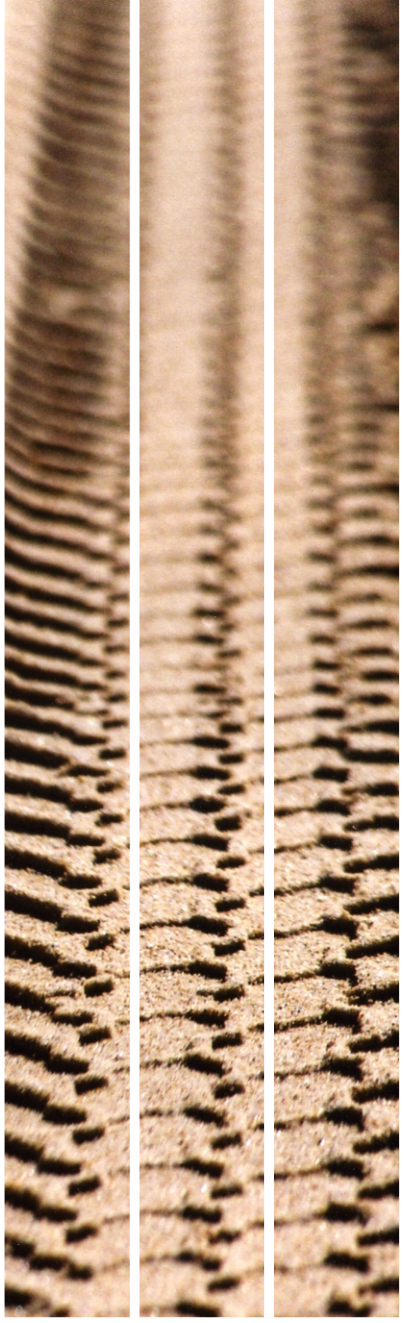
ENVIRONMENTAL ASSESSMENT



Modifications to Mackas Sand
Extraction Operations on Lot 218
Salt Ash, NSW

MACKA'S SAND PTY LTD

JULY 2015

ENVIRONMENTAL ASSESSMENT OF MODIFICATION TO MACKAS SAND EXTRACTION OPERATIONS

Lot 218 DP 1044608, Salt Ash, NSW

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Mackas Sand

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Report No.	1646/R55/FINAL
Date:	July 2015

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1.0 Introduction

1.1 Overview

1.1.1 Background

Major Project Approval 08_0142 (PA08_0142) was granted on 20 September 2009 to Mackas Sand Pty Ltd (Mackas Sand) for the extraction of up to 2 million tonnes of sand annually from Lot 218 DP 1044608 and Lot 220 DP 1049608 in Salt Ash, Port Stephens (refer to **Figure 1.1**). Sand extraction commenced in Lot 220 in November 2009, while extraction in Lot 218 commenced in February 2015.

The Major Project Approval was modified by the Planning Assessment Commission (PAC) on 30 September 2013. This approval related to the establishment of an alternative access route to Lot 218 and incorporated additional conditions of approval in relation to impact assessment and operational criteria.

Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Mackas Sand to undertake the necessary environmental assessments for the proposed modification. The modification proposal is being assessed under Section 75W of the Part 3A Transitional Provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1.2 The Proponent

Mackas Sand currently has approval to undertake sand extraction operations on Lot 218 and Lot 220 under agreement with the landowners, Worimi Local Aboriginal Land Council (WLALC). WLALC was formed under the *Aboriginal Land Rights Act 1983*. The objectives of the WLALC are to improve, protect and foster the best interests of all Aboriginal people within the WLALC area and other people who are members of the Council.

1.1.3 The Proposed Modification

The modification proposal relates to the modification of truck movements (in and out) of Lot 218.

Mackas Sand is now seeking approval for a further modification of PA08_0142 to allow 24 laden truck movements out per hour, plus 24 truck movements in per hour, from Lot 218 between 7.00 am and 10.00 pm Monday to Friday and 7.00 am and 4.00 pm Saturdays. Approval is also sought to allow an increase in the truck movements during the 5.00 am to 7.00 am shoulder period Monday to Friday (from 5 to 14 laden trucks) and during the 6.00 am to 7.00 am shoulder period on Saturdays (from 5 to 9 laden trucks). It is not proposed to alter truck movements on Sundays and Public Holidays or during the 5.00 am to 6.00 am shoulder period on Saturdays, or alter the truck movements from Lot 220. Further, no change is being sought to the maximum annual tonnage of sand that is allowed to be extracted from Lot 218 or Lot 220.

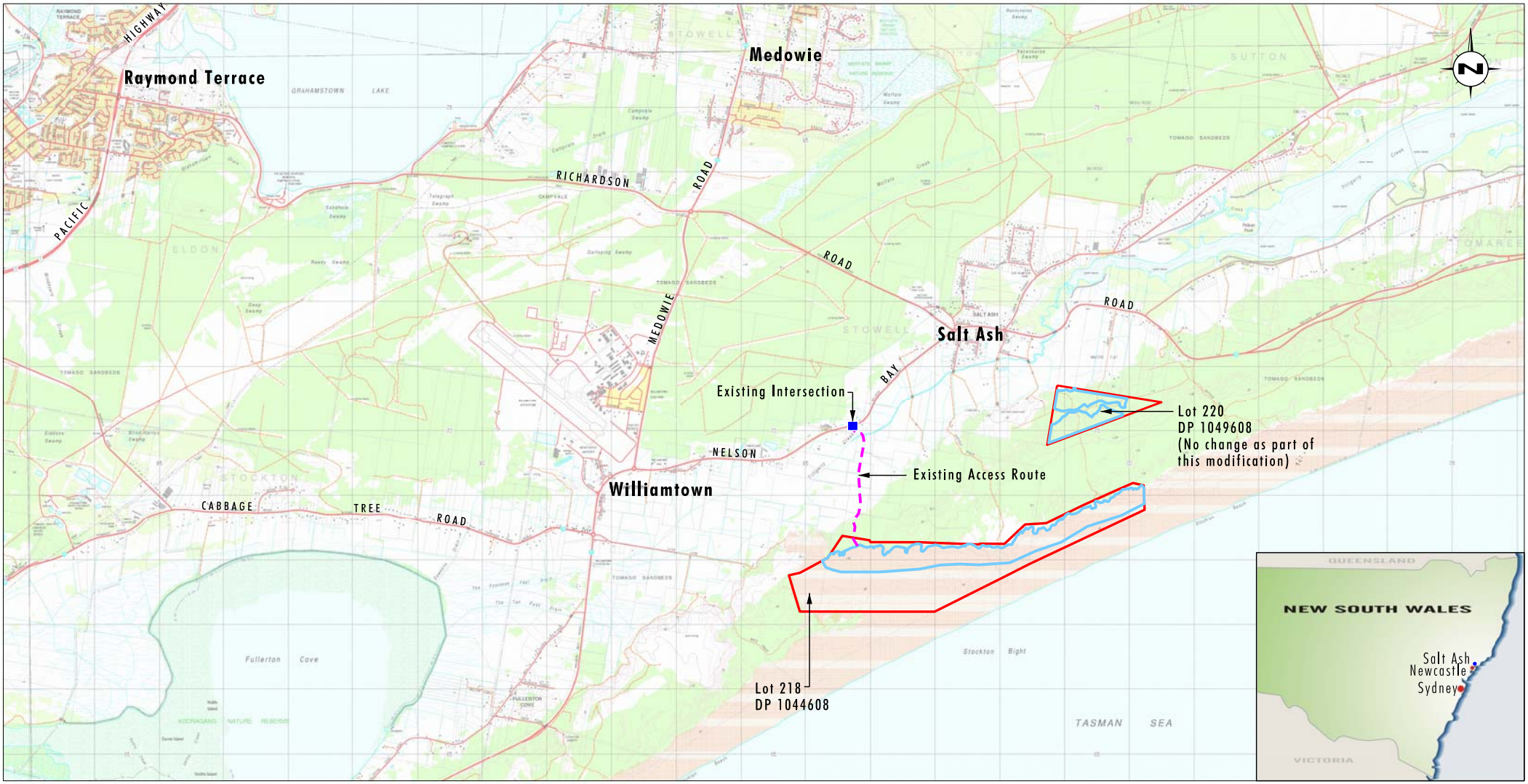


Image Source: Department of Lands (2006)

Legend

- Lot Boundaries
- Approval Areas
- Existing Access Route
- Existing Intersection Location

FIGURE 1.1

Locality Plan

File Name (A4): R55/1646_419.dgn
20150716 14.17

Table 1.1 Approved and Proposed Truck Movements from Lot 218

Transportation Period	Approved Truck Movements per hour (in plus out)	Proposed Truck Movements per hour (in plus out)
Monday to Friday Shoulder (5.00 am to 7.00 am)	10	28
Saturday Shoulder (5.00 am to 6.00 am)	10	No change
Saturday Shoulder (6.00 am to 7.00 am)	10	18
Monday to Friday 7.00 am to 10.00 pm)	16	48
Saturday (7.00 am to 4.00 pm)	16	48
Sundays and Public Holidays	10[1]	No change

Note 1: Combined 10 truck movements (in plus out) from Lot 218 and Lot 220 (i.e. total of 10 truck movements (in plus out) per hour).

1.2 Approval Requirements

The original proposal satisfied the definition of a Major Project under *State Environmental Planning Policy (Major Development) 2005* and was approved under, the now repealed, Part 3A of the EP&A Act by the Minister for the former Department of Planning (DoP) (now Department of Planning and Environment – DP&E).

Accordingly, this modification application has been prepared to address the transitional requirements of Part 3A of the EP&A Act, the requirements of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and amendments.

1.3 Consultation

1.3.1 Agency Consultation

Consultation with government agencies has previously been undertaken during preparation of the environmental assessments (EAs, including the 2013 modification), during and following preparation of the management plans required by PA08_0142 and during the EA undertaken during the modification process. This has included consultation with:

- DP&E;
- Port Stephens Council (PSC); and
- Roads and Maritime Services (RMS).

It was not considered necessary to undertake any additional consultation with government agencies as part of the current application to modify the PA08_0142 as the only change currently being sought is to the number of truck movements permitted per hour.

1.3.2 Community Consultation

There has been extensive consultation undertaken with the local community throughout the approval processes and during the operation of the existing sand extraction operation. This has included the establishment of a Community Consultative Committee (CCC) to encourage effective communication between the proponent of the project (including the Environmental Managers employed by Mackas Sand) and the local community and holding a panel hearing into the previous modification.

In the lead up to the preparation of the current modification application, Mackas Sand has been actively engaged with residents in the immediate vicinity of the alternative access road to/from Lot 218 that was approved by the PAC on 30 September 2013. Condition 9(b) of PA08_0142 identifies four potentially affected residents adjacent to the intersection of the approved access road and Nelson Bay Road. All of these residents have confirmed in writing that they have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5 am and 10 pm Monday to Saturday, or between the hours of 8 am to 12 pm on Sundays and public holidays.

Copies of these signed letters confirming no objection to the currently proposed modification can be found at **Appendix 1.**

1.3.3 Worimi Local Aboriginal Land Council and NSW Aboriginal Land Council

Mackas Sand has also actively engaged the Worimi LALC and the NSW ALC regarding the proposed modification to truck movements approved under PA08_0142. The matter was discussed with the Worimi LALC board and raised at the NSW ALC meeting on 18 June 2015 and consent was granted for the proposed modification as outlined above (refer to **Appendix 2**).

1.4 Environmental Assessment team

This EA was prepared by Umwelt (Australia) Pty Limited on behalf of Mackas Sand. Specialist traffic assessment has been provided by GHD.

1.5 Structure of the Environmental Assessment

An overview of the structure of this EA is provided below:

- **Section 1** introduces the modification proposal, outlines the background to the proposal, provides a summary of key details, and outlines the structure of the EA.
- **Section 2** contains a detailed description of the modification proposal, the study area and the consideration of alternatives.
- **Section 3** describes the planning context and environmental context for the proposal, including the applicability of Commonwealth and State legislation.
- **Section 4** contains a comprehensive analysis and assessment of the key environmental issues relevant to the proposal, including direct and cumulative impacts.
- **Section 5** contains a conclusion and justification regarding the proposed modifications to PA08_0142.
- **Section 6** provides a list of references referred to in the EA.

2.0 Description of the Proposed Modifications

The modification proposal relates to an increase in truck movements (in and out) at Lot 218, which forms part of the site approved for sand extraction in accordance with PA08_0142. It is not intended to modify the maximum annual amount of sand extraction from the approved extraction areas located within Lot 218 DP 1044608 and Lot 220 DP 1049608.

The proposed modification seeks to amend Condition 4B of Schedule 3 of PA08_0142 to allow 24 laden truck movements out per hour, plus 24 truck movements in per hour, from Lot 218 between 7.00 am and 10.00 pm Monday to Friday and 7.00 am and 4.00 pm Saturdays. Approval is also sought to allow an increase in the truck movements during the 5.00 am to 7.00 am shoulder period Monday to Friday (from 5 to 14 laden trucks) and during the 6.00 am to 7.00 am shoulder period on Saturdays (from 5 to 9 laden trucks). It is not proposed to alter truck movements on Sundays and Public Holidays or during the 5.00 am to 6.00 am shoulder period on Saturdays, or alter the truck movements from Lot 220. Further, no change is being sought to the maximum annual tonnage of sand that is allowed to be extracted from Lot 218 or Lot 220 (refer to **Table 1.1** above).

The limit placed on the PA08_0142 with respect to the transportation of sand product from the subject site includes the terms of Condition 6 of Schedule 2, which states:

> *6. The proponent shall not transport, or permit to be transported, more than:*
>
> *a) 1,000,000 tonnes of product in a calendar year from Lot 218; and*
>
> *b) 1,000,000 tonnes of product in a calendar year from Lot 220.*

The current restrictions on truck movements imposed on the operation by Condition 4B of Schedule 3 does not allow the approved tonnage of sand product to be transported from Lot 218 annually without operating at maximum permitted truck movements per hour for extended hours of every day of operation. This is not practically achievable. In order to achieve the approved amount of sand to be transported from the site, it is necessary that movements occur during the Shoulder period (i.e. the period from 5 am to 7 am Monday to Friday) prescribed by PA08-0142 and on Sundays and Public Holidays.

The proposed modification to Condition 4B will enable Mackas Sand to transport the sand extracted from Lot 218 on DP 1044608 to the approved amount of up to 1 million tonnes annually and will assist in reducing the overall need for significant truck movements during the Shoulder period and on Sundays and Public Holidays. Sand extraction at Lot 218 at full operation will utilise two loaders each capable for loading approximately 12 trucks per hour (i.e. 24 laden trucks per hour). The proposed modification will enable a more effective and efficient use of the two loaders.

Mackas Sand has recently installed an hourly truck counter on its weighbridge associated with its operations. This provides a running count of the number of trucks leaving the site on an hourly basis. This system is used to control the total truck movements from the site per hour.

Accordingly, it is requested that Condition 4B of Schedule 3 be modified to read as follows:

> *4B. The Proponent shall ensure, for the use of the Alternative access road that:*
>
> *a) a speed limit of 40km/h is applied and enforced for all vehicles;*

b) *trucks slowing to use the intersection of the access road and Nelson Bay Road do not use engine or compression braking systems;*

c) *truck movements (in plus out) do not exceed 28 per hour during the 5 am to 7 am Shoulder period Mondays to Fridays;*

d) *truck movements (in plus out) do not exceed 10 per hour during the 5 am to 6 am Shoulder period on Saturday;*

e) *truck movements (in plus out) do not exceed 18 per hour during the 6 am to 7 am Shoulder period on Saturday;*

f) *truck movements (in plus out) do not exceed 48 per hour between 7 am and 10 pm, Mondays to Fridays;*

g) *truck movements (in plus out) do not exceed 48 per hour between 7 am and 4 pm on Saturdays; and*

h) *combined truck movements (in plus out) from Lot 218 and Lot 220 do not exceed 10 per hour in total on Sundays and Public Holidays.*

3.0 Planning Context

3.1 Commonwealth Legislation

3.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires any action that has, or is likely to have, a significant impact on Commonwealth land or Matters of National Environmental Significance (MNES) to obtain approval of the Commonwealth Minister for the Environment. These matters are:

- World Heritage properties;
- National Heritage Places;
- Wetlands of international importance;
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mines); and
- a water resource, in relation to coal seam gas development and large coal mining development.

The proposed modification relates to an increase in truck movements only and presents no impact or threat to any MNES that have already been considered in the previous approval and modification.

3.1.2 Native Title Act 1993

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

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

Native Title claims are investigated by the National Native Title Tribunal and determined by the Federal Court of Australia.

On 28 November 2005, it was determined that Native Title did not exist for an area that included Lots 218 and 220.

3.2 State Legislation

3.2.1 Environmental Planning and Assessment Act 1979

The original proposal satisfied the definition of a Major Project under the State Environmental Planning Policy (Major Development) 2005 and approval was given in accordance with the requirements of the now repealed Part 3A of the EP&A Act. Modifications to projects approved under Part 3A that are outside the scope of the original approval are permitted with consent under Section 75W of the EP&A Act in accordance with the relevant transitional provisions. The Minister for Planning and Environment is the determining authority for modifications under Section 75W of the EP&A Act.

3.2.2 Aboriginal Land Rights Act 1983

Under the *Aboriginal Land Rights Act 1983* (ALR Act), the NSW Aboriginal Land Council has oversight for land dealings associated with Local Aboriginal Land Council's landholdings. At its meeting held on 18 June 2015, the NSW Aboriginal Land Council issued its consent for the modification of the Project Approval in relation to the Mackas Sand Project – Application No. 08_0142 so as to allow an increase in the maximum number of trucks permitted to cart sand from Lot 218 in DP 104608 pursuant to section 106 of the ALR Act (see **Appendix 2**).

3.2.3 Summary of Other State Legislation

Table 3.1 discusses the application of other NSW legislation to the proposal.

Table 3.1 NSW Legislation

Legislation	Key Requirements	Relevance to the Proposal
Heritage Act 1977	Approval is required from the Heritage Council of NSW to disturb or excavate land where this will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed.	No approval is required under this legislation for projects assessed under Part 3A of the EP&A Act.
National Parks and Wildlife Act 1974	Approval is required from OEH to destroy, deface or damage; or cause or permit the destruction of or damage to an Aboriginal object or Aboriginal Place.	No approval is required under this legislation for projects assessed under Part 3A of the EP&A Act.
Native Vegetation Act 2003	Approval is required under this Act from the relevant Local Land Service (LLS) (formerly Catchment Management Authority (CMA)) to clear native vegetation in certain circumstances.	No approval is required under this legislation for projects assessed under Part 3A of the EP&A Act.

Legislation	Key Requirements	Relevance to the Proposal
Protection of the Environment Operations Act 1997	Environment Protection Licences (EPLs) are required from OEH for 'scheduled activities' and 'scheduled development work'.	The sand extractive activities approved under PA08_0142 are subject to EPL 13218. No additional EPL, or variation to the existing EPL, will be required for the proposed modification to the approved Project.
Roads Act 1993	Development that affects a public road, Crown road, highway, main road, freeway or tollway requires approval from the NSW Roads and Maritime Services (RMS) or the local Council under this Act.	The proposed modification will not affect a public road, Crown road, highway, main road, freeway or tollway and approval is therefore not required for the Project.
Threatened Species Conservation Act	Approval is required to: (a) harm any animal that is of, or is part of, a threatened species, population or ecological community; (b) pick any plant that is of, or is part of, a threatened species, population or ecological community; (c) damage critical habitat; or (d) damage habitat of a threatened species, population or ecological community.	The proposed modification is for an increase to truck movements only and will not result in additional disturbance threatened species protected by the legislation.
Water Management Act 2003	Approval is required to interfere with any groundwater sources contained in the Tomago, Tomaree and Stockton aquifers in accordance with the Water Sharing Plan for the Tomago-Tomaree-Stockton Groundwater Sources 2003, which was made in accordance with this legislation.	No approvals under the *Water Management Act 2003* are sought at this time. A water access licence may be sought in the future but will be the subject of a separate application.

3.2.3.1 Hunter Water Regulations 2010

The *Hunter Water Regulations 2010* are a regulation under the *Hunter Water Act 1991* that applies to the Chichester, Grahamstown, Nelson Bay, North Stockton and Tomago Catchment Areas. The proposal lies within the North Stockton Catchment. Under Clause 10 (1) of the Regulation, a person can only engage in an extractive industry with an approval given by the Director-General of the Department of Trade and Investment.

A permit under the *Hunter Water Regulations 2010* for sand extraction operations on Lot 218 and Lot 220 was granted on 7 June 2012. This is still deemed to be a valid permit as the current modification application does not alter the approved maximum annual extraction of sand from Lot 218 or Lot 220.

3.3 Local Planning and Regional Planning Instruments

3.3.1 Port Stephens Local Environmental Plan 2013

The proposal has been considered in accordance with the provisions of the Port Stephens Local Environmental Plan (LEP) 2013. This plan sets the broad planning framework for development in the Port Stephens local government area (LGA). The proposed operations are located within Zone E3 – Environmental Management. The objectives of this zone are as follows:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To provide for a limited range of development that does not have an adverse effect on those values.

The proposed modification is considered to be consistent with the objectives of the zone.

3.3.2 Port Stephens Development Control Plan 2007

The Port Stephens Development Control Plan 2007 (the DCP) provides guidelines for development within the Port Stephens LGA. However, under Section 75R of the EP&A Act, the DCP does not apply to projects being assessed under Part 3A of the EP&A Act.

3.3.3 Port Stephens Section 94 Development Contributions Plan 2007

The Port Stephens Council (PSC) *Section 94 Development Contributions Plan 2007* provides a framework for Council to obtain contributions from developers toward the provision of public amenities, services and infrastructure required as a consequence of their development.

The plan recognises the substantial costs associated with maintaining the local council's road network for road haulage from extractive and other industrial sources by regulating the per-tonne cost of haulage in relation to CPI. In accordance with Schedule 2, Condition 13 of PA08_0142, Mackas Sand currently pays PSC contributions for road works in accordance with the PSC *Section 94 Development Contributions Plan 2007*.

The current application to modify PA08_0142 will not increase the number of truck movements on any roads managed by Port Stephens Council and, therefore, will not require any alteration to Condition 13 outlined above.

3.3.4 Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources 2004

The *Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources 2004* (WSPGWS) commenced on 1 July 2004. The WSPGWS was due for extension/replacement in July 2014. In May 2014, the Minister approved the extension of the plan until its date of replacement (by 1 July 2015 or sooner).

The Study Area is located in the Stockton Groundwater Source area of the Tomago Tomaree Stockton Groundwater Sources area. The proposed modification does not affect the groundwater source and an approval under the *Water Management Act 2003* is not required at this time. Should a water access licence be required, it would be the subject of a separate application.

3.4 Aquifer Interference Policy

The Aquifer Interference Policy (AIP) provides details of the role and requirements of the Minister administering the *Water Management Act 2000* in the water licensing and assessment processes for aquifer interference activities under the *Water Management Act 2000* and other relevant legislative frameworks.

The AIP applies to all activities that penetrate, interfere, obstruct, take or dispose with/of water in an aquifer. The proposed modification is only related to an increase in truck movements and no interference of the aquifer is proposed, as such no further assessment of the proposal against the AIP is required.

4.0 Environmental Assessment

4.1 Relevant Previous Work and Conditions

Potential environmental impacts of the extractive operations on Lot 218 were addressed as part of the EA (Umwelt, 2009) that accompanied Major Project Approval application PA08_0142 to the Minister for Planning. Through the review and submission process, appropriate environmental controls were refined with these controls set out in approval conditions granted on 20 September 2009, licence conditions and Statement of Commitments from the proponent, Mackas Sand.

Since that time, an Environmental Management Strategy (Umwelt, 2014) and a number of reports, management plans and monitoring programs have been prepared and submitted to relevant government agencies. These include:

- Maximum Extraction Depth Map;
- Groundwater Monitoring Report;
- Soil and Water Management Plan;
- Landscape Management Plan;
- Biodiversity Monitoring program;
- Weed Management Plan;
- Rehabilitation and Decommissioning Plan;
- Archaeology and Cultural Heritage Management Plan;
- Non-Indigenous Heritage Management Plan;
- Noise Management Plan;
- Summer 2011, Winter 2011, June 2012 and September 2012 Noise Monitoring Programs;
- Air Quality Monitoring Program;
- Unexploded Ordnance Management Plan;
- Operational Management Procedure;
- Hydrocarbon Spill Procedure; and
- Annual Environmental Management Reports for 2009-2011, 2011-2012, 2012-2013 and 2014.

Each of the above reports, management plans and monitoring programs are available on Mackas Sand website (www.mackassand.com.au.com). These reports detail the current status of sand extraction operations under PA08_0142.

As outlined above in **Section 1.1.1**, PA08_0142 was modified by the PAC to allow for an alternative access route to/from Lot 218. The conditions attached to PA08_0142 were updated to reflect the approved alternative access arrangements, including the impact assessment criteria in regard to the noise generated by the use of the alternative access road (Condition 4A) and limitations to truck movements (Condition 4B).

Prior to lodging this modification application, noise monitoring and assessment has been undertaken to ensure that impact assessment criteria prescribed by Condition 4A can still be achieved if the truck movements prescribed by Condition 4B were to be increased as currently proposed. Details of the outcomes of this assessment can be found in **Section 4.4** of this report below.

4.2 Environmental Risk Analysis

A preliminary environmental risk analysis, summarised in **Table 4.1**, identified issues considered as requiring detailed investigation in the EA.

Table 4.1 Potential Environmental Impacts Associated with the Project

Environmental Aspect	Preliminary Environmental Risk Analysis	Further Assessment Required for Project
Land Resources	The proposed modification will not result in any change to approved impacts on land resources.	No
Biodiversity	The proposed modification will not result in any change to approved impacts on biodiversity.	No
Aboriginal Archaeology and Cultural Heritage	The proposed modification will not result in any change to approved impacts on Aboriginal archaeology and cultural heritage.	No
Historical Heritage	The proposed modification will not result in any change to approved impacts on historical heritage.	No
Traffic and Access	The proposed modification to truck movements for Lot 218, from 16 truck movements (in plus out) per hour to 48 truck movements (in plus out) per hour has the potential to result in additional traffic and access impacts beyond those currently approved, the potential impact on traffic and the local road network has been assessed in a Traffic Impact Assessment (refer to **Appendix 3**) undertaken by GHD, which is summarised in **Section 4.3**.	Yes, refer to **Section 4.3**.
Noise	The potential for additional noise impacts as a result of the proposed modification to truck movements for Lot 218 has been assessed in a Noise Impact Assessment undertaken by Umwelt. Refer to **Section 4.4**.	Yes, refer to **Section 4.4**.
Air Quality	The proposed modification will not result in any change to approved impacts on air quality.	No

Environmental Aspect	Preliminary Environmental Risk Analysis	Further Assessment Required for Project
Water Resources	The proposed modification will not result in any change to approved impacts on water resources.	No
Visual Amenity	The proposed modification will not result in any change to approved impacts on visual amenity.	No
Greenhouse Gas	The detailed Greenhouse Gas Assessment prepared in 2009 for the approved Project was completed for the extraction of 1 million tonnes annually. The proposed modification will not change this and as such will not result in any change to approved impacts on greenhouse gas.	No
Hazard and Risk	The proposed modification will not result in any additional impacts in relation to hazard and risk.	No
Waste	The proposed modification will not result in any change to waste for the approved Project.	No
Socio-economic	The proposed modification will not create any adverse social-economic impacts, including demographic impacts, quality of life impacts, local housing market impacts, impacts to existing businesses in the area, and any resultant employment and income opportunities in the local area. In fact, the proposed modification will enable the existing operation to better achieve the levels of sand extraction approved as part of the original Project Approval and will potentially improve local employment levels as a result.	No
Rehabilitation	The proposed modification will not result in any change to rehabilitation for the approved Project.	No

4.3 Traffic

Mackas Sand engaged GHD to undertake a traffic impact assessment associated with the proposed increase in truck movements associated with the transport of sand from Lot 218. A copy of the traffic impact assessment can be found at **Appendix 3**. The report evaluates the impacts of the proposed modification of truck movements on the Richardson Road and Nelson Bay roundabout and the Nelson Bay Road site access.

The traffic impact assessment concludes that the site access and the intersection with Nelson Bay Road will continue to operate with spare capacity from 2015 to 2035, and that the existing road network will continue to operate with minimal negative impacts as a result of the proposed modification to the approved truck movements.

4.4 Noise

The noise assessment has been prepared in accordance with the *NSW Industrial Noise Policy* (INP) [Environment Protection Authority (EPA) 2000] and *NSW Road Noise Policy* [Department of Environment, Climate Change and Water *(DECCW)* 2011].

As presented in **Section 1.0,** Mackas Sand is seeking approval to modify development consent PA08_0142 to increase truck movements from Lot 218 between:

- 7.00 am and 10.00 pm Monday to Friday and between 7.00 am and 4.00 pm Saturdays from 16 truck movements per hour (in plus out) to 48 truck movements per hour (in plus out, making a total of 24 *laden* trucks per hour);
- 5.00 am and 7.00 am Monday to Friday from 10 truck movements per hour (in plus out) to 28 truck movements per hour (in plus out, making a total of 14 *laden* trucks per hour); and
- 6.00 am and 7.00 am Saturdays from 10 truck movements per hour (in plus out) to 18 truck movements per hour (in plus out, making a total of 9 *laden* trucks per hour).

It is not proposed to alter truck movements from Lot 220, or on Sundays and Public Holidays, or during the night time period outside of shoulder hours (10.00 pm to 5.00 am Monday to Saturday morning), or between 5.00 am and 6.00 am on Saturdays.

The noise impacts related to the proposed increase in truck movements have been assessed using two methodologies:

- as an industrial noise source under the INP (EPA, 2000) (in accordance with Section 1.3 of the INP and the application notes of the INP) for the proposed increase in heavy vehicle traffic on the private access road linking Nelson Bay Road and Lot 218; and
- as a road traffic noise source under the NSW Road Noise Policy (DECCW, 2011) for the proposed increase in road traffic associated with sand extraction from Lot 218 along Nelson Bay Road between Medowie Road and Richardson Road.

4.4.1 Noise Assessment for Private Access Road linking Nelson Bay Road and Lot 218

The INP (EPA, 2000) has two components for the assessment of industrial noise sources, intrusive noise impacts and noise amenity levels. When assessing the noise impact of industrial sources both components are considered for residential receivers. The noise environment adjacent to Nelson Bay Road was recorded during the preparation of the original EA (Umwelt, 2009). The results of the monitoring program and resulting criteria are discussed below.

Section 6 of the INP (EPA, 2000) requires the prediction of noise levels taking into account all the possible noise sources, operational durations, representative locations, topography and meteorological conditions. Due to the proximity of the residential receivers to the private access road and to Nelson Bay Road and the relatively flat terrain in the vicinity of the private access road to Lot 218, topography and meteorological effects were not included in the noise modelling.

Receiver Locations

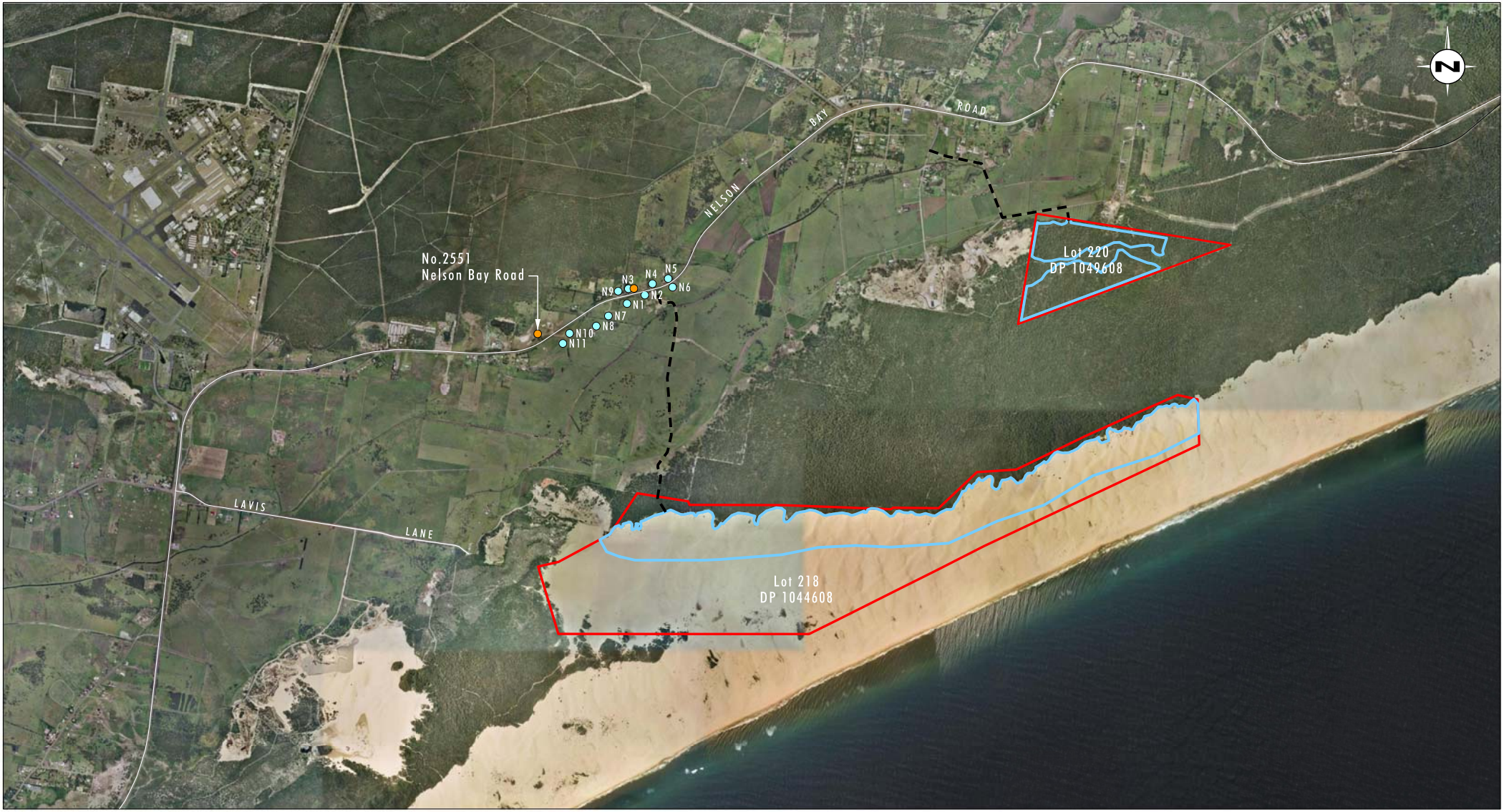
The *Environmental Assessment of Modifications to Mackas Sand Extraction Operations on Lot 218 and Lot 220 Salt Ash NSW* (Umwelt, 2012) identified that the use of the private access road would not result in any additional noise impacts from those set out in the original EA (Umwelt, 2009) other than for residences immediately adjacent to the intersection on Nelson Bay Road. Potentially affected receivers, representing the nearest residences to the private haul road, is shown on **Figure 4.1** and listed in **Table 4.2**.

Table 4.2 Monitoring Results, dB(A)

Receiver ID	Receiver Address
N1	2330 Nelson Bay Road, Williamtown
N2	2344 Nelson Bay Road, Williamtown
N3	2331 Nelson Bay Road, Williamtown
N4	2353 Nelson Bay Road, Williamtown
N5	2367 Nelson Bay Road, Williamtown
N6	2368 Nelson Bay Road, Williamtown
N7	2318 Nelson Bay Road, Williamtown
N8	2294 Nelson Bay Road, Williamtown
N9	6 Sansom Road, Williamtown
N10	2264 Nelson Bay Road, Williamtown
N11	2258 Nelson Bay Road, Williamtown

Existing Noise Environment

The typical noise environment of properties adjacent to Nelson Bay Road was recorded at 2251 Nelson Bay Road as a part of the Noise Impact Assessment for the original EA (Umwelt, 2009). The residence at 2251 Nelson Bay Road is located approximately 800 metres to the west of the intersection of the private access road and Nelson Bay Road (refer to **Figure 4.1**). The noise logger was located 80 metres from the centreline of Nelson Bay Road. The results of the monitoring program, reported as the underlying Rating Background Level (RBL) and the Mean $L_{Aeq, period}$ (where 'period' equals day, evening and night) are presented in **Table 4.3**.



Source: Department of Lands (2003)

0 0.5 1 2km
1:45 000

Legend

- Lot Boundaries (218 & 220)
- Approved Operational Area
- Site Access
- Noise Logging Location
- Noise Receiver Location

FIGURE 4.1

Private Access Road and Noise Receivers

File Name (A4): R55_V1/1646_418.dgn

Table 4.3 Monitoring Results, dB(A)

Location		2251 Nelson Bay Road			
Period		Day	Evening	Night	Shoulder
RBL		37.6	37.8	30.0	33.8
Intrusiveness (RBL+5)		43	43	35	39
Acceptable Amenity (rural receiver)		50	45	40	-
Measured LAeq		55.4	54.6	52.7	-
Table 2.2 industrial noise adjustment		-	-	-	-
High traffic noise adjustment		-10	-10	-10	-
Amenity Criterion		45	45	43	44
PSNL	LAeq, 15 min	43	43	35	39
	LAeq, period	45	45	43	44

Monday to Saturday, Day-time 7.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-7.00 am, Shoulder 5.00 am-7.00 am.
Sundays and Public Holidays, Day-time 8.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-8.00 am.

During the monitoring program, data affected by rain or wind speeds in excess of 5 m/s was excluded in accordance with the Section 3.4 of the INP (EPA, 2000). Meteorological data was obtained from the Bureau of Meteorology (BoM) Williamtown automatic weather station (AWS) located approximately 2 kilometres to the west of the private access road.

The noise levels presented in **Table 4.3** represent the underlying level of noise at the time of the original EA (Umwelt, 2009) at the monitoring location and show influence of traffic travelling along Nelson Bay Road.

More recent background monitoring data was collected in February 2015 at N3 (2331 Nelson Bay Road) for a period of two days as part of an investigation into truck acceleration noise from the acceleration lane from the private access road from Lot 218 onto Nelson Bay Road. The truck acceleration investigation found that the worst case recorded noise levels from trucks leaving the private access road (on Nelson Bay Road) were within the existing 1 hour road noise criteria at receiver N3. Subsequent analysis of the truck drive by noise levels measured at N3 found that 24 trucks per hour leaving Lot 218 would not exceed the existing 1 hour road traffic noise criteria listed in the development consent. It is noted that the existing development consent has classified Nelson Bay Road as a local road instead of an arterial road which has a $L_{Aeq,15\ hour}$ day time assessment criteria.

A background noise analysis from the February 2015 noise monitoring at N3 was undertaken to verify the validity of the background noise assessment from the original EA (Umwelt, 2009) and is presented in **Table 4.4.** N3 is located approximately 200 metres to the west of the intersection of the private access road and Nelson Bay Road (refer to **Figure 4.1**). The noise logger was located approximately 40 metres from the centreline of Nelson Bay Road. The results of the monitoring program, taking into account offset distance to Nelson Bay Road, indicate that between the times when the background noise monitoring was undertaken for the original EA (Umwelt, 2009) and 2015, daytime background noise levels are now higher, likely due to the influence of increased levels of general traffic on Nelson Bay Road.

Table 4.4 Monitoring Results, dB(A)

Location		2251 Nelson Bay Road			
Period		Day	Evening	Night	Shoulder
RBL		47.1	38.7	34.5	40.8
Intrusiveness (RBL+5)		52	44	39	46
Acceptable Amenity (rural receiver)		50	45	40	-
Measured LAeq		62.0	51.9	51.9	-
Table 2.2 industrial noise adjustment		-	-	-	-
High traffic noise adjustment		-10	-10	-10	-
Amenity Criterion		52	42	42	47
PSNL	LAeq, 15 min	52	44	39	46
	LAeq, period	52	42	42	47

Monday to Saturday, Day-time 7.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-7.00 am, Shoulder 5.00 am-7.00 am.
Sundays and Public Holidays, Day-time 8.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-8.00 am.

As the monitoring period of the February 2015 program was relatively short, this assessment has used the more conservative project specific noise levels from the original EA (Umwelt, 2009).

Application of the Noise Assessment Guidelines

Project-specific Noise Levels

The INP has two components for the assessment of industrial noise sources, intrusive noise impacts and noise amenity levels. When assessing the noise impact of industrial sources both components are considered for residential receivers.

The monitoring results presented in **Table 4.3** show that the rated background noise levels (RBL) at 2251 Nelson Bay Road are between 30 to 38 dB(A). The proximity of Nelson Bay Road to the monitoring location has some impact on the background noise environment during the day time and evening periods due to road traffic noise. The Intrusiveness Criteria, presented in **Table 4.3**, range from 35 dB(A) (the minimum possible intrusiveness criterion under the INP (EPA, 2000)) during the night to a maximum of 43 dB(A) during the day-time and evening periods.

The ambient noise levels, measured as $L_{Aeq, period}$ at the monitoring location are affected by road traffic noise from Nelson Bay Road. The INP (EPA, 2000) notes that where the ambient noise levels are affected by road traffic noise the amenity criteria would be set at 10 dB below the existing measured road traffic effected noise level. The Amenity Criteria, presented in **Table 4.3**, at 2251 Nelson Bay Road ranges from 43 dB(A) during the night-time period to a maximum of 45 dB(A) during the day-time and evening periods.

The day-time, evening and night-time project-specific noise levels (PSNL) for the properties adjacent to the private access road are presented in **Table 4.3**. In accordance with the INP (EPA, 2000) the PSNL for the morning shoulder period is the average of the night-time and day-time PSNLs.

Noise Modelling

The noise impacts from the increase in vehicle movements on the private access road were modelled using a line-of-site attenuation over distance model based on time of exposure for different vehicle speeds and setback distances. The predicted received $L_{Aeq,15minute}$ noise level associated with 48 truck movements per hour (in plus out, making a total of 24 *laden* trucks per hour) during the weekday INP (EPA, 2000) day time and evening periods, 28 truck movements per hour (in plus out, making a total of 14 *laden* trucks per hour) during the weekday shoulder period (5.00 am to 7.00 am Monday to Saturday), and 18 truck movements per hour (in plus out, making a total of 9 *laden* trucks per hour) during the second half of Saturday shoulder periods (6.00 am to 7.00 am), is presented in **Table 4.5**.

Table 4.5 Predicted $L_{Aeq,15minute}$ Noise Levels, dB(A)

Receiver	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Day Time Intrusiveness Criteria	43										
Predicted Day Time noise level 48 movements/hour 7.00 am to 6.00 pm Monday to Friday 7.00 am to 4.00 pm Saturdays	42	47	42	47	45	47	39	38	40	36	36
Evening Intrusiveness Criteria	43										
Predicted Evening noise level 48 movements/hour 6.00 pm to 10.00 pm Monday to Friday	42	47	42	47	45	47	39	38	40	36	36
Shoulder Intrusiveness Criteria	39										
Predicted Shoulder noise level 28 movements/hour 5.00 am to 7.00 am Monday to Friday	39	44	39	45	43	45	37	36	38	34	33
Shoulder Intrusiveness Criteria	39										
Predicted Shoulder noise level 18 movements/hour 6.00 am to 7.00 am Saturdays	38	42	37	43	41	43	35	34	36	32	32

Monday to Saturday, Day-time 7.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-7.00 am, Shoulder 5.00 am-7.00 am.
Sundays and Public Holidays, Day-time 8.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-8.00 am.

The results in **Table 4.5** indicate that the $L_{Aeq,15minute}$ noise levels due to trucks entering and leaving the site would achieve the day-time intrusiveness criteria at all the properties adjacent to the private access road with the exception of receivers N2, N4, N5 and N6.

The owners of the residences at receivers N2, N4, N5 and N6 have confirmed in writing that they have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5 am and 10 pm Monday to Saturday, or between the hours of 8 am to 12 pm on Sundays and public holidays. Copies of these signed letters confirming no objection to the currently proposed modification can be found in **Appendix 1**.

Notwithstanding the private agreements in place with receivers N2, N4, N5 and N6, the results of the February 2015 background noise monitoring indicate that the predicted noise levels at receivers N2, N4, N5 and N6 are likely to be within both the day time amenity and intrusiveness criteria based on levels of road traffic noise from Nelson Bay Road used in the original EA (Umwelt, 2009). As stated above, traffic noise levels have increased compared to those reported in the original EA.

4.4.2 Road Traffic Noise Assessment for Nelson Bay Road

The road traffic noise impacts associated with the proposed increase in truck movements associated with sand extraction from Lot 218 on Nelson Bay road between Medowie Road and Richardson Road were modelled using the *US Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.5 Look-Up Tables* (US Department of Transportation, 2004). TNM is a road traffic noise prediction and analysis model used to analyse road geometries including vehicle speeds, vehicle type, setback distances and the effectiveness of barriers.

Road Traffic Noise Criteria

OEH's *NSW Road Noise Policy* (DECCW, 2011) sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

Table 4.6 outlines the criteria relevant for the predicted increase in traffic volumes on Nelson Bay Road as a result of proposed increased truck movements.

Table 4.6 Road Noise Criteria, dB(A)

Road Category	Type of project/land use	Assessment Criteria dB(A)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq(15 hour) 60 (external)	LAeq(9 hour) 55 (external)

Source: *NSW Road Noise Policy* (DECCW 2011)

Where the criteria in **Table 4.6** are not achievable through feasible and reasonable mitigation measures, Section 3.41 of the *NSW Road Noise Policy* (DECCW, 2011) gives further guidance stating: 'any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

It is noted that the existing development consent has classified Nelson Bay Road as a local road instead of an arterial road which has a $L_{Aeq,15\ hour}$ day time assessment criteria. The traffic noise criteria as presented in **Table 4.6** are the Arterial road criteria as presented in the *NSW* Road Noise Policy (DECCW, 2011). A shoulder period criteria of LAeq(1 hour) 55 dB(A) has been assumed for the shoulder period between 5.00 am and 7.00 am Monday to Saturday.

Road Traffic Noise Modelling

Levels of existing road traffic were measured by GHD in May and June 2015 and predicted increases in road traffic levels are in accordance with traffic report (GHD, 2015) (refer to **Section 4.3** and **Appendix 3**). The US FHWA Traffic Noise Model (TNM) was used to model the pre and post noise impacts associated with the movement of traffic generated by the proposed increase in truck movements on Nelson Bay Road. The predicted increase in road traffic noise impacts due to the proposed increase in truck movements, based on the projected additional traffic volumes, is presented in **Tables 4.7** to **4.11**.

Table 4.7 Predicted Increase in NSW Road Noise Policy Weekday Day Time Road Traffic Noise Levels, dB(A)

Receiver	Criteria	Traffic Noise Levels, dB(A) LAeq,15hr					
		Existing – 2015			Predicted – 2035		
		No Modification[1]	Proposed Increase to 48 trucks/hr	Predicted Increase	No Modification[1]	Proposed Increase to 48 trucks/hr	Predicted Increase
N1	60 dB(A) - Day LAeq,15hr	58.6	60.5	1.9	59.5	61.1	1.6
N2	60 dB(A) - Day LAeq,15hr	67.6	69.0	1.4	68.4	69.7	1.3
N3	60 dB(A) - Day LAeq,15hr	61.8	63.5	1.7	62.6	64.1	1.5
N4	60 dB(A) - Day LAeq,15hr	61.8	63.5	1.7	62.6	64.1	1.5
N5	60 dB(A) - Day LAeq,15hr	67.6	69.0	1.4	68.4	69.7	1.3
N6	60 dB(A) - Day LAeq,15hr	64.0	65.6	1.6	64.9	66.2	1.3
N7	60 dB(A) - Day LAeq,15hr	55.5	57.5	2.0	56.4	58.1	1.7
N8	60 dB(A) - Day LAeq,15hr	53.3	55.3	2.0	54.2	55.9	1.7
N9	60 dB(A) - Day LAeq,15hr	61.8	63.5	1.7	62.6	64.1	1.5
N10	60 dB(A) - Day LAeq,15hr	60.0	61.8	1.8	60.9	62.4	1.5
N11	60 dB(A) - Day LAeq,15hr	55.5	57.5	2.0	56.4	58.1	1.7
Minimum residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (15 m)	60 dB(A) - Day LAeq,15hr	72.2	73.6	1.4	73.1	74.3	1.2
Average residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (64 m)	60 dB(A) - Day LAeq,15hr	58.6	60.5	1.9	59.5	61.1	1.6

Note 1: Assumes worst case that traffic numbers measured by GHD (2015) do not include traffic related to Mackas Sands approved operations.

Table 4.8 Predicted Increase in NSW Road Noise Policy Saturday Day Time Road Traffic Noise Levels, dB(A)

Receiver	Criteria	Traffic Noise Levels, dB(A) LAeq,15hr					
		Existing – 2015			Predicted – 2035		
		No Modification[1]	Proposed Increase to 48 trucks/hr	Predicted Increase	No Modification[1]	Proposed Increase to 48 trucks/hr	Predicted Increase
N1	60 dB(A) - Day LAeq,15hr	55.8	57.9	2.1	56.6	58.4	1.8
N2	60 dB(A) - Day LAeq,15hr	65.5	66.9	1.4	66.4	67.6	1.2
N3	60 dB(A) - Day LAeq,15hr	59.2	61.1	1.9	60.1	61.6	1.5
N4	60 dB(A) - Day LAeq,15hr	59.2	61.1	1.9	60.1	61.6	1.5
N5	60 dB(A) - Day LAeq,15hr	65.5	66.9	1.4	66.4	67.6	1.2
N6	60 dB(A) - Day LAeq,15hr	61.7	63.3	1.6	62.6	64	1.4
N7	60 dB(A) - Day LAeq,15hr	52.4	54.7	2.3	53.3	55.3	2.0
N8	60 dB(A) - Day LAeq,15hr	50.1	52.5	2.4	51	53	2.0
N9	60 dB(A) - Day LAeq,15hr	59.2	61.1	1.9	60.1	61.6	1.5
N10	60 dB(A) - Day LAeq,15hr	57.3	59.3	2.0	58.2	59.9	1.7
N11	60 dB(A) - Day LAeq,15hr	52.4	54.7	2.3	53.3	55.3	2
Minimum residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (15 m)	60 dB(A) - Day LAeq,15hr	70.3	71.6	1.3	71.1	72.2	1.1
Average residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (64 m)	60 dB(A) - Day LAeq,15hr	55.8	57.9	2.1	56.6	58.4	1.8

Note 1: Assumes worst case that traffic numbers measured by GHD (2015) do not include traffic related to Mackas Sands approved operations.

Table 4.9 Predicted Increase in Weekday Shoulder Period 5AM to 6AM Road Traffic Noise Levels, dB(A)

Receiver	Criteria	Traffic Noise Levels, dB(A) LAeq,1hr					
		Existing – 2015			Predicted – 2035		
		No Modification[1]	Proposed Increase to 28 trucks/hr	Predicted Increase	No Modification[1]	Proposed Increase to 28 trucks/hr	Predicted Increase
N1	55 dB(A) - Shoulder LAeq,1hr	56.7	58.4	1.7	57.6	59	1.4
N2	55 dB(A) - Shoulder LAeq,1hr	65.6	66.9	1.3	66.4	67.6	1.2
N3	55 dB(A) - Shoulder LAeq,1hr	59.8	61.4	1.6	60.7	62	1.3
N4	55 dB(A) - Shoulder LAeq,1hr	59.8	61.4	1.6	60.7	62	1.3
N5	55 dB(A) - Shoulder LAeq,1hr	65.6	66.9	1.3	66.4	67.6	1.2
N6	55 dB(A) - Shoulder LAeq,1hr	62	63.5	1.5	62.9	64.2	1.3
N7	55 dB(A) - Shoulder LAeq,1hr	53.6	55.4	1.8	54.5	56	1.5
N8	55 dB(A) - Shoulder LAeq,1hr	51.4	53.3	1.9	52.3	53.8	1.5
N9	55 dB(A) - Shoulder LAeq,1hr	59.8	61.4	1.6	60.7	62	1.3
N10	55 dB(A) - Shoulder LAeq,1hr	58.1	59.7	1.6	58.9	60.3	1.4
N11	55 dB(A) - Shoulder LAeq,1hr	53.6	55.4	1.8	54.5	56	1.5
Minimum residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (15 m)	55 dB(A) - Shoulder LAeq,1hr	70.2	71.5	1.3	71.1	72.2	1.1
Average residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (64 m)	55 dB(A) - Shoulder LAeq,1hr	56.7	58.4	1.7	57.6	59	1.4

Note 1: Assumes worst case that traffic numbers measured by GHD (2015) do not include traffic related to Mackas Sands approved operations.

Table 4.10 Predicted Increase in Weekday Shoulder Period 6AM to 7AM Road Traffic Noise Levels, dB(A).

Receiver	Criteria	Traffic Noise Levels, dB(A) LAeq,1hr					
		Existing – 2015			Predicted – 2035		
		No Modification[1]	Proposed Increase to 28 trucks/hr	Predicted Increase	No Modification[1]	Proposed Increase to 28 trucks/hr	Predicted Increase
N1	55 dB(A) - Shoulder LAeq,1hr	59.8	60.7	0.9	60.7	61.4	0.7
N2	55 dB(A) - Shoulder LAeq,1hr	68.7	69.4	0.7	69.5	70.1	0.6
N3	55 dB(A) - Shoulder LAeq,1hr	62.9	63.8	0.9	63.8	64.5	0.7
N4	55 dB(A) - Shoulder LAeq,1hr	62.9	63.8	0.9	63.8	64.5	0.7
N5	55 dB(A) - Shoulder LAeq,1hr	68.7	69.4	0.7	69.5	70.1	0.6
N6	55 dB(A) - Shoulder LAeq,1hr	65.2	66	0.8	66	66.7	0.7
N7	55 dB(A) - Shoulder LAeq,1hr	56.7	57.7	1.0	57.6	58.4	0.8
N8	55 dB(A) - Shoulder LAeq,1hr	54.5	55.5	1.0	55.4	56.2	0.8
N9	55 dB(A) - Shoulder LAeq,1hr	62.9	63.8	0.9	63.8	64.5	0.7
N10	55 dB(A) - Shoulder LAeq,1hr	61.2	62.1	0.9	62	62.8	0.8
N11	55 dB(A) - Shoulder LAeq,1hr	56.7	57.7	1.0	57.6	58.4	0.8
Minimum residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (15 m)	55 dB(A) - Shoulder LAeq,1hr	73.3	74	0.7	74.2	74.7	0.5
Average residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (64 m)	55 dB(A) - Shoulder LAeq,1hr	59.8	60.7	0.9	60.7	61.4	0.7

Note 1: Assumes worst case that traffic numbers measured by GHD (2015) do not include traffic related to Mackas Sands approved operations.

Table 4.11 Predicted Increase in Saturday Shoulder Period 6AM to 7AM Road Traffic Noise Levels, dB(A).

Receiver	Criteria	Traffic Noise Levels, dB(A) LAeq,1hr					
		Existing – 2015			Predicted – 2035		
		No Modification[1]	Proposed Increase to 18 trucks/hr	Predicted Increase	No Modification[1]	Proposed Increase to 18 trucks/hr	Predicted Increase
N1	55 dB(A) - Shoulder LAeq,1hr	54.2	56.1	1.9	55.1	56.7	1.6
N2	55 dB(A) - Shoulder LAeq,1hr	63.1	64.6	1.5	64	65.3	1.3
N3	55 dB(A) - Shoulder LAeq,1hr	57.3	59.1	1.8	58.2	59.7	1.5
N4	55 dB(A) - Shoulder LAeq,1hr	57.3	59.1	1.8	58.2	59.7	1.5
N5	55 dB(A) - Shoulder LAeq,1hr	63.1	64.6	1.5	64	65.3	1.3
N6	55 dB(A) - Shoulder LAeq,1hr	59.6	61.2	1.6	60.4	61.8	1.4
N7	55 dB(A) - Shoulder LAeq,1hr	51.1	53.1	2.0	52	53.7	1.7
N8	55 dB(A) - Shoulder LAeq,1hr	48.9	51	2.1	49.8	51.5	1.7
N9	55 dB(A) - Shoulder LAeq,1hr	57.3	59.1	1.8	58.2	59.7	1.5
N10	55 dB(A) - Shoulder LAeq,1hr	55.6	57.4	1.8	56.5	58	1.5
N11	55 dB(A) - Shoulder LAeq,1hr	51.1	53.1	2.0	52	53.7	1.7
Minimum residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (15 m)	55 dB(A) - Shoulder LAeq,1hr	67.7	69.2	1.5	68.6	69.8	1.2
Average residence setback to Nelson Bay Rd between Medowie Road and Richardson Road (64 m)	55 dB(A) - Shoulder LAeq,1hr	54.2	56.1	1.9	55.1	56.7	1.6

Note 1: Assumes worst case that traffic numbers measured by GHD (2015) do not include traffic related to Mackas Sands approved operations.

The results presented in **Tables 4.7** to **4.11** indicate the traffic volumes on Nelson Bay Road currently result in road traffic noise levels, depending on setback distances from the road, could exceed the *NSW Road Noise Policy* (DECCW, 2011) criteria presented in **Table 4.6**.

Tables 4.7 to **4.11** indicate that the noise levels exceed the day-time $L_{Aeq(15\ hour)}$ criteria of 60 dB(A) and the assumed shoulder period $L_{Aeq(1\ hour)}$ criteria of 55 dB(A) presented in **Table 4.6** at a number of receiver locations. The predicted increase in traffic noise levels from vehicle movements associated with the proposed increase in truck movements on the private access road will either be:

- less than the day-time LAeq(15 hour) criteria of 60 dB(A) where applicable; or
- less than the shoulder period LAeq(1 hour) criteria of 55 dB(A) where applicable; or
- less than the maximum increase of 2 dB recommended in Section 3.41 of the *NSW Road Noise Policy* (DECCW, 2011).

5.0 Conclusion and Justification

5.1 Overview of Environmental Impacts

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

- assessment of the site characteristics;
- review of existing expert technical assessments, management plans and historical monitoring data;
- consultation with impacted landowners; and
- expert technical assessments.

The key issues identified (traffic and noise) were the subject of comprehensive technical assessment to identify and assess the potential impacts of the proposed modification on the existing environment and community. The results of these assessments are detailed in **Section 4.0**.

The scale of the proposed modification, being an increase in truck movements per hour for Lot 218, will enable the operation to match its approved sand extraction capacity and to occur with minimal environmental, economic and social impacts. The proposed increase in truck movements will operate within acceptable noise impact criteria both on the site and along the existing road network. As a result, the modifications will not unduly impact on the existing quality of life experienced by residents on adjoining and nearby properties, and will not disrupt local market conditions for existing businesses or trading operations. In addition, as Mackas Sand has a range of well-established and effective measures to minimise and manage impacts associated with the proposed modification, including monitoring and auditing processes, and it is anticipated that the proposed modification can proceed within acceptable environmental standards over the anticipated life of the project.

5.2 Suitability of the Site

The proposed modification involves an increase in the maximum number of truck movements to allow 24 laden truck movements out per hour, plus 24 truck movements in per hour, from Lot 218 between 7.00 am and 10.00 pm Monday to Friday and 7.00 am and 4.00 pm Saturdays. Approval is also sought to allow an increase in the truck movements during the 5.00 am to 7.00 am shoulder period Monday to Friday (from 5 to 14 laden trucks) and during the 6.00 am to 7.00 am shoulder period on Saturdays (from 5 to 9 laden trucks). It is not proposed to alter truck movements on Sundays and Public Holidays or during the 5.00 am to 6.00 am shoulder period on Saturdays, or alter the truck movements from Lot 220. This change to the approved operation will enable the existing operation to better achieve the annual limits on sand extraction approved under PA08_0142, with no change being necessary to the maximum annual tonnage of sand that is allowed to be extracted from Lot 218 or Lot 220.

The extent of additional impact on public and private assets, infrastructure or environmental features is limited and consistent with those previously approved under PA08_0142. The proposed modification will not unduly impact on the continued use of Nelson Bay Road by residents and other private road users. In particular, the traffic impact assessment has demonstrated that the roundabout at the intersection of Nelson Bay Road and Richardson Road (Pauls Corner roundabout) has sufficient capacity to accommodate the increased traffic movements. Also, the intersection of the site access and Nelson Bay Road, which has

been upgraded with a new acceleration lane as part of the previous modification approval, has sufficient capacity to accommodate the proposed increase in truck movements.

The proposed modification will not significantly adversely impact on the surrounding community. The private haul road to/from Lot 218 is relatively isolated from sensitive receptors, and existing management and monitoring programs are in place to identify and manage the potential impacts associated with truck movements. In addition, the noise impact assessment has demonstrated that the proposed modification will operate within the noise impact criteria applied to the current operation.

Accordingly, the site is considered suitable to accommodate the proposed modification to truck movements.

5.3 Benefits of the Proposed Modification

The key benefits associated with the proposed modification are summarised below:

- The proposed modification will facilitate the supply of high quality construction and industrial grade sand into the greater Sydney and Hunter region markets to meet identified demand for these materials, through allowing Mackas Sand to better reach their annual extraction limit of 1 million tonnes from Lot 218.

- The modification will support the rapid growth and development strategy of the area, through the supply of high quality construction materials and assist in achieving the aims and objectives of the various strategic and regional planning policies. In particular in the Lower Hunter with the *Lower Hunter Regional Strategy: 2006-2031* (DoP, 2006) estimating a population increase of 160,000 people to 2031.

- The proposed modification will support the upgrade of Williamtown Airport in preparation for the Joint Strike Force fighters that is currently underway.

- The site has convenient, economic access to its core markets, which assists in reducing supply costs, greenhouse gas emissions and other environmental impacts per tonne kilometre of product transported.

- The proposed modification will provide for the employment of additional personnel on-site and road transport drivers, with positive flow on economic effects to the local and regional economy.

- The modification to truck movements per hour for Lot 218 would assist in reducing the number of truck movements that are required after 5.00 pm, thereby reducing evening impacts of the Project on the surrounding community.

- The proposed modification will also contribute to Commonwealth and State governments finances through payment of additional taxes as a result of the increased sale of sand product.

5.4 Alternatives to the Proposed Modification

A range of alternatives were considered in developing the proposed modifications to Major Project Approval 08_0142. These included:

- Not seek an increase in truck movements to/from the sand extraction area in Lot 218. This alternative is not preferred due to the proponent's concerns about its inability to transport the 1,000,000 tonnes of product approved under PA08_0142 and to meet current and projected future market demand. This

alternative would result in continued restrictions in the quarry's ability to supply sand as and when it is needed.

- To seek a modification of truck movement numbers associated with the sand extraction area located on Lot 220. This alternative is not preferred on the basis that there are likely to be greater impacts to landowners and occupants adjacent to the access route for Lot 220 in terms of potential noise and traffic impacts. It is also not preferred as sand from Lot 220 is better suited and of higher value to other markets than sand from Lot 218. The preferred option provides a superior outcome by limiting impacts to adjoining and nearby owners/occupants of existing residential properties.

5.5 Ecologically Sustainable Development

The EP&A Act aims to encourage ecologically sustainable development (ESD) within NSW. As outlined in **Section 3.0**, the proposed modification requires approval from the Minister for Planning and Environment, or their delegate, under Section 75W of the EP&A Act. As such, the Minister needs to be satisfied that the proposed modification is consistent with the principles of ESD. This section provides an assessment of the proposed modification in relation to the principles of ESD.

To justify the Project with regard to ESD principles, the benefit of the Project in an environmental and socio-economic context should outweigh any negative impacts. The ESD principles encompass the following:

- the precautionary principle;
- inter-generational equity;
- conservation of biological diversity; and
- valuation and pricing of resources.

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

5.5.1 The Precautionary Principle

Schedule 2 Clause 7(4)(a) of the EP&A Regulation 2000 defines the precautionary principle as follows:

> *Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*
>
> *In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.*

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

The assessment process has involved a detailed study of the existing environment and the use of engineering and scientific modelling and study to assess and determine potential impacts as a result of the proposed modification. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

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

1. Relevant government authorities, community members and other stakeholders were consulted during original EA preparation and the matters raised during consultation have been taken into account in assessing the proposed modification. This has enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.

2. Mackas Sand has designed and implemented a comprehensive Environmental Management System (EMS), and related environmental management plans and programs, that seek to implement best practice management. The proposed modification will incorporate the practices implemented and demonstrated to be effective at Lot 218 and Lot 220 and the existing EMS will be revised to incorporate any additional controls outlined in this EA.

3. The EA has been undertaken on the basis of the best available scientific information for the study area. Where uncertainty in the data used in the assessment has been identified, a conservative worst-case analysis has been undertaken and contingency measures have been identified to manage that uncertainty.

5.5.2 Intergenerational Equity

The EP&A Regulation defines intergenerational equity as:

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

Social equity involves concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fairer distribution of costs and benefits to improve the well-being and welfare of the community, population or society (DUAP, 1997).

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

The objective of the proposed modification is to allow for an efficient recovery of the resource in a manner that achieves the best practical safety, environmental, social and economic outcomes while aiming to minimise any associated environmental impacts. The environmental management measures discussed above have been developed to minimise the impact on the environment to the greatest extent reasonably possible and will continue to be implemented when the modification to truck movements to/from Lot 218 comes into effect.

The management of environmental issues as outlined in the EA will maintain the health, diversity and productivity of the environment for future generations. The proposed modification will also contribute to maintaining services in the community through the direct and flow on effects of employee and operational expenditure.

5.5.3 Conservation of Biological Diversity and Ecological Integrity

Schedule 2 Clause 7(4)(c) of the EP&A Regulation 2000 defines conservation of biological diversity and ecological integrity as follows:

> *conservation of biological diversity and ecological integrity namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

This refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Project are described in this EA. Potential impacts are also outlined and measures to ameliorate any adverse impacts are outlined in the statement of commitments (refer to **Section 5.0**). As the proposed modification is for an increase to truck movements (in and out) per hour for Lot 218, it is not envisaged to be any additional impact on biodiversity as a result of the proposed modification.

5.5.4 Valuation and Pricing of Resources

The goal of improved valuation of natural capital is detailed in Schedule 2 Clause 7(4)(d) of the EP&A Regulation 2000 and has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment.

The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

Increasing truck movements to/from the access route to Lot 218 will allow increased and more efficient supply of fine grade natural sand to the market for many construction and industrial products and processes. Currently, no man-made products are available as supplements to this type of sand. Whilst, alternative products are available, including medium and coarse grade construction sand, the use of these products is currently constrained by high processing and transport costs and limited availability.

5.6 Conclusion

The proposed modification to truck movements associated with the Project Approval will allow for an increase in the efficiency of supply of high quality construction and industrial grade sand into the greater Sydney and Hunter region markets for the life of the approval (until 31 December 2029), providing a valuable and necessary resource to the local and regional economy. The modification will support the rapid growth and development strategy for the area, in particular in the Lower Hunter, with the *Lower Hunter Regional Strategy: 2006-2031* (DoP, 2006) estimating a population increase of 160,000 people to 2031, through the efficient and timely supply of high quality construction materials and assist in achieving the aims and objectives of the various strategic and regional planning policies.

The modification proposal has been designed with due consideration of the environmental values of the Project Area and potential impacts (noise and traffic) of the proposed changes have been carefully assessed and have been determined to be within acceptable limits. Similarly, the modifications to the current approval are unlikely to result in any undue socio-economic impacts in terms of the quality of life of adjoining and nearby residents, the need for additional social services and facilities to accommodate the increased intensity of the operation, or local market impacts and disruption.

The existing mitigation measures and environmental safeguards associated with the current operation will be maintained into Project design and operational management. These mitigation measures have been built into the design of the Project to minimise the need for ongoing management throughout the life of the Project.

It is considered that the modifications will allow for the significant benefits of the Project for the local and regional communities to be realised in a sustainable manner.

6.0 References

EPA, 2000. *NSW Industrial Noise Policy.*

DECCW, 2011. *NSW Road Noise Policy.*

DoP, 2006. *Lower Hunter Regional Strategy: 2006-2031.*

DUAP, 1997. *Assessing Social Impacts*, NSW Department of Urban Affairs and Planning.

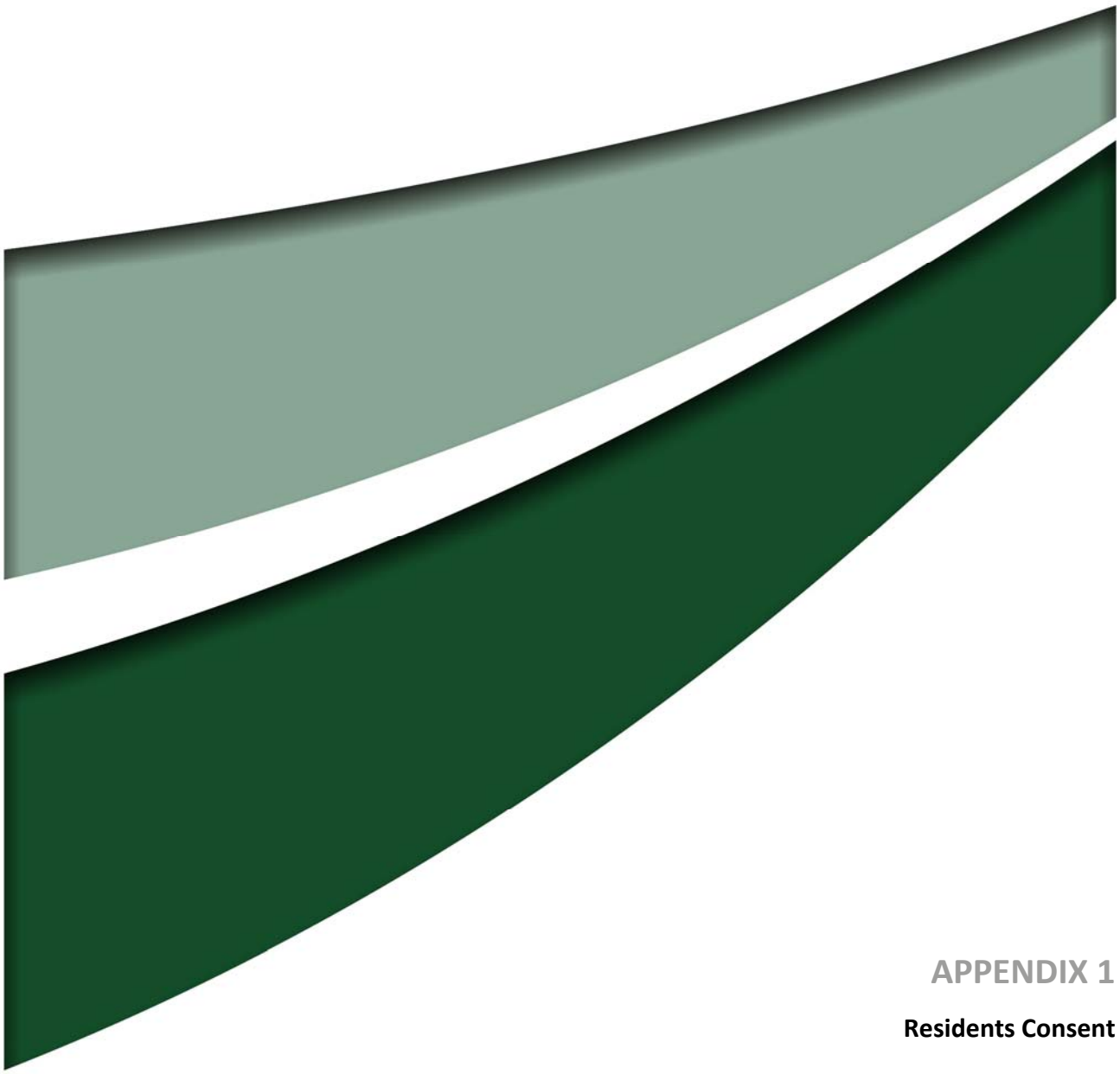
GHD, 2015. Mackas Sand Traffic Study – Development Traffic Assessment.

Umwelt (Australia) Pty Limited, 2009. Environmental Assessment of Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash.

Umwelt (Australia Pty Limited, 2012. Environmental Assessment of Modifications to Mackas Sand Extraction Operations on Lot 218 and Lot 220 Salt Ash NSW.

Umwelt (Australia) Pty Limited, 2014. Environmental Management Strategy, Lot 218 and Lot 220, Salt Ash, NSW.

US Department of Transportation 2004. *US Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.5 Look-Up Tables*



APPENDIX 1

Residents Consent

18-7-15

2344 Nelson Bay Road

Williamtown

NSW 2318

15 April 2015

To whom it may concern,

As the residents at 2344 Nelson Bay Road, Williamtown:

We have no objection to Mackas Sand operating with loading times between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

We have no objection to Mackas Sand generating higher noise levels than those listed in Table 1A of the Mackas Sand Project Approval.

Additionally, we have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

Kind Regards,

Signature: _____

Name: Ian Raby

2353 Nelson Bay Road

Williamtown

NSW 2318

15 April 2015

To whom it may concern,

As the residents at 2353 Nelson Bay Road, Williamtown:

We have no objection to Mackas Sand operating with loading times between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

We have no objection to Mackas Sand generating higher noise levels than those listed in Table 1A of the Mackas Sand Project Approval.

Additionally, we have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

Kind Regards,

Signature: 

Name: DIANNE L. PARLETT

15/4/2015.

2367 Nelson Bay Road

Williamtown

NSW 2318

15 April 2015

To whom it may concern,

As the residents at 2367 Nelson Bay Road:

We have no objection to Mackas Sand operating with loading times between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

We have no objection to Mackas Sand generating higher noise levels than those listed in Table 1A of the Mackas Sand Project Approval.

Additionally, we have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

Kind Regards,

Signature: S O'Brien JP ID 12015 Registration 152646
152646

Name: Shirley O'Brien

2367 Nelson Bay Rd,
Williamstown, 2318
NSW

Home Phone Number: 0249651460:

19/4/2015

2368 Nelson Bay Road

Williamtown

NSW 2318

15 April 2015

To whom it may concern,

As the residents at 2368 Nelson Bay Road, Williamtown:

We have no objection to Mackas Sand operating with loading times between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

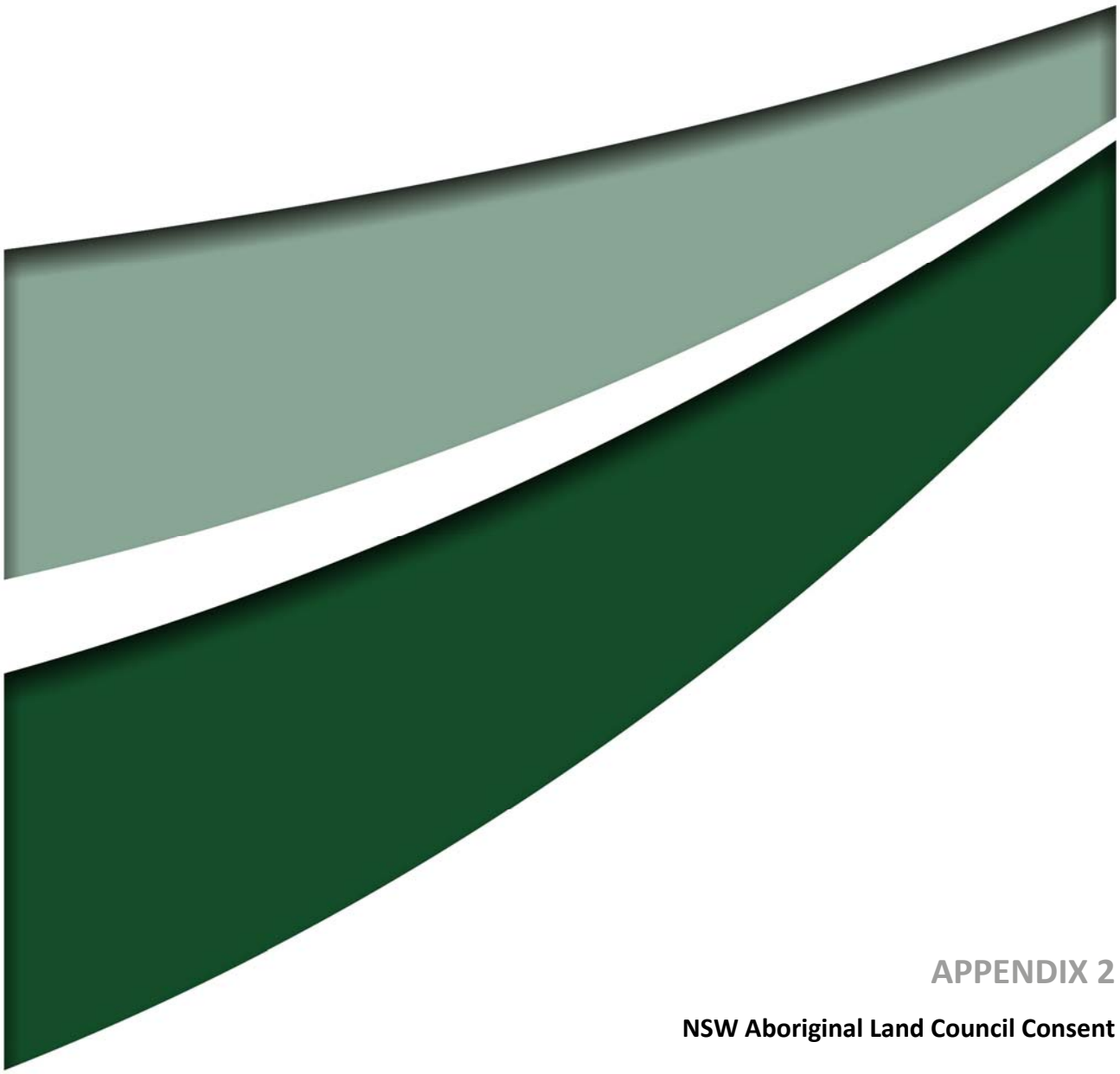
We have no objection to Mackas Sand generating higher noise levels than those listed in Table 1A of the Mackas Sand Project Approval.

Additionally, we have no objection to Mackas Sand having unrestricted hourly truck movements along the access road between the hours of 5am and 10pm Monday to Saturday or between the hours of 8am to 12pm on Sundays and public holidays.

Kind Regards,

Signature: _____

Name: John Padmos



APPENDIX 2

NSW Aboriginal Land Council Consent

Subject: **Worimi LALC – Mackas Sand Project modification – NSWALC consent sought – Decision Brief**

323rd Council Meeting
Date: 16-18 June 2015
Day 3, 18 June 2015
Item: New Item

Motion No: **21**

Subject: **Worimi LALC – Mackas Sand Project modification – NSWALC consent sought – Decision Brief**

Resolution: That the Council of the New South Wales Aboriginal Land Council (NSWALC), pursuant to section 106 of the *Aboriginal Land Rights Act* 1983 and Clause 8F(1A) of the *Environmental Planning and Assessment Regulation* 2000 **CONSENTS** to:

(a) The modification of the Project Approval in relation to the Mackas Sand Project - Application No. 08_0142 (at Attachment 1) so as to increase the maximum number of trucks permitted to cart product from Lot 218 in DP 1044608 per hour to 24 trucks however this consent does not change the currently approved maximum annual production of 1 million tonnes of product per annum.

MOVED: **Cr D Jones, Western Region**

SECONDED: **Cr J Hampton, South Coast Region**

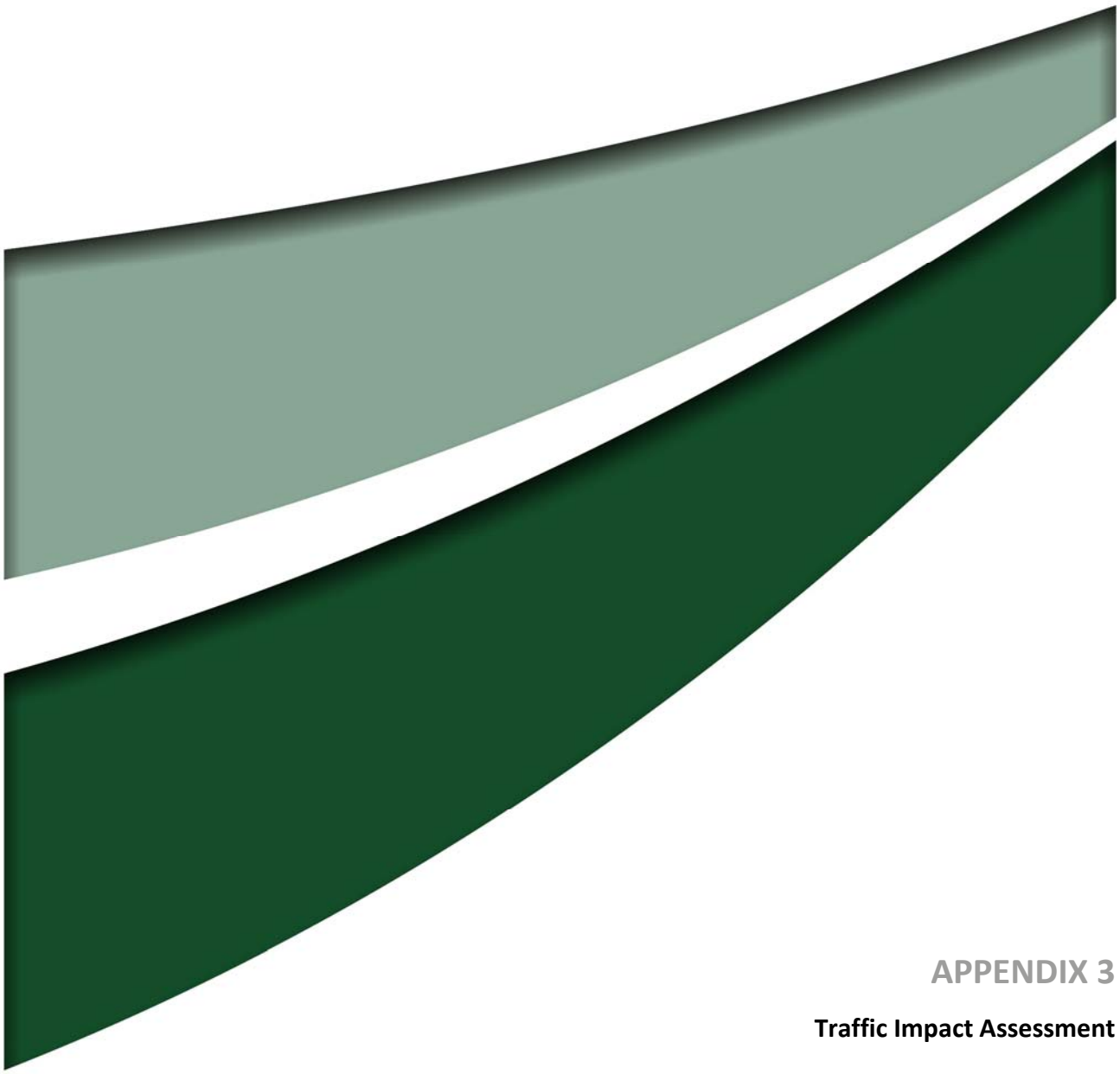
ABSENT: **Cr R Ah-See, Sydney/Newcastle Region**
Cr P Smith, Mid North Coast Region

CARRIED: **Carried**

SIGNED: _____ **Date:** 18/6/2015

Cr Craig Cromelin, Chairperson

ACTION BY: **Principal Legal Officer/Manager, Land and Property**



APPENDIX 3

Traffic Impact Assessment

03 July 2015

Peter Jamieson
Umwelt (Australia)
75 York Street
Teralba, NSW 2284

Our ref: 22/17872
110074

Your ref:

Dear Peter,

GHD was engaged by Umwelt Australia Pty Ltd to prepare a traffic study for the Macka's Sand development.

Mackas Sand traffic study
Development traffic assessment

1 Overview

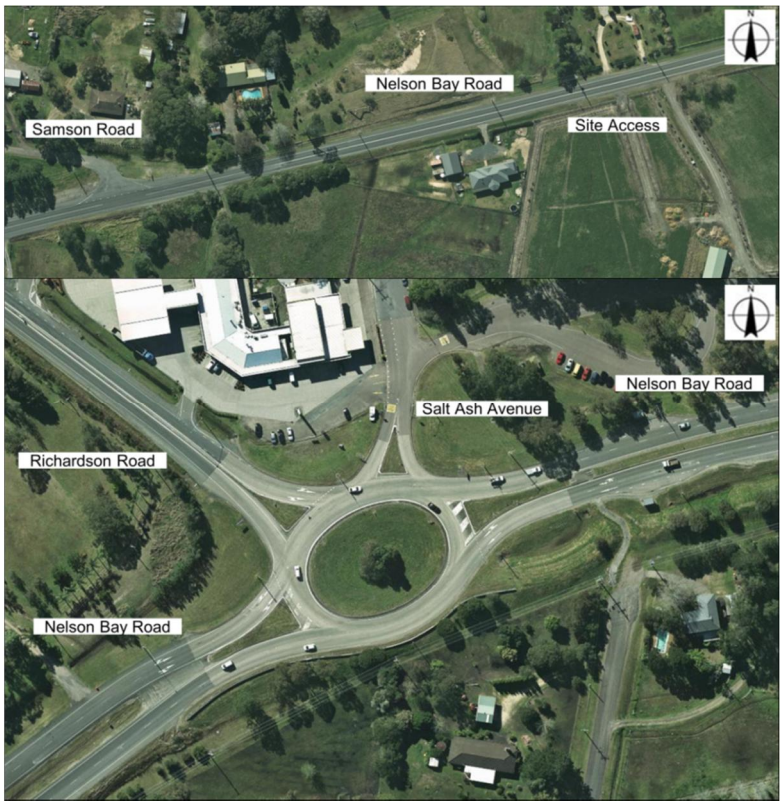
Nelson Bay Road is the main arterial link connecting Newcastle to Williamtown and the Tomaree Peninsula. It carries a large volume of local and tourist traffic visiting the Nelson Bay area. It is the only route servicing the Tomaree Peninsula and the various townships between Newcastle and Nelson Bay.

Macka's Sand development proposes to increase truck movements from eight vehicles per hour entering and exiting the site to 24 vehicles per hour entering the site and 24 vehicles per hour exiting the site in the future. The traffic study evaluates the impacts on the Richardson Road and Nelson Bay roundabout and the Nelson Bay Road site access. Figure 1 provides an understanding of the site location and roads included in the study.

The scope of work for this study comprises the assessment of:

- The existing traffic conditions surrounding the site;
- The performance of Nelson Bay Road, Richardson Road and Salt Ash Avenue roundabout and the site access intersection under existing traffic conditions; and
- The performance of Nelson Bay Road, Richardson Road and Salt Ash Avenue roundabout and the site access intersection with additional heavy vehicles movements.

Figure 1– Site locations and study roads



Source: Google Maps, adapted by GHD

This traffic study has necessarily relied on a number of assumptions as follows:

- Data collection has been limited to peak hour traffic surveys provided by NTPE (Ron Brown) Consulting and average daily counts;
- Using AUSTROADS vehicle classification system. Instead of modelling light vehicles (vehicle classes 1 and 2) and heavy vehicles (vehicle classes 3 to 9) only, an additional vehicle class of large trucks was considered in the models to acknowledge different traffic behaviour of B-Doubles (vehicle class 10, 25 m long and 2.5 m wide) as this has been highlighted to be the type of vehicles provided in *Mackas Sand Quarry MR108 Nelson Bay Road, Salt Ash, Cardno, 2014 drawing number 81014007-CI-10001, revision 2*
- Cycling movements across Nelson Bay Road were not modelled in this study;
- Traffic distribution assumes that large trucks arriving from the south will travel along Nelson Bay Road up to Richardson Road and Salt Ash Avenue roundabout, make a U-turn and continue on Nelson Bay Road towards the site access. No other large trucks were assumed to come from different directions than south.
- Traffic background growth is considered to be 1% according to *MR 108 Nelson Bay Road Upgrade Cromarty Lane to Port Stephens Drive, Review of Environmental Factors, Roads and Maritime Services*, 2012. The future scenario will consist of evaluating the increased heavy vehicle movements and background traffic growth by 2035;
- Nelson Bay Road and the site access intersection layout was based on *Mackas Sand Quarry MR108 Nelson Bay Road, Salt Ash, Cardno, 2014 drawing number 81014007-CI-*

10001, revision 2;

- Vehicle speeds of 60 km/h on Salt Ash Avenue departure and approach lanes.. This was calculated given the peak hour period identified for this modelling exercise covers part of the school zone 40 km/h speed restrictions (i.e. from 8:00 to 8:30 in the AM peak and from 15:45 to 16:45 in the PM peak);
- Vehicle speeds of 80 km/h on remaining departure and approach lanes of Nelson Bay Road, Richardson Road and Nelson Bay Road; and
- SIDRA intersection and roundabouts were modelled as individual sites.

2 Daily and network peak hour traffic

This section provides an understanding of current traffic volumes on the road network surrounding the development site and the modelled future conditions given the assumptions outlined.

To understand the existing traffic conditions surrounding the site, two traffic surveys methods have been commissioned:

- Intersection turning movement surveys were carried out by NTPE, on Thursday, 28th of May 2015 between 7:00 and 9:00 in the AM peak and between 15:00 and 17:00 in the PM peak at the Nelson Bay Road, Richardson Road and Salt Ash Avenue roundabout. The results of the survey and network AM and PM peak periods are presented in Table 1 and a copy of the roundabout traffic survey data is provided as attached documentation.

Table 1 Existing traffic volumes – 28th May 2015

Location	AM Peak Hour (7:30-8:30 am) (vph)*	PM Peak Hour (3:45-4:45 pm) (vph)*	Daily (vpd)**
Nelson Bay Road /Richardson Road Roundabout	2,104	2,286	21,040

*Note: *(vph) = vehicles per hour;*

***(vpd) = vehicles per day. The daily traffic volume for these roads has been estimated based on the assumption that the peak hour traffic flow is approximately 10% of the daily traffic volume.*

- A seven day Automatic Traffic Count (ATC) was undertaken 50 m east of Samson Road between 28th May 2015 and 3rd June 2015 to gain an understanding of the existing daily volumes and 24 hour traffic profile. Figure 2 presents the daily traffic profile and Table 2 provides an understanding of the heavy vehicle ratio for the surveyed roundabout.

Figure 2 – Nelson Bay Rd traffic profile on weekdays and weekends, 50 m east of Sansom Rd

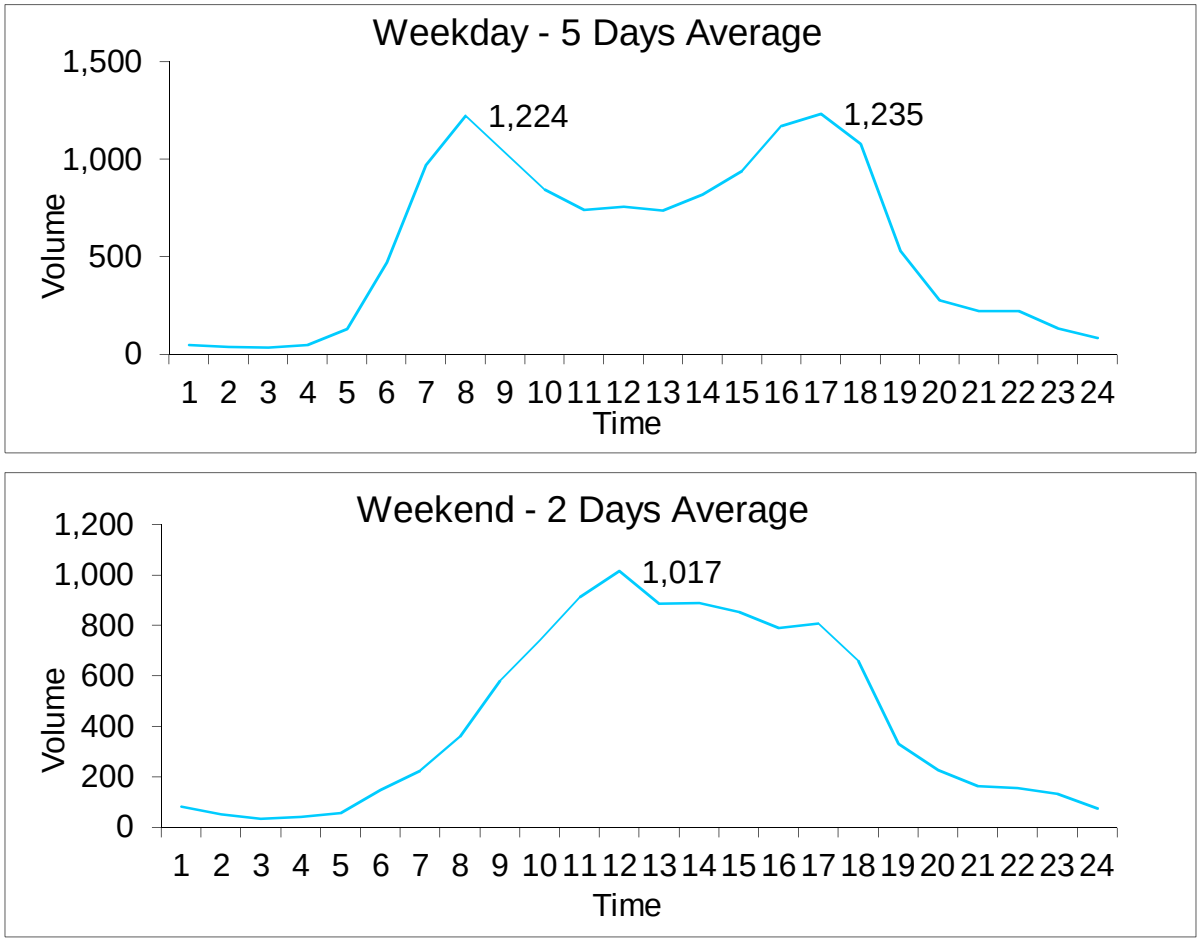


Table 2 Heavy vehicles proportions based on surveys on 28 May 2015

Location	Vehicles per hour (vph)	HCV (vph)*	HCV* %
AM - Nelson Bay Road near Richardson Road	1,259	87	7 %
PM - Nelson Bay Road near Richardson Road	1,274	75	6 %
AM Nelson Bay Road near Sansom Road	1,185	83	7 %
PM Nelson Bay Road near Sansom Road	1,224	71	6 %

Note: HCV – heavy commercial vehicles (

3 Existing roundabout performance

The performance of the existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. SIDRA intersection modelling software was used to assess the proposed peak hour operating performance of Nelson Bay Road, Richardson Road and Salt Ash Avenue roundabout and the site access. The criteria for evaluating the operational performance of intersections is provided by the RTA Guide to Traffic Generating Developments 2002 and reproduced in Table 3. This criteria for evaluating the operational performance of intersections is based on a qualitative measure (i.e. Level of Service), which is applied to each band of average vehicle delay.

Table 3 Level of Service (LoS) criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

Source: RTA Guide to Traffic Generating Developments (2002)

Notes: The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.The level of service (LoS) for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.

The 2015 traffic flows were analysed using SIDRA to obtain the existing operation of the roundabout. The results of the 2015 SIDRA assessment is summarised in Table 4. SIDRA outputs are also provided as attached documentation.

Table 4 Existing performance with 2015 traffic volumes but no additional B-Doubles

Intersection	Priority Type	AM peak			PM peak		
		LoS	Average Delay (s)	Queue (m)	LoS	Average Delay (s)	Queue (m)
Nelson Bay Road /Richardson Road	Roundabout	B	8	22	B	8	29
Nelson Bay Road /Site Access	Give Way	A	1	0	A	1	0

Table 4 indicates that the existing roundabout of Nelson Bay Road, Richardson Road and Salt Ash Avenue currently operates with spare capacity at LoS B in both the existing AM and PM peak periods, and B-double movements did not raise any issues within the roundabout. The intersection of Nelson bay Road and the site access indicates that the access operates satisfactorily with spare capacity in both the AM and PM peaks in 2015 under existing traffic conditions.

A 20% traffic growth has been added to the 2015 traffic flows to obtain an understanding of traffic conditions in 2035. Table 5 outlines the SIDRA results.

Table 5 Existing performance with 2035 traffic volumes but no additional B-Doubles

Intersection	Priority Type	AM peak			PM peak		
		LoS	Average Delay (s)	Queue (m)	LoS	Average Delay (s)	Queue (m)
Nelson Bay Road /Richardson Road	Roundabout	B	8	31	B	10	45
Nelson Bay Road /Site Access	Give Way	A	1	0	A	1	0

3.1 Roundabout performance under additional heavy vehicle traffic

An indication of the additional heavy vehicle traffic generation from the Macka's Sand site is assumed to be 24 vehicles travelling in and 24 vehicles travelling out of the site. A summary of the results and SIDRA outputs when modelling the roundabout with the additional heavy vehicle movements is provided in

Table 6 - Future performance with 2015 traffic volumes and additional B-Doubles

Intersection	Priority Type	AM peak			PM peak		
		LoS	Average Delay (s)	Queue (m)	LoS	Average Delay (s)	Queue (m)
Nelson Bay Road /Richardson Road	Roundabout	B	8	23	B	9	31
Nelson Bay Road /Site Access	Give Way	A	1	0	A	1	0

Table 7 Future performance with 2035 traffic volumes and additional B-Doubles

Intersection	Priority Type	AM peak			PM peak		
		LoS	Average Delay (s)	Queue (m)	LoS	Average Delay (s)	Queue (m)
Nelson Bay Road /Richardson Road	Roundabout	B	9	31	B	10	50
Nelson Bay Road /Site Access	Give Way	A	1	0	A	1	0

Table 6 and **Table 7** indicate that the existing roundabout of Nelson Bay Road, Richardson Road and Salt Ash Avenue will not be adversely impacted by the additional B-Double movements. The results indicate that the roundabout will continue to perform with spare capacity at LoS B in both the existing AM and PM peak hours for 2015 and 2035 years.

The analysis indicates that the site access in both 2015 and 2035 would continue to operate with spare capacity at LoS A.

In summary the existing road network analysed would continue to operate with minimal impact under the proposed conditions.

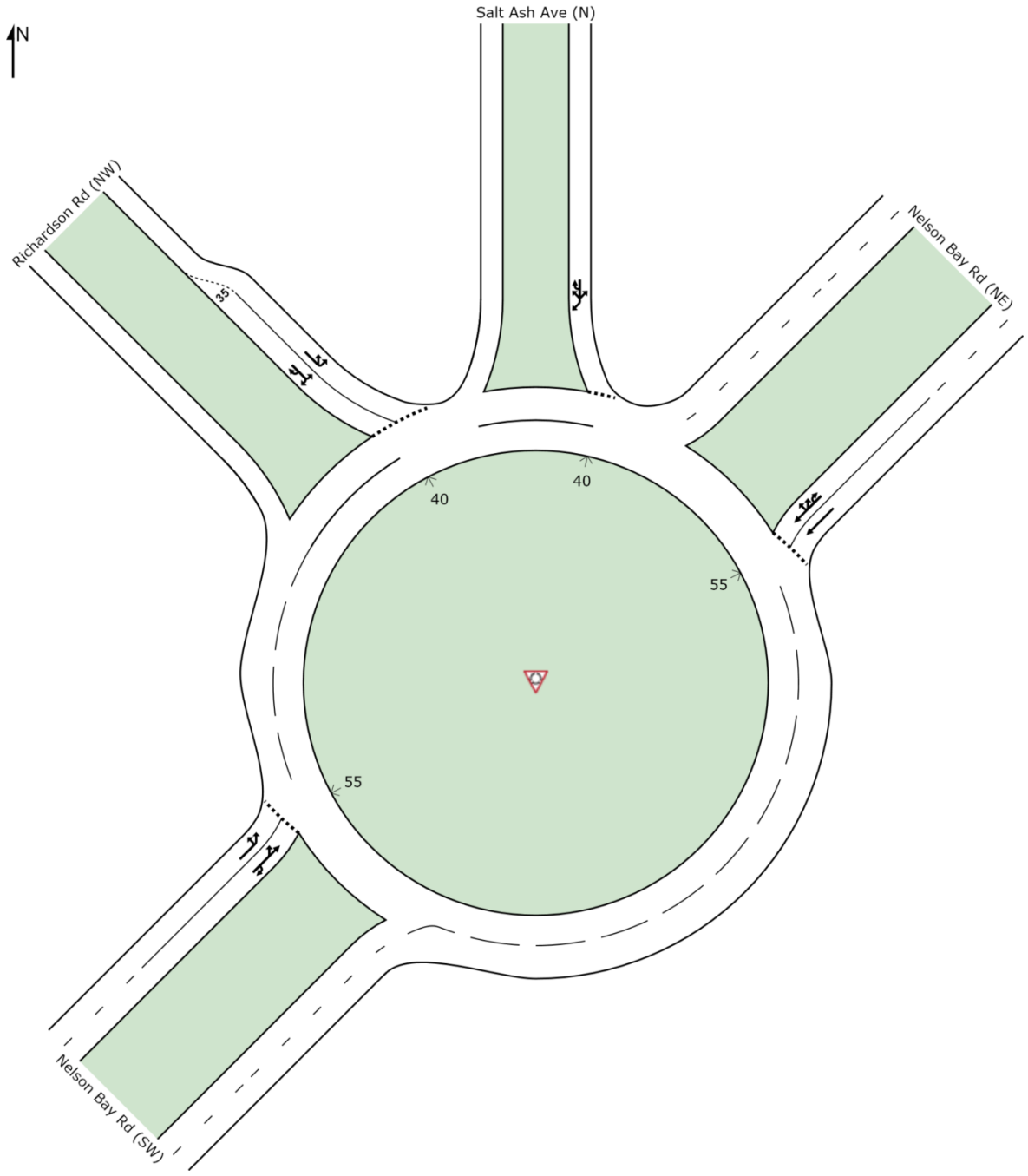
Kind Regards,

Stephen Jamieson
Senior Civil Engineer
(02) 4979 9999

SITE LAYOUT

Nelson Bay Road / Richardson Road

Roundabout



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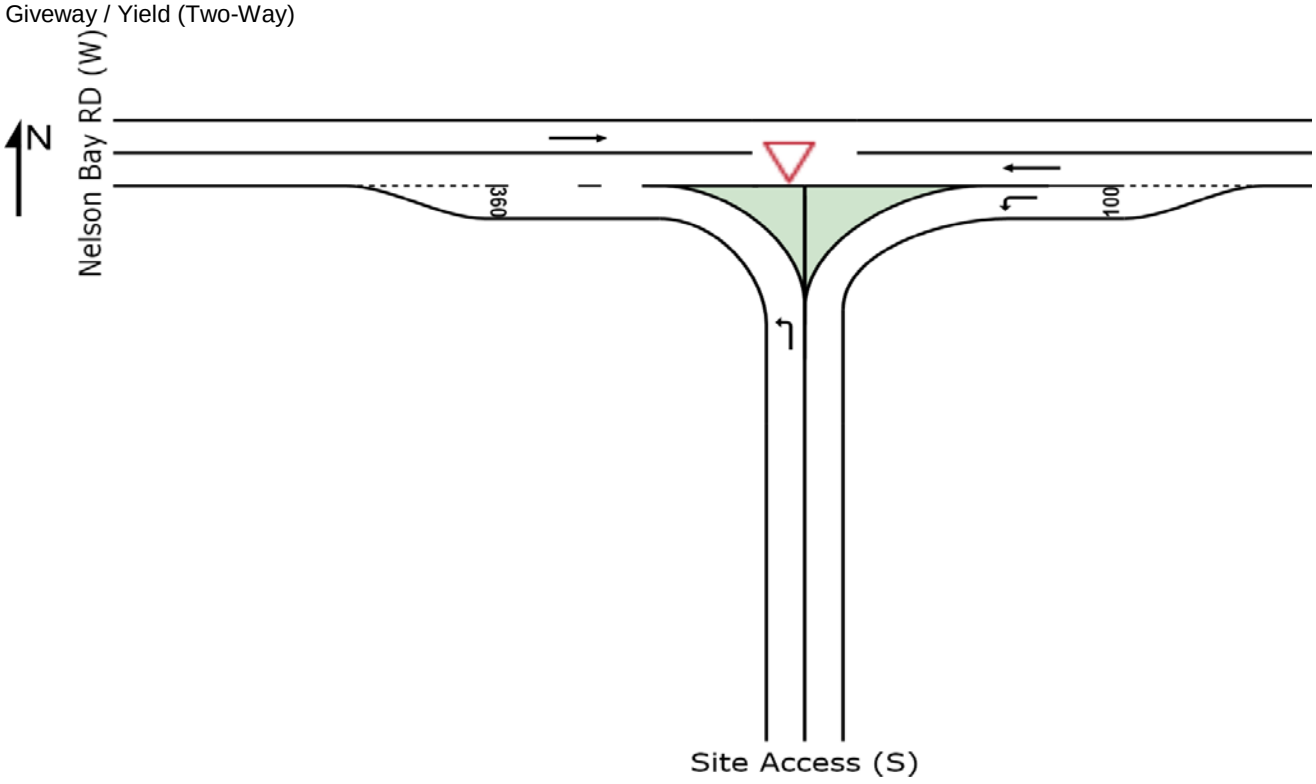
SITE LAYOUT

Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)



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2015 Results

MOVEMENT SUMMARY

Site: 2015 AM Existing Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	883	5.9	0.416	5.6	LOS A	3.0	22.4	0.31	0.45	71.3
9	R2	407	4.9	0.416	13.7	LOS A	3.0	22.2	0.35	0.62	44.1
26b	R3	65	16.9	0.416	15.4	LOS B	3.0	22.2	0.35	0.62	42.8
9u	U	11	18.2	0.416	17.0	LOS B	3.0	22.2	0.35	0.62	65.2
Approach		1366	6.2	0.416	8.6	LOS A	3.0	22.4	0.32	0.51	61.1
North: Salt Ash Ave (N)											
7b	L3	49	18.4	0.114	4.3	LOS A	0.5	3.7	0.53	0.71	51.4
9a	R1	24	0.0	0.114	8.9	LOS A	0.5	3.7	0.53	0.71	55.1
9b	R3	23	13.0	0.114	11.8	LOS A	0.5	3.7	0.53	0.71	16.9
9u	U	1	0.0	0.114	12.9	LOS A	0.5	3.7	0.53	0.71	12.4
Approach		97	12.4	0.114	7.3	LOS A	0.5	3.7	0.53	0.71	44.0
NorthWest: Richardson Rd (NW)											
27b	L3	8	25.0	0.143	5.8	LOS A	0.7	4.9	0.46	0.62	33.8
10	L2	266	8.6	0.143	5.9	LOS A	0.7	4.9	0.47	0.64	64.8
12	R2	19	15.8	0.143	13.7	LOS A	0.6	4.8	0.48	0.67	59.4
12u	U	16	6.3	0.143	17.0	LOS B	0.6	4.8	0.48	0.67	37.7
Approach		309	9.4	0.143	7.0	LOS A	0.7	4.9	0.47	0.64	63.3
SouthWest: Nelson Bay Rd (SW)											
1	L2	6	0.0	0.036	6.7	LOS A	0.2	1.6	0.57	0.55	46.1
30a	L1	35	11.4	0.036	6.8	LOS A	0.2	1.6	0.57	0.55	44.6
2	T1	291	9.3	0.224	7.2	LOS A	1.5	12.3	0.63	0.59	69.5
3u	U	9	100.0	0.224	23.8	LOS B	1.5	12.3	0.63	0.59	64.7
Approach		341	11.7	0.224	7.9	LOS A	1.5	12.3	0.62	0.59	67.0
All Vehicles		2113	7.9	0.416	8.1	LOS A	3.0	22.4	0.40	0.55	61.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 PM Existing Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	419	7.6	0.225	5.4	LOS A	1.4	10.7	0.21	0.40	72.4
9	R2	299	10.7	0.246	13.5	LOS A	1.6	11.8	0.23	0.63	43.5
26b	R3	34	8.8	0.246	15.0	LOS B	1.6	11.8	0.23	0.63	42.4
9u	U	27	7.4	0.246	16.5	LOS B	1.6	11.8	0.23	0.63	67.3
Approach		779	8.9	0.246	9.3	LOS A	1.6	11.8	0.22	0.50	58.8
North: Salt Ash Ave (N)											
7b	L3	85	7.1	0.211	7.9	LOS A	1.1	8.0	0.78	0.89	49.6
9a	R1	14	0.0	0.211	12.6	LOS A	1.1	8.0	0.78	0.89	52.2
9b	R3	19	5.3	0.211	15.5	LOS B	1.1	8.0	0.78	0.89	15.2
9u	U	1	0.0	0.211	16.6	LOS B	1.1	8.0	0.78	0.89	10.5
Approach		119	5.9	0.211	9.7	LOS A	1.1	8.0	0.78	0.89	44.5
NorthWest: Richardson Rd (NW)											
27b	L3	7	14.3	0.339	7.9	LOS A	2.0	14.7	0.75	0.83	32.1
10	L2	531	2.6	0.339	8.1	LOS A	2.0	14.7	0.75	0.85	64.2
12	R2	7	14.3	0.339	16.4	LOS B	1.9	13.4	0.75	0.88	59.2
12u	U	10	10.0	0.339	19.7	LOS B	1.9	13.4	0.75	0.88	36.0
Approach		555	3.1	0.339	8.4	LOS A	2.0	14.7	0.75	0.85	63.6
SouthWest: Nelson Bay Rd (SW)											
1	L2	2	0.0	0.056	6.2	LOS A	0.3	2.3	0.49	0.52	46.6
30a	L1	67	7.5	0.056	6.2	LOS A	0.3	2.3	0.49	0.52	45.0
2	T1	765	4.8	0.488	7.0	LOS A	3.9	28.5	0.62	0.56	70.2
3u	U	9	88.9	0.488	20.2	LOS B	3.9	28.5	0.62	0.56	50.6
Approach		843	5.9	0.488	7.1	LOS A	3.9	28.5	0.61	0.56	68.4
All Vehicles		2296	6.2	0.488	8.3	LOS A	3.9	28.5	0.52	0.63	62.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 AM with Additional Heavy Vehicles Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	883	5.9	0.420	5.7	LOS A	3.1	22.5	0.33	0.46	71.2
9	R2	407	4.9	0.420	13.8	LOS A	3.0	22.2	0.37	0.62	44.0
26b	R3	65	16.9	0.420	15.5	LOS B	3.0	22.2	0.37	0.62	42.7
9u	U	11	18.2	0.420	17.1	LOS B	3.0	22.2	0.37	0.62	65.1
Approach		1366	6.2	0.420	8.7	LOS A	3.1	22.5	0.35	0.52	61.0
North: Salt Ash Ave (N)											
7b	L3	49	18.4	0.115	4.3	LOS A	0.5	3.8	0.54	0.72	51.4
9a	R1	24	0.0	0.115	8.9	LOS A	0.5	3.8	0.54	0.72	55.0
9b	R3	23	13.0	0.115	11.9	LOS A	0.5	3.8	0.54	0.72	16.9
9u	U	1	0.0	0.115	12.9	LOS A	0.5	3.8	0.54	0.72	12.4
Approach		97	12.4	0.115	7.3	LOS A	0.5	3.8	0.54	0.72	43.9
NorthWest: Richardson Rd (NW)											
27b	L3	8	25.0	0.144	5.9	LOS A	0.7	5.0	0.47	0.62	33.7
10	L2	266	8.6	0.144	6.0	LOS A	0.7	5.0	0.48	0.65	64.8
12	R2	19	15.8	0.144	13.7	LOS A	0.6	4.8	0.48	0.68	59.3
12u	U	16	6.3	0.144	17.0	LOS B	0.6	4.8	0.48	0.68	37.7
Approach		309	9.4	0.144	7.0	LOS A	0.7	5.0	0.48	0.65	63.2
SouthWest: Nelson Bay Rd (SW)											
1	L2	6	0.0	0.037	6.7	LOS A	0.2	1.6	0.58	0.55	46.1
30a	L1	35	11.4	0.037	6.8	LOS A	0.2	1.6	0.58	0.55	44.5
2	T1	291	9.3	0.233	7.3	LOS A	1.6	13.0	0.63	0.61	69.4
3u	U	25	100.0	0.233	19.9	LOS B	1.6	13.0	0.63	0.61	58.5
Approach		357	15.7	0.233	8.8	LOS A	1.6	13.0	0.63	0.61	66.3
All Vehicles		2129	8.5	0.420	8.3	LOS A	3.1	22.5	0.42	0.56	61.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 PM with Additional Heavy Vehicles Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	Demand Flows HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	419	7.6	0.227	5.5	LOS A	1.4	10.5	0.24	0.41	72.2
9	R2	299	10.7	0.250	13.6	LOS A	1.5	11.7	0.27	0.63	43.4
26b	R3	34	8.8	0.250	15.1	LOS B	1.5	11.7	0.27	0.63	42.3
9u	U	27	7.4	0.250	16.6	LOS B	1.5	11.7	0.27	0.63	67.2
Approach		779	8.9	0.250	9.4	LOS A	1.5	11.7	0.25	0.51	58.6
North: Salt Ash Ave (N)											
7b	L3	85	7.1	0.217	8.2	LOS A	1.1	8.3	0.80	0.90	49.4
9a	R1	14	0.0	0.217	12.8	LOS A	1.1	8.3	0.80	0.90	52.0
9b	R3	19	5.3	0.217	15.7	LOS B	1.1	8.3	0.80	0.90	15.1
9u	U	1	0.0	0.217	16.8	LOS B	1.1	8.3	0.80	0.90	10.5
Approach		119	5.9	0.217	10.0	LOS A	1.1	8.3	0.80	0.90	44.3
NorthWest: Richardson Rd (NW)											
27b	L3	7	14.3	0.348	8.0	LOS A	2.1	15.3	0.76	0.84	32.0
10	L2	531	2.6	0.348	8.3	LOS A	2.1	15.3	0.76	0.86	64.0
12	R2	7	14.3	0.348	16.6	LOS B	1.9	13.9	0.76	0.89	58.9
12u	U	10	10.0	0.348	19.9	LOS B	1.9	13.9	0.76	0.89	35.7
Approach		555	3.1	0.348	8.6	LOS A	2.1	15.3	0.76	0.86	63.4
SouthWest: Nelson Bay Rd (SW)											
1	L2	2	0.0	0.057	6.2	LOS A	0.3	2.3	0.49	0.52	46.6
30a	L1	67	7.5	0.057	6.2	LOS A	0.3	2.3	0.49	0.52	45.0
2	T1	765	4.8	0.506	7.1	LOS A	4.1	30.7	0.64	0.57	70.1
3u	U	25	96.0	0.506	20.5	LOS B	4.1	30.7	0.64	0.57	49.8
Approach		859	7.7	0.506	7.4	LOS A	4.1	30.7	0.63	0.56	67.8
All Vehicles		2312	6.9	0.506	8.5	LOS A	4.1	30.7	0.54	0.63	62.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 AM Existing Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	9	88.9	0.012	6.8	LOS A	0.0	0.0	0.00	0.49	36.2
Approach		9	88.9	0.012	6.8	NA	0.0	0.0	0.00	0.49	36.2
East: Nelson Bay RD (E)											
4	L2	8	100.0	0.011	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	890	5.2	0.473	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		898	6.0	0.473	0.3	NA	0.0	0.0	0.00	0.00	79.4
West: Nelson Bay RD (W)											
11	T1	295	12.5	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		295	12.5	0.165	0.0	NA	0.0	0.0	0.00	0.00	79.9
All Vehicles		1202	8.2	0.473	0.1	NA	0.0	0.0	0.00	0.01	79.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 PM Existing Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	9	88.9	0.012	6.8	LOS A	0.0	0.0	0.00	0.49	36.2
Approach		9	88.9	0.012	6.8	NA	0.0	0.0	0.00	0.49	36.2
East: Nelson Bay RD (E)											
4	L2	8	100.0	0.011	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	383	8.1	0.208	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		391	10.0	0.208	0.2	NA	0.0	0.0	0.00	0.01	79.1
West: Nelson Bay RD (W)											
11	T1	841	4.8	0.445	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		841	4.8	0.445	0.0	NA	0.0	0.0	0.00	0.00	79.8
All Vehicles		1241	7.0	0.445	0.1	NA	0.0	0.0	0.00	0.01	79.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 AM with Addditional Heavy Vehicles Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	25	96.0	0.034	6.9	LOS A	0.0	0.0	0.00	0.48	35.4
Approach		25	96.0	0.034	6.9	NA	0.0	0.0	0.00	0.48	35.4
East: Nelson Bay RD (E)											
4	L2	24	100.0	0.034	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	890	5.2	0.473	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		914	7.7	0.473	0.4	NA	0.0	0.0	0.00	0.01	78.7
West: Nelson Bay RD (W)											
11	T1	295	12.5	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		295	12.5	0.165	0.0	NA	0.0	0.0	0.00	0.00	79.9
All Vehicles		1234	10.6	0.473	0.3	NA	0.0	0.0	0.00	0.02	78.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2015 AM with Addditional Heavy Vehicles Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	25	96.0	0.034	6.9	LOS A	0.0	0.0	0.00	0.48	35.4
Approach		25	96.0	0.034	6.9	NA	0.0	0.0	0.00	0.48	35.4
East: Nelson Bay RD (E)											
4	L2	24	100.0	0.034	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	890	5.2	0.473	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		914	7.7	0.473	0.4	NA	0.0	0.0	0.00	0.01	78.7
West: Nelson Bay RD (W)											
11	T1	295	12.5	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		295	12.5	0.165	0.0	NA	0.0	0.0	0.00	0.00	79.9
All Vehicles		1234	10.6	0.473	0.3	NA	0.0	0.0	0.00	0.02	78.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2035 Results

MOVEMENT SUMMARY

Site: 2035 AM Existing Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	1060	5.9	0.505	5.8	LOS A	4.2	30.6	0.38	0.46	70.9
9	R2	488	4.9	0.505	13.9	LOS A	4.1	30.3	0.42	0.62	43.9
26b	R3	78	16.9	0.505	15.7	LOS B	4.1	30.3	0.42	0.62	42.6
9u	U	13	18.2	0.505	17.2	LOS B	4.1	30.3	0.42	0.62	64.9
Approach		1639	6.2	0.505	8.8	LOS A	4.2	30.6	0.39	0.52	60.7
North: Salt Ash Ave (N)											
7b	L3	59	18.4	0.148	4.8	LOS A	0.7	5.0	0.59	0.77	51.0
9a	R1	29	0.0	0.148	9.3	LOS A	0.7	5.0	0.59	0.77	54.5
9b	R3	28	13.0	0.148	12.3	LOS A	0.7	5.0	0.59	0.77	16.8
9u	U	1	0.0	0.148	13.3	LOS A	0.7	5.0	0.59	0.77	12.2
Approach		116	12.4	0.148	7.8	LOS A	0.7	5.0	0.59	0.77	43.6
NorthWest: Richardson Rd (NW)											
27b	L3	10	25.0	0.181	6.1	LOS A	0.9	6.6	0.52	0.66	33.4
10	L2	319	8.6	0.181	6.2	LOS A	0.9	6.6	0.53	0.68	64.5
12	R2	23	15.8	0.181	14.0	LOS A	0.8	6.3	0.53	0.72	59.0
12u	U	19	6.3	0.181	17.3	LOS B	0.8	6.3	0.53	0.72	37.4
Approach		371	9.4	0.181	7.2	LOS A	0.9	6.6	0.53	0.69	62.9
SouthWest: Nelson Bay Rd (SW)											
1	L2	7	0.0	0.047	7.2	LOS A	0.3	2.2	0.65	0.59	45.8
30a	L1	42	11.4	0.047	7.4	LOS A	0.3	2.2	0.65	0.59	44.2
2	T1	349	9.3	0.289	7.9	LOS A	2.2	17.5	0.74	0.65	68.9
3u	U	9	100.0	0.289	25.7	LOS B	2.2	17.5	0.74	0.65	64.1
Approach		407	11.3	0.289	8.5	LOS A	2.2	17.5	0.73	0.64	66.4
All Vehicles		2534	7.8	0.505	8.4	LOS A	4.2	30.6	0.47	0.58	61.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 PM Existing Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	503	7.6	0.272	5.4	LOS A	1.9	13.9	0.24	0.40	72.1
9	R2	359	10.7	0.298	13.6	LOS A	2.0	15.4	0.27	0.63	43.4
26b	R3	41	8.8	0.298	15.0	LOS B	2.0	15.4	0.27	0.63	42.2
9u	U	32	7.4	0.298	16.5	LOS B	2.0	15.4	0.27	0.63	67.2
Approach		935	8.9	0.298	9.4	LOS A	2.0	15.4	0.26	0.50	58.6
North: Salt Ash Ave (N)											
7b	L3	102	7.1	0.325	11.4	LOS A	1.9	13.7	0.88	0.95	46.9
9a	R1	17	0.0	0.325	16.0	LOS B	1.9	13.7	0.88	0.95	48.7
9b	R3	23	5.3	0.325	19.0	LOS B	1.9	13.7	0.88	0.95	14.3
9u	U	1	0.0	0.325	20.0	LOS B	1.9	13.7	0.88	0.95	9.8
Approach		143	5.9	0.325	13.2	LOS A	1.9	13.7	0.88	0.95	42.0
NorthWest: Richardson Rd (NW)											
27b	L3	8	14.3	0.489	10.4	LOS A	3.7	26.7	0.88	0.99	29.3
10	L2	637	2.6	0.489	10.8	LOS A	3.7	26.7	0.87	0.98	61.1
12	R2	8	14.3	0.489	19.7	LOS B	3.3	23.9	0.86	0.98	55.4
12u	U	12	10.0	0.489	22.9	LOS B	3.3	23.9	0.86	0.98	32.5
Approach		666	3.1	0.489	11.2	LOS A	3.7	26.7	0.87	0.98	60.5
SouthWest: Nelson Bay Rd (SW)											
1	L2	2	0.0	0.070	6.6	LOS A	0.4	3.0	0.54	0.56	46.3
30a	L1	80	7.5	0.070	6.6	LOS A	0.4	3.0	0.54	0.56	44.7
2	T1	918	4.8	0.613	8.3	LOS A	6.2	45.4	0.75	0.68	69.3
3u	U	9	88.9	0.613	21.9	LOS B	6.2	45.4	0.75	0.68	50.0
Approach		1010	5.8	0.613	8.3	LOS A	6.2	45.4	0.73	0.67	67.6
All Vehicles		2753	6.2	0.613	9.6	LOS A	6.2	45.4	0.61	0.71	61.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 AM with Additional Heavy Vehicles Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	1060	5.9	0.510	5.8	LOS A	4.2	30.6	0.40	0.47	70.7
9	R2	488	4.9	0.510	14.0	LOS A	4.1	30.3	0.44	0.63	43.8
26b	R3	78	16.9	0.510	15.8	LOS B	4.1	30.3	0.44	0.63	42.5
9u	U	13	18.2	0.510	17.3	LOS B	4.1	30.3	0.44	0.63	64.8
Approach		1639	6.2	0.510	8.8	LOS A	4.2	30.6	0.41	0.53	60.6
North: Salt Ash Ave (N)											
7b	L3	59	18.4	0.150	4.9	LOS A	0.7	5.2	0.60	0.77	51.0
9a	R1	29	0.0	0.150	9.4	LOS A	0.7	5.2	0.60	0.77	54.4
9b	R3	28	13.0	0.150	12.4	LOS A	0.7	5.2	0.60	0.77	16.7
9u	U	1	0.0	0.150	13.4	LOS A	0.7	5.2	0.60	0.77	12.2
Approach		116	12.4	0.150	7.8	LOS A	0.7	5.2	0.60	0.77	43.5
NorthWest: Richardson Rd (NW)											
27b	L3	10	25.0	0.184	6.2	LOS A	0.9	6.8	0.53	0.66	33.3
10	L2	319	8.6	0.184	6.2	LOS A	0.9	6.8	0.53	0.69	64.4
12	R2	23	15.8	0.184	14.1	LOS A	0.9	6.4	0.54	0.72	59.0
12u	U	19	6.3	0.184	17.4	LOS B	0.9	6.4	0.54	0.72	37.3
Approach		371	9.4	0.184	7.3	LOS A	0.9	6.8	0.54	0.69	62.9
SouthWest: Nelson Bay Rd (SW)											
1	L2	7	0.0	0.047	7.2	LOS A	0.3	2.3	0.66	0.59	45.8
30a	L1	42	11.4	0.047	7.4	LOS A	0.3	2.3	0.66	0.59	44.1
2	T1	349	9.3	0.299	8.0	LOS A	2.3	18.4	0.74	0.66	68.7
3u	U	25	100.0	0.299	20.9	LOS B	2.3	18.4	0.74	0.66	57.7
Approach		423	14.7	0.299	9.3	LOS A	2.3	18.4	0.73	0.65	65.8
All Vehicles		2550	8.4	0.510	8.5	LOS A	4.2	30.6	0.49	0.58	61.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 PM with Additional Heavy Vehicles Nelson Bay Road / Richardson Road

New Site
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
NorthEast: Nelson Bay Rd (NE)											
8	T1	503	7.6	0.275	5.5	LOS A	1.8	13.5	0.27	0.41	71.9
9	R2	359	10.7	0.304	13.7	LOS A	2.0	15.2	0.31	0.63	43.3
26b	R3	41	8.8	0.304	15.2	LOS B	2.0	15.2	0.31	0.63	42.1
9u	U	32	7.4	0.304	16.6	LOS B	2.0	15.2	0.31	0.63	67.0
Approach		935	8.9	0.304	9.5	LOS A	2.0	15.2	0.29	0.51	58.4
North: Salt Ash Ave (N)											
7b	L3	102	7.1	0.336	12.1	LOS A	2.0	14.5	0.89	0.97	46.4
9a	R1	17	0.0	0.336	16.7	LOS B	2.0	14.5	0.89	0.97	48.0
9b	R3	23	5.3	0.336	19.6	LOS B	2.0	14.5	0.89	0.97	14.1
9u	U	1	0.0	0.336	20.6	LOS B	2.0	14.5	0.89	0.97	9.7
Approach		143	5.9	0.336	13.9	LOS A	2.0	14.5	0.89	0.97	41.5
NorthWest: Richardson Rd (NW)											
27b	L3	8	14.3	0.504	10.8	LOS A	3.9	28.3	0.90	1.00	28.8
10	L2	637	2.6	0.504	11.3	LOS A	3.9	28.3	0.89	1.00	60.5
12	R2	8	14.3	0.504	20.2	LOS B	3.5	25.2	0.88	1.00	54.8
12u	U	12	10.0	0.504	23.5	LOS B	3.5	25.2	0.88	1.00	32.0
Approach		666	3.1	0.504	11.6	LOS A	3.9	28.3	0.89	1.00	59.9
SouthWest: Nelson Bay Rd (SW)											
1	L2	2	0.0	0.071	6.6	LOS A	0.4	3.0	0.55	0.56	46.3
30a	L1	80	7.5	0.071	6.6	LOS A	0.4	3.0	0.55	0.56	44.7
2	T1	918	4.8	0.633	8.6	LOS A	6.8	50.2	0.77	0.72	69.2
3u	U	25	96.0	0.633	22.4	LOS B	6.8	50.2	0.77	0.72	49.2
Approach		1026	7.3	0.633	8.7	LOS A	6.8	50.2	0.75	0.70	67.1
All Vehicles		2769	6.7	0.633	9.9	LOS A	6.8	50.2	0.63	0.72	61.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 AM Existing Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	9	88.9	0.012	6.8	LOS A	0.0	0.0	0.00	0.49	36.2
Approach		9	88.9	0.012	6.8	NA	0.0	0.0	0.00	0.49	36.2
East: Nelson Bay RD (E)											
4	L2	8	100.0	0.011	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	1068	5.2	0.568	0.0	LOS A	0.0	0.0	0.00	0.00	79.6
Approach		1076	5.9	0.568	0.4	NA	0.0	0.0	0.00	0.00	79.3
West: Nelson Bay RD (W)											
11	T1	354	12.5	0.198	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		354	12.5	0.198	0.0	NA	0.0	0.0	0.00	0.00	79.9
All Vehicles		1439	8.0	0.568	0.1	NA	0.0	0.0	0.00	0.01	79.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 PM Existing Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	Demand Flows HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	9	88.9	0.012	6.8	LOS A	0.0	0.0	0.00	0.49	36.2
Approach		9	88.9	0.012	6.8	NA	0.0	0.0	0.00	0.49	36.2
East: Nelson Bay RD (E)											
4	L2	8	100.0	0.011	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	460	8.1	0.250	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		468	9.7	0.250	0.2	NA	0.0	0.0	0.00	0.01	79.2
West: Nelson Bay RD (W)											
11	T1	1009	4.8	0.534	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		1009	4.8	0.534	0.1	NA	0.0	0.0	0.00	0.00	79.7
All Vehicles		1486	6.8	0.534	0.1	NA	0.0	0.0	0.00	0.01	79.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 AM with Addditional Heavy Vehicles Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	25	96.0	0.034	6.9	LOS A	0.0	0.0	0.00	0.48	35.4
Approach		25	96.0	0.034	6.9	NA	0.0	0.0	0.00	0.48	35.4
East: Nelson Bay RD (E)											
4	L2	24	100.0	0.034	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	1068	5.2	0.568	0.0	LOS A	0.0	0.0	0.00	0.00	79.6
Approach		1092	7.3	0.568	0.5	NA	0.0	0.0	0.00	0.01	78.8
West: Nelson Bay RD (W)											
11	T1	354	12.5	0.198	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		354	12.5	0.198	0.0	NA	0.0	0.0	0.00	0.00	79.9
All Vehicles		1471	10.0	0.568	0.2	NA	0.0	0.0	0.00	0.02	78.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2035 PM with Addditional Heavy Vehicles Nelson Bay Road / Site Access

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site Access (S)											
1	L2	25	96.0	0.034	6.9	LOS A	0.0	0.0	0.00	0.48	35.4
Approach		25	96.0	0.034	6.9	NA	0.0	0.0	0.00	0.48	35.4
East: Nelson Bay RD (E)											
4	L2	24	100.0	0.034	6.3	LOS A	0.0	0.0	0.00	0.50	53.2
5	T1	460	8.1	0.250	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		484	12.7	0.250	0.4	NA	0.0	0.0	0.00	0.02	78.0
West: Nelson Bay RD (W)											
11	T1	1009	4.8	0.534	0.0	LOS A	0.0	0.0	0.00	0.00	79.7
Approach		1009	4.8	0.534	0.1	NA	0.0	0.0	0.00	0.00	79.7
All Vehicles		1518	8.8	0.534	0.2	NA	0.0	0.0	0.00	0.02	78.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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