Member for Nepean. Neither Single nor the successive owner Robert Wisdom lived on the property making it unlikely that the Mass Concrete House had been constructed by this time. Following Wisdom's death in 1890, the property was sold to Cecil and William Maybury, who in 1897 sold it again to an orchardist named Ernest Caban by whom the Mass Concrete House is thought to have been constructed. Between 1903 and 1912, the property changed ownership four times, and the later owners, Sherwood and Grice lived on the property from 1912, supporting a construction date of the early 1900s'. In 1932 the 25 acre property was sold to dairy farmers Andreas and Selma Holst. In 1960 or 1961 to River Sand & Gravel Pty Ltd, who had abandoned the property by 1975.

Building

The house was constructed of early concrete, from local materials (river pebbles have been found) in the traditional pise manner. The use of formwork in laying the concrete has given it the classification of 'mass concrete'. Presently only partially standing and fallen mass concrete walls remain. Poured in approximately 400 millimetre layers, the exterior of the walls were cement rendered and scored with lines to give the appearance of ashlar blocks. Interior walls were plastered. The house consisted of five rooms, including two bedrooms, kitchen dining and lounge room, and had a basic L-shape design. Under an external patio was a bathroom and septic toilet. The roof is thought to have been hipped and potentially featured Marseille tiling. The front windows were thought to have moulded decorative frames. The front verandah was supported by posts of Queen Anne-style, and it is this and the possible Marseille tiling that suggest the house was built prior to 1900, although a date of c.1900 is generally accepted. Few of these features have survived.

Current State

The ruins of a mass concrete house are located on the crest of a hill on the Cranebrook Escarpment, and are surrounded by early farming paddocks which all form part of a conservation area. The remains consist of standing and fallen mass concrete walls. None of the former roof frame or cladding, chimneys or windows survives, and much of the building has collapsed. Plaster is still evident in places on internals walls and remnant flooring could be present under the debris and vegetation.

The mass concrete ruins are in a severe state of decay, with no chance of repair, and continued deterioration. The immediate surrounds are overgrown with weeds and scrub, which allows very little ground visibility and hastens the decaying process.

Heritage Significance

Mass Concrete House Ruins were deemed to be of high historical, aesthetic, social and scientific significance at a local level. Prominently situated, they contribute to creating a 'sense of place' within the region, while presenting breathtaking views. The ruins remain largely intact and the unaltered surroundings have resulted in this area being declared part of a conservation area. Mass concrete is an unusual building technique, and given that there three other examples of mass concrete structures in the Castlereagh region, it is important to preserve these ruins for interpretative purposes.

The house itself is representative of the increase in small land holdings in the Castlereagh area during the early twentieth century. At this time the local dairy farming, market gardening and orchards developed significantly in order to fulfil the increased demand of a growing Sydney market. Joseph Daniel Single was an important character in the district who was well known and respected from the 1850s to 1900.

Appendix H

Landscape and Visual Assessment

H1 Landscape and Visual

H1.1 Baseline Conditions

The landscape of the site has been altered over time through extraction activities, filling of the areas, lake formation and the construction of roads and other infrastructure. Following extraction for mining purposes, the excavated areas are filled and revegetated with native grass and other suitable native species. More extensive revegetation projects have been undertaken in sections of the Scheme, most noticeably in the vicinity of the formed lakes (such as Cranebrook and Boyces Lakes). The result of differing land uses in the Scheme, including heritage conservation, private land use at the site of 'The Poplars', revegetation, mining and remediation and new facilities (such as the Whitewater stadium) is a widely varied and visually fragmented landscape.

H1.2 Assessment of Impacts

The proposal will not result in significant change of the proposed landform. Any changes would only reflect ongoing design changes resulting from improved modelling techniques.

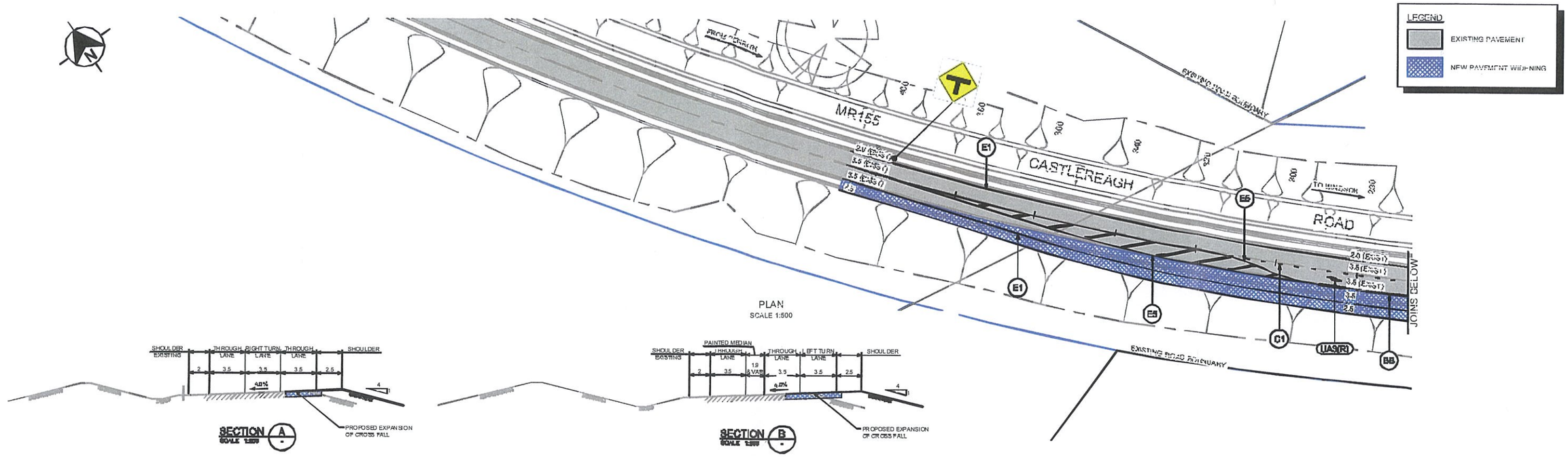
H1.3 Management Measures

Bunding is required by the existing consents, which prevent public viewing of roadworks, stockpiles, trucks and earthmoving machinery enclosed within the site. Additional lighting will not be required. Other measures for mitigating visual impacts described in DA2, DA3 and DA4 will be undertaken where appropriate.

The impact of the modification on Landscape and Visual is considered to be negligible

Appendix I

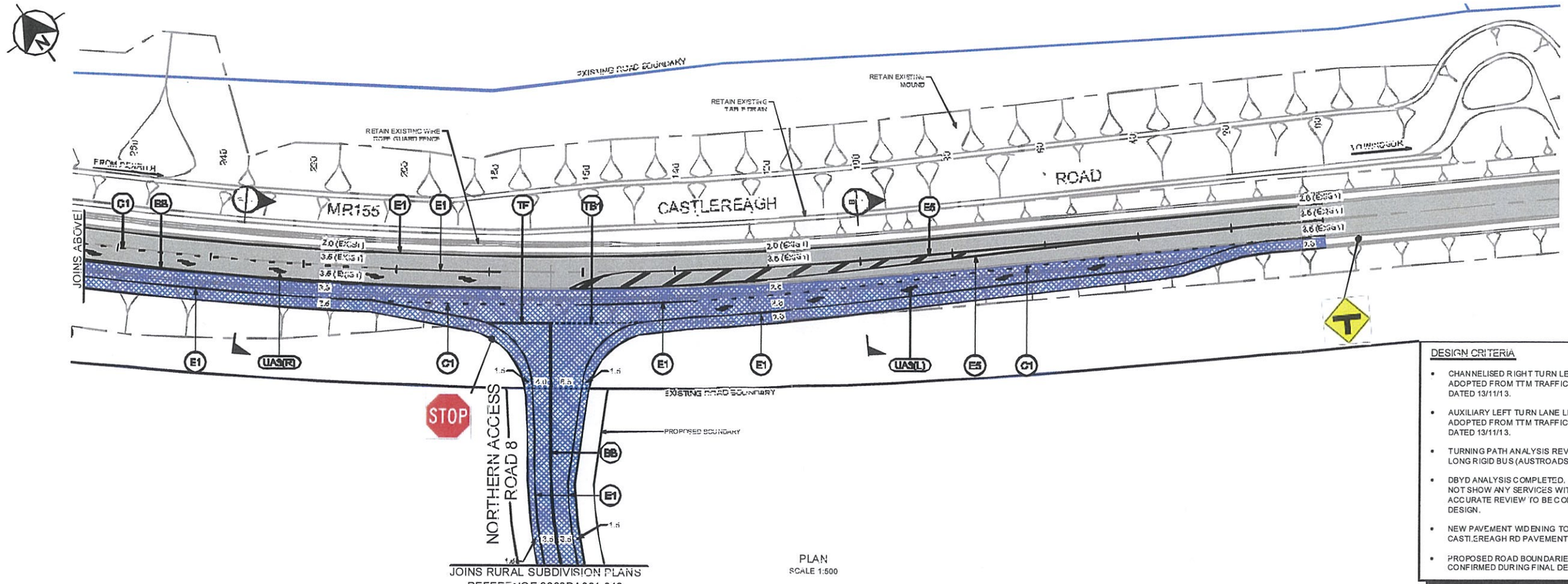
Preliminary Design for road network upgrade adjacent to Gate 3



PLAN
SCALE 1:500

SECTION A
SCALE 1:200

SECTION B
SCALE 1:200



PLAN
SCALE 1:500

1:500 (AT A1) 10 0 10 20 30 40 50 METRES

1:200 (AT A1) 4 2 0 4 8 12 16 20 METRES

DESIGN CRITERIA

- CHANNELISED RIGHT TURN LENGTH (137.5m INCLUDING TAPER) ADOPTED FROM TTM TRAFFIC REPORT 13SYT0024TRep1311i3 DATED 13/11/13.
- AUXILIARY LEFT TURN LANE LENGTH (125m INCLUDING TAPER) ADOPTED FROM TTM TRAFFIC REPORT 13SYT0024TRep131113 DATED 13/11/13.
- TURNING PATH ANALYSIS REVIEWED. DESIGN VEHICLE 14.5m LONG RIGID BUS (AUSTROADS 2006)
- DBYD ANALYSIS COMPLETED. UTILITY AUTHORITY PLANS DO NOT SHOW ANY SERVICES WITHIN ROAD RESERVE. MORE ACCURATE REVIEW TO BE COMPLETED DURING DETAIL DESIGN.
- NEW PAVEMENT WIDENING TO MATCH EXISTING CASTLEREAGH RD PAVEMENT DESIGN SUBJECT TO TESTING.
- PROPOSED ROAD BOUNDARIES SHOWN ON PLAN TO BE CONFIRMED DURING FINAL DETAIL DESIGN

CLIENT: PENRITH LAKES

THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS PART OF AN APPROVED CONSTRUCTION CERTIFICATE.

ADVANCE COPY ONLY
NOT FOR CONSTRUCTION

ISSUE	AMENDMENT	DATE	BY
C	ISSUE FOR DA APPROVAL	09/12/13	KM
B	ISSUE FOR DA APPROVAL	22/11/13	KM
A	ISSUE FOR CLIENT REVIEW	15/11/13	KM

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DESIGNED JT
DRAWN JT
CHECKED PS

DATUM: A.H.D ORIGIN: M.G.A
SCALES: AS SHOWN

PENRITH CITY COUNCIL
INTERSECTION WORKS
UPGRADE TO MR155 CASTLEREAGH ROAD
CONCEPT DESIGN
NORTHERN ACCESS INTERSECTION

PLAN No. 9600-DAR-002 C
FILE No. 9600
SHEET 002 OF --- SHEETS

Plotted: 9 Dec 2013 @ 2:43:20 PM File Name: J:\9600\DR\DS_DAR - Development Application Approval Plans\9600-DAR-002.dwg