Appendix B10.5

Jali Borrow Site Management Plan

Woolgoolga to Ballina (sections 3 to 11)

Pacific Highway Upgrade

AUGUST 2017

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Pacific Complete Environment & Sustainability Manager	Pacific Complete Project Director	Roads and Maritime General Manager Pacific Highway

Revision history

Revision	Date	Description
0	16/01/17	Internal review
1	06/02/17	Initial RMS review
2	02/06/17	Draft for second RMS review
3	20/06/17	Draft for third RMS review
4	26/06/17	Submission to DPE
5	15/8/17	Final submission to DPE

Contents

Tables

Figures

Appendices

Glossary / Abbreviations

BSMP	Approved Pacific Complete Borrow Site Management Plan (sections 3 to 11)
CAQMP	Approved Pacific Complete Construction Air Quality Management Plan (sections 3 to 11)
CEMP	Construction Environmental Management Plan
CCEMP	Contractor's construction environmental management plan
CFFMP	Approved Pacific Complete Construction Flora and Fauna Management Plan
CNVMP	Approved Pacific Complete Construction Noise and Vibration Management Plan (sections 3 to 11)
CSWMP	Approved Pacific Complete Construction Soil and Water Quality Management Plan (sections 3 to 11)
CWREMP	Approved Pacific Complete Construction Waste Resource and Energy Management Plan sections 3 to 11)
dB	Decibels
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESCP	Erosion and sediment control plan
EWMS	Environmental Work Method Statements
LEP	Local environment plan
MCoA	Minister's condition of approval
NCA	Noise catchment area
NML	Noise management level
NPW Act	*National Parks and Wildlife Act 1974*
OEH	Office of Environment and Heritage
PACHI	Procedure for Aboriginal cultural heritage consultation and investigation

Project, the	The Woolgoolga to Ballina Project
RBL	Rating background level
Secretary	Secretary of the Department of Planning and Environment
SPIR	Submissions/ Preferred Infrastructure Report
RMS, Roads and Maritime Services	Roads and Maritime
UDLP	Urban Design Landscape Plan

1 Introduction

1.1 Context

This Borrow Site Management Plan (BSMP) for the Jali Borrow Site forms part of the Construction Environmental Management Plan (CEMP) for construction of sections 3 to 11 of the Woolgoolga to Ballina Pacific Highway Upgrade.

This BSMP has been prepared to address the requirements of the Minister's Conditions of Approval (MCoA), specifically MCoA D22, the mitigation measures listed in the Pacific Highway Upgrade: Woolgoolga to Ballina Submissions / Preferred Infrastructure Report November 2013 (SPIR) and all applicable legislation.

The EIS indicates that if nearby road projects and quarries cannot supply the material required for the project, other material sources near the project would be investigated. The EIS also advised that any material sourced would need to be:

- More than 40 metres from waterways
- Of low ecological and heritage value
- Greater than 100 metres from the closest receiver (unless a negotiated agreement is in place).

1.2 Background

On behalf of the Australian and NSW governments, NSW Roads and Maritime Services (Roads and Maritime) is progressively upgrading the Pacific Highway to dual carriageway between the Hunter and NSW/Queensland border.

The Woolgoolga to Ballina Pacific Highway Upgrade involves upgrading approximately 155 kilometres (km) of highway to four-lane dual-carriageway road between Woolgoolga (north of Coffs Harbour) and Ballina (near the NSW/Queensland border) on the NSW north coast. The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell. The project will include road duplication, alignment modification and new road sections. Once complete, the project will create a four-lane divided road, with two lanes in each direction. It would also allow for the road's upgrade in the future to a six-lane divided highway.

The Woolgoolga to Ballina Project was declared critical State significant infrastructure under section 115V of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and was assessed under Part 5.1 of the EP&A Act. Following preparation and exhibition of the environmental impact statement (EIS) and response to submissions (SPIR) the project was approved by the NSW Government on 24 June 2014.

The Woolgoolga to Ballina project has also been subject to approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Woolgoolga to Ballina Project was declared by the Commonwealth Minister for Sustainability, Environment, Water, Populations and Communities to be a controlled action under this Act on 20 June 2012. Approval was granted on 14 August 2014.

The Woolgoolga to Ballina project has been staged with Sections 1 and 2 delivered separately. This document covers Sections 3-11 of the Woolgoolga to Ballina upgrade (the project). The project will be delivered by the Pacific Complete, appointed as the Delivery Partner of Roads and Maritime. Pacific Complete comprises Laing O'Rourke Australia Construction Pty Ltd and Parsons Brinckerhoff Australia Pty Limited working in close collaboration with Roads and Maritime Services (Roads and Maritime).

1.3 Environmental management system overview

The Pacific Complete CEMP (sections 3 to 11) describes the overall system for environmental management of the project being delivered by Pacific Complete in partnership with Roads and Maritime.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors will be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a Contractor's Construction Environmental Management Plan (CCEMP) that will be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS) prepared by the contractor.

Contractor EWMS will be developed and signed off by the PC Environment Manager prior to commencement of works and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Additionally an online GIS system of mapping (PCMap) has been developed for the project and this includes all of the sensitive environmental issues identified during the environmental assessment process for the project. Used together, the CEMP, PCMap, strategies, procedures and EWMS form a management system that clearly identifies required environmental management actions for reference by project personnel and contractors.

The review and document control processes for this plan are described in Chapters 9 and 10 of the CEMP.

1.3.1 Pacific Complete Environment Protection Licence (EPL)

Following the approval of this borrow site management plan, Pacific Complete would seek a variation to the boundary of our EPL (20713) to incorporate the borrow site and its associated activities.

1.4 Purpose

The purpose of this plan is to describe how Pacific Complete will manage the establishment, operation and rehabilitation of Jali's Borrow Site which will be used for the construction of the Woolgoolga to Ballina Pacific Highway Project (sections 3 to 11).

1.5 Objectives

The key objective of this BSMP is to ensure that impacts caused by the borrow site are minimised within the scope permitted by the planning approval. To achieve this, the following will be undertaken:

- Ensure appropriate measures are implemented to address the relevant MCoA outlined in Table 2.2 and the safeguards detailed in the EIS and SPIR
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 2.1 of this plan.
- Ensure appropriate measures are implemented to avoid damage or destruction to threatened species, aboriginal and non-aboriginal sites and artefacts and sensitive ecosystems during the establishment, operation, decommissioning and rehabilitation of the site.

- Provide staff with an increased level of understanding and awareness of sensitive environmental issues within or adjacent to the borrow site and ensure effective communication is maintained with statutory authorities.
- Ensure consultation is carried out with sensitive receives and stakeholders and address questions or concerns raised during consultation.
- Ensure that the site is rehabilitated to an acceptable level after the site is decommissioned.

2 Relevant legislation and guidelines

2.1 Legislation

Table 2-1 lists the principal legislation and regulation that applies to ancillary facilities management.

Table 2-1 Principal legislation and regulation relevant to ancillary facility management

Legislation and regulation	Relevance
Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999	Provides for the protection of matters of national environmental significance including species, populations, communities and their habitat that could be impacted by the work.
National Greenhouse and Energy Report Act 2007	Provides the statutory basis for the National Greenhouse and Energy Reporting Scheme in relation to greenhouse gas emissions and energy consumption and production.
Native Title Act 1993	Provides a mechanism for the recognition and protecting of native title.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Protects objects and areas that are of particular significance to Aboriginal people.
State	
Environmental Planning and Assessment Act 1979 (EP&A Act)	Describes the processes for consenting development in NSW, managing land use and implementing environmental planning instruments. Describes certain permitting and licencing streaming and exclusion provisions that will apply to the work.
Protection of the Environment Operations Act 1997	Prescribes pollution control, incident notification, offence notices and the provision of Environment Protection Licences.
Noxious Weeds Act 1993	Provides for the management and control of noxious weeds to reduce the spread of weeds and minimise damage to the environment.
Threatened Species Conservation Act 1995	Provides a complete list of all endangered and vulnerable species and ecological communities in NSW listed under the Act.
Fisheries Management Act 1994	Governs the management of fish and their habitat in NSW.
Native Vegetation Act 2003	Stipulates the way native vegetation is managed in NSW by preventing largescale clearing, unless it improves or maintains environmental outcomes.
National Parks and Wildlife Act 1974	Provides statutory protection for native fauna and flora and Aboriginal places and objects throughout NSW.

Legislation and regulation	Relevance
Heritage Act 1997	Provides for the conservation of buildings, works, archaeological relics and places of heritage value.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)	Enacted to specifically protect Aboriginal and Torres Strait Islander heritage.
Water Act 1912	Provides for the protection of groundwater in the few areas in NSW where water-sharing plans have not come into effect.
Water Management Act 2000	Provides for the protection, enhancement and restoration of water sources and ecosystems, ecological processes and biological diversity.
Soil Conservation Act 1938	Establishes controls to prevent soil erosion and land degradation.
Contaminated Land Management Act 1997	Provides for the investigation and remediation of contaminated land considered to post a significant risk to human health of the environment.
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	Supplementary legislation aimed at reducing waste and resource consumption, defining the waste hierarchy and promoting its adoption across NSW.
Environmentally Hazardous Chemicals Act 1985	Controls the movement, storage, and disposal of chemical waste. Administered by EPA and the Hazardous Chemicals Advisory Committee.
Dangerous Goods (Roads and Rail Transport) Act 2008	Ensures that dangerous goods are transported in a safe manner.
Pesticides Act 1999	Controls and regulates the use of pesticides in NSW. It prohibits the misuse of pesticides that harms people, property, animals or plants. Under the Act the EPA can issue a person with a clean-up notice, prevention notice and compliance cost notice.

2.1.1 Guidelines

- NSW Road Noise Policy (RNP) (DECCW 2011)
- NSW Industrial Noise Policy (INP) (EPA 2000)
- RTA Environmental Noise Management Manual (ENMM) (RTA 2001)
- Interim Construction Noise Guideline (ICNG) (DECC 2009)
- Assessing Vibration: A Technical Guideline (DEC 2006)
- British Standard 7385: Part 2 ""Evaluation and measurement of vibration in buildings"
- *German DIN 4150: Part 3 – 1999 Effects of Vibration on Structure* (DIN 1999)
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990) Australian and New Zealand Environment and Conservation Council (ANZECC)
- Australian Standard AS2187.2-2006: "Explosives – Storage, Transport and Use"

- National Environment Protection Council's (NEPC) – NEPM for Ambient Air Quality Guidelines
- Protection of the Environment Operations (Clean Air) Regulation, 2002
- AS 3580.1.1:2007 Methods for Sampling and Analysis of Ambient Air – Guide to Siting Air Quality Monitoring Equipment.
- AS 3580.10.1-2003 Methods of Sampling Analysis of Ambient Air
- Action for Air 2009 (NSW DEC)
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005)
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC 2007)
- Air Quality Monitoring Criteria for Deposited Dust (DEC Guideline).

2.2 Minister's Conditions of Approval

The MCoA relevant to this plan are listed in Table 2-2. A cross reference is also included to indicate where the condition is addressed in this plan or other project management documents.

Table 2-2 Conditions of approval relevant to the Borrow Site Management Plan

MCoA No.	Condition Requirements	Document Reference
D22	The Applicant shall prepare and implement a **Borrow Sites Management Plan**, to manage the construction, operation and rehabilitation of the borrow sites used to source construction material for the SSI, prior to the commencement of construction at the borrow sites, or as otherwise agreed by the Secretary. The Plan shall be prepared in consultation with the EPA, OEH and DPI (Fisheries) and to the satisfaction of the Secretary, and shall include, but not necessarily be limited to:	
	(a) details of construction/extraction methods and activities carried out at the borrow site;	Section 4
	(b) management and mitigation measures to be used to minimise surface and groundwater impacts, Aboriginal and non-Aboriginal heritage, air quality, noise and vibration, biodiversity and visual impacts;	Section 6
	(c) consultation with sensitive receivers; and	Section 7
	(d) details of the rehabilitation of the borrow site, including future landform and use of the borrow site, landscaping and revegetation, and measures that would be implemented to minimise or manage the ongoing environmental effects of the site.	Section 8
	The Plan shall demonstrate that the construction and operation of the Lang Hill borrow site has no adverse impact on the known Oxleyan Pygmy Perch habitat waterway.	NA

MCoA No.	Condition Requirements	Document Reference
B79	The applicant shall ensure that material extracted from the borrow sites established for the SSI, is only used for the construction of the SSI subject to this approval, and no other sections of the Pacific Highway or other works.	Noted.

2.3 EIS borrow site criteria

The criteria outlined in the EIS for the location of borrow sites and a summary response is detailed in Table 2-3. A cross reference is also included to indicate where the criteria is addressed in more detail in this plan.

Table 2-3 EIS Criteria for borrow sites

Criteria	Summary response	Document Reference
More than 40 metres from waterways	The borrow site is located more than 40 metres from a major waterway.	Section 5.1
Of low ecological and heritage value	The borrow site is considered to be of low ecological and heritage value. The borrow site is located on predominantly cleared, highly degraded land due to historical quarrying at the site. Extensive areas of exposed earth are evident at the site with patches of grassed area, recolonising vegetation. Koala habitat and evidence of koala activity has been identified in the vegetation surrounding and the near the site. The site would be managed in accordance with the approved Koala Management Plan and Construction Flora and Fauna Management Plan (sections 3 to 11), Appendix B2 of the CEMP and specific management measures outlined in Section 6. No Aboriginal or non-Aboriginal items of heritage significance were identified within or surrounding the site.	Section 5.3 and Section 5.7
Greater than 100 metres from the closest receiver (unless a negotiated agreement is in place).	No receivers are located within 100 metres of the site.	Section 5.5

3 Borrow site description

The Jali Borrow Site is located approximately 4 kilometres south west of the township of Wardell (see Figure 3-1). The site is located adjacent to the western side of the project boundary, in Portion D of the Woolgoolga to Ballina Pacific Highway Upgrade (sections 3 to 11). The land is owned by the Jali Local Aboriginal Land Council and will be leased by RMS for the duration of the works at the site. The land would be rehabilitated post excavation works and then handed back to the land council.

The borrow site consists of an excavation area, located within a pre-existing quarry and potentially associated infrastructure for staff offices and amenities. The site would initially be accessed via Old Bagotville Road until the construction corridor has been cleared and is accessible for construction vehicles. Figure 3-2 provides a site layout of the borrow site.

Table 3-1 Site description

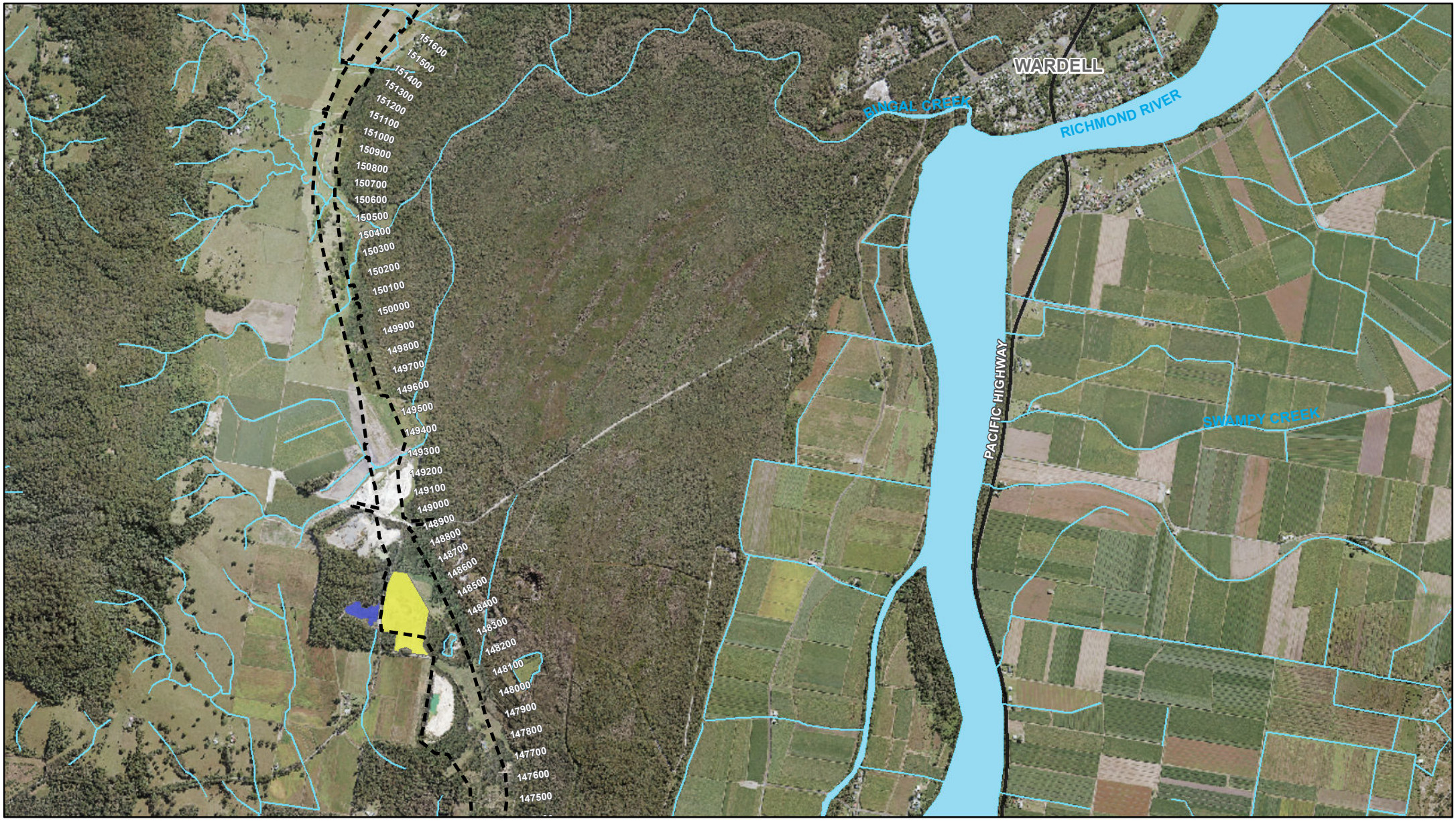
Item	Description
Chainage	148500 to 148700
Location	Old Bagotville Road, south west of Wardell
Lot ID	Lot 244 DP755691
Size	2 hectares

The site is located on predominantly cleared, highly degraded land due to historical quarrying at the site. Extensive areas of exposed earth are evident at the site with patches of grassed area, recolonising vegetation and two shallow artificial ponds that hold water after rain. The surrounding vegetation consists of Blackbutt grassy open forest of the lower Clarence Valley of the North Coast and a patch of Narrow-leaved Red Gum woodlands of the lowlands of the North Coast. Much of the surrounding vegetation has been classified as regrowth, particularly on the western and northern sides of the quarry. The works at the Jali Borrow Site would occur within the footprint of the pre-existing quarry, therefore no removal of vegetation adjacent to the site would be required. Vegetation to be removed would consist of exotic grasses, herbaceous weeds and a limited number of common shrubs and tree species.

Koala scats were recorded under a number of Tallowwood trees within the vegetation on the southern margins of the site during a survey of the site. The Mammal Management Plan for the project identifies records of Long-nosed Potoroo to the west of the site and on the opposite side of the project alignment. Wallum Sedge Frog breeding and foraging/dispersal habitat is also outlined in the Frog Management Plan on the opposite side of the project corridor, approximately 600 metres from the site.

The borrow site is located above the 20 year and 100 year ARI flood level. No major waterways are located in the vicinity of the site. There are no major waterways in the vicinity of the borrow site. A small drainage line is located approximately 250 metres to the south of the site. Two small OEH identified wetlands are located approximately 600 metres to the east of the site, on the opposite side of the construction corridor.

The site is located in a rural landscape. The closest sensitive receiver is located approximately 350 metres to the south of the site.



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Woolgoolga to Ballina

Gibsons and Jali Borrow Sites Location

Figure 3-1

Approved Project Boundary Version 11 (June 2016)

Gibsons Borrow Site

Jali Borrow Site

1:25,000 at A4

0 125 250 500 750 1,000

Metres

Print Date:	21/12/2016
Author:	LABRUYEREA

PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites Layout

Figure 3-2

- Koala grid
- Drainage
- Exclusion fencing
- Access during establishment and prior to the opening of the construction corridor
- Access once construction corridor is operational
- Approved Project Boundary Version 11 (June 2016)
- Staff office/amenities and stockpile area
- Gibsons Borrow Site excavation area
- Jali Borrow Site excavation area

1:4,000 at A4

0 25 50 100 150
Metres

Print Date:	9/02/2017
Author:	LABRUYEREA

3.2 Justification

The following four borrow sites were identified in the SPIR: Lang Hill, Lumleys Hill, Gibsons and Eatons. Jali Borrow Site was not initially identified in the SPIR, however has subsequently been identified to alleviate the deficit in material required for the construction of Portion D. The EIS outlines the potential to develop additional borrow sites near the project if there are any shortfalls of material. Chapter 6 of the Environmental Impact Statement (EIS), Section 6.4.1. Material Quantities and Sources states the following:

> *The balance of earthwork material would be reviewed during detailed design, and it is possible that there could be a shortfall or surplus of materials. For example, there may not be sufficient quantity or quality of material within the project boundary, or it may not be feasible or economical to transport material between project sections. If there were any shortfall or excess of materials, this could be addressed in a number of ways:*
>
> - *Flattening the cutting batters to provide more material*
> - *Increasing the excavated width at the base of cutting batters*
> - *Lowering some sections of new local access roads*
> - *Obtaining material generated from other road projects near the project that is in excess*
> - *Obtaining materials from licensed local quarries near the project*
> - *Developing other borrow sites near the project*
> - *Using recycled material (such as removed pavement for select fill).*
>
> *In terms of sourcing external fill, the priority would be to obtain material from nearby road projects and licensed quarries. Potential material sources are identified in Table 6-13. If nearby road projects and quarries are not able to supply the material within the timeframe, or have the quantity required, other material sources near the project would be investigated. Any material source areas would need to be:*
>
> - *More than 40 metres from waterways*
> - *Of low ecological and heritage value*
> - *Greater than 100 metres from the closest receiver (unless a negotiated agreement is in place.)*

Additionally, the Minister's Conditions of Approval (MCoA) do not prevent the applicant from exploring options for additional borrow sites for the project. MCoA D22 specifies that the applicant is to prepare and implement a borrow site management plan, to manage the construction, operation and rehabilitation of the borrow sites used to source construction material for the SSI.

The Jali's Borrow Site would assist in providing the appropriate material to offset the deficit of rock and gravel products required for the project. The extracted material would be used for fill rock and gravel material required to create a stable road formation within Portion D of the project.

The borrow sites located in close proximity to the construction corridor, alleviates the need to source material from existing quarries, reducing cost and travel time. Once the construction corridor is open to construction vehicles, the material would be hauled along the construction corridor, reducing the number of haulage vehicles that would otherwise be required to travel along the existing highway and local road network.

3.3 Commissioning and decommissioning

Table 3-2 Indicative timeframes for borrow site activities

	2017				2018				2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Site establishment																
Operation																
Decommissioning																
Rehabilitation																

4 Material extraction

4.1 Extraction description

It is estimated that 83,100 m^3 of material would be extracted from the Jali Borrow Site. The material to be extracted from the site is metamorphosed siltstone and metamorphosed sandstone. The material would be used for both rock fill and gravels for the construction of the project.

4.2 Construction and extraction method

4.2.1 Construction method

Access to the site establishment and early operation would be from Old Bagotville Road, as shown in Figure 3-2, and utilised until the construction corridor has been cleared and accessible for construction vehicles. Old Bagotville Road is currently used for the haulage of materials from nearby quarries and has been used previously for the supply of material for other Pacific Highway projects including Alstonville Bypass and Ballina Bypass.

The site is predominantly cleared, highly degraded land due to historical quarrying at the site. Extensive areas of exposed earth are evident at the site with patches of grassed area, recolonising vegetation and two shallow artificial ponds that hold water after rain. The surrounding forest consists of Blackbutt grassy open forest of the lower Clarence Valley of the North Coast and a patch of Narrow-leaved Red Gum woodlands of the lowlands of the North Coast. Much of the surrounding vegetation has been classified as regrowth, particularly on the western and northern sides of the quarry. Clearing limits would be demarcated and clearing/ grubbing of the scattered vegetation would be undertaken.

A site office and staff amenities including minor fuel and chemical storage and parking for heavy and light vehicles would be mobile and located within the footprint of the borrow site. Alternatively a permanent site office may be established at the adjacent Gibsons Borrow Site.

A number of activities at the borrow site would require access to water including dust suppression, crushing and screening and rehabilitation. It is anticipated that water for these activities would be sourced from the sediment basin/pond at the site or nearby basins within the alignment and/or trucked in and stored at the site. Potable water would also be required for the crib room and staff amenities. The construction contractor would determine the amount of water required for the site and from where the water would be sourced.

4.2.2 Extraction method

The excavation works would occur within the footprint of the former quarry at the site. The existing floor level would be lowered by approximately seven metres and the existing quarry walls would be excavated to reshape the batters.

Conventional extraction methods would be used to excavate materials including ripping, hammering and controlled blasting to fragment the rock for processing. Processing techniques would include crushing, screening and stockpiling. All processing plant would be mobile and fitted with industry best practice misting sprays for dust suppression. Materials would be stockpiled at the borrow site until transported for use on the project.

All blasts would be planned, executed and monitored in accordance with the Blast Management Procedure, Appendix B of the approved Pacific Complete Construction Noise and Vibration Management Plan (sections 3 to 11) (CNVMP), Appendix B3 of the CEMP, and would ensure the overpressure and vibration limits outlined in MCoA B22 and B23 are not exceeded. This would be achieved through the preparation of a site specific blast management plan prior to any blasting which would be prepared by the contractor and would address

potential risks and control measures. A detailed trial blast would be undertaken to determine the site specific blasting criteria for controlled blasting.

4.3 Activities to be carried out at the facility

Activities to be carried out at the borrow site include:

- Site establishment/mobilisation of the site, including:
  - Clearing and grubbing of revegetation within the existing quarry footprint
  - Establishment of site office/staff amenities (unless established at Gibsons Borrow Site)
  - Installation of exclusion fencing
  - Installation of plant equipment
  - Establishment of sedimentation and erosion control measures
  - Stockpiling of topsoil/overburden material.
- Mechanical excavation, drilling and blasting
- Material processing (crushing and screening)
- Monitoring and maintenance of environmental measures during the use of the site and demobilisation when extraction is complete.
- Rehabilitation.

As outlined in the project approval, the site would operate during the hours of:

Monday to Friday: 7am to 6pm
Saturday: 8am to 5pm
Sunday and Public Holidays: no work.

Low noise impact activities and works, as defined in the Minister's conditions of approval, may also be carried out between Monday to Friday: 6am to 7am and 6pm to 7pm.

Blasting would only be conducted during the hours of:
Monday to Friday: 9am to 5pm
Saturday: 9am to 1pm
Sunday and Public Holidays: no blasting.

4.4 Plant and equipment

Table 4-1 Plant and equipment to be used and stored at the site

Plant	Equipment
Site establishment/decommissioning (site office/amenities) • semi-trailers and other delivery trucks • 1 x small mobile crane • 1 x grader • 1 x 13T padfoot • 1 x 13T smooth drum • 1 x backhoe / 23T excavator • 10 x LVs • Watercart **Extraction operations** • 3 x 35t-50t excavator (including rock breakers and hydraulic hammers) • 2 x D6-9 bulldozer, • 2x front end loader • 2x backhoe	• Pumps • Generator • Fuel and chemical storage • Trailers • Shipping containers • Tools.

Plant	Equipment
• 6 x 30t-50t articulated dump truck • 6 x 631 scraper • 6 x truck and dog • 2 x water carts • 20t smooth drum roller • 20t padfoot roller • 1 x drill rig and support vehicles for blasting • 10 x light vehicles **Crushing and screening** • 1 x jaw crusher • 1 x cone crusher • 1 x screen • 30t excavator • Front end loader • 1 x watercart • 5 x LVs **Rehabilitation** • 25t excavator • 1 x grader • 4 x 30-40t articulated dump truck (or 4 x truck and dog) • 13t smooth drum roller • 13t padfoot roller • 10 x light vehicles	

4.5 Chemical and fuel storage details

It is anticipated that there would be some fuel and chemicals stored at the borrow site. Fuel and chemicals and indicative quantities expected to be stored at the facility include:

- Diesel fuel – 10,000 L
- Unleaded fuel – 100L
- Oils – 100L
- Grease – 100kg
- Short term storage of blasting related materials (emulsion chemicals).

5 Environmental impacts of the borrow site

Section 5 of the environmental constraints located within and adjacent to the Jali Borrow Site. In addition, the impacts associated with the sites activities have been assessed to determine whether they are consistent with the approved project.

5.1 Hydrology and flooding

The Jali Borrow Site is located above the 20 year and 100 year ARI flood level for the area.

Hydrology and flooding impacts associated with the proposed borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the relevant requirements of the Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.2 Soils, sediments and water

There are no major waterways in the vicinity of the borrow site. A small drainage line is located approximately 250 metres to the south of the site. Two small OEH identified wetlands are located approximately 600 metres to the east of the site, on the opposite side of the construction corridor.

The site is located within an area that was identified in the EIS as having no known occurrence of acid sulfate soils.

Two groundwater regimes are located within the area of the Jali Borrow Site, a shallow sand and minor gravels alluvium which includes coastal barrier sands and a second within the bedrock of the Neranleigh Fernvale Beds underlying the alluvium. The borrow site is located on a low ridge comprising the Neranleigh Fernvale Beds with the coastal sands and Richmond River Alluvium located within 100 to 200 metres to the east, northeast and south of the adjacent Gibsons Borrow Site in low lying areas, approximately 300 to 00 metres from the Jali Borrow Site.

The shallow sand (gravel) aquifer was identified during investigation works on the north-east margin of the adjacent Gibsons Borrow Site, as outlined in Appendix A, Groundwater Review. It is inferred that this aquifer rapidly thins out to the west so is considered unlikely to be intercepted by the excavation works at the Jali Borrow Site.

The Neranleigh Fernvale Beds, the material that would be quarried from the site, sustains three groundwater systems:

- A shallow perched (within 5 m below ground level) in the thin weathered regolith profile
- A porous aquifer in some low lying areas
- A deeper fractured bedrock groundwater system.

The porous aquifer was identified during the preparation of the groundwater review that covers both the Gibsons and Jali Borrow Sites. The porous aquifer was identified on the eastern side of the Gibsons Borrow Site and, if intercepted, this could result in drawn down for several hundred meters to the east. As the Jali Borrow Site is located to the west of Gibsons Borrow Site, it is not anticipated that this porous aquifer would not to be intercepted.

The borrow site is proposed to be excavated approximately seven metres below the existing ground level, resulting in a depth of 2.5 metres AHD. Based on available data this would intercept the water table by approximately 2 to 6 metres (Refer to Appendix A). This would create a localised groundwater sink altering groundwater flow in the area such that water would flow towards the excavation pit instead of from the high ridge area, to the west of the site, to low topographic areas to the east of the site. Dewatering of the bedrock aquifer is anticipated to occur however, due to the very low permeability of the bedrock, dewatering is considered to be localised (with a tight drawdown cone around the excavation pit).

Impacts to vegetation surrounding the site are considered to be minimal if the ecological communities are sustained by the shallow perched groundwater and, to a limited degree, by deeper groundwater underlying the ridge. Impacts are considered to be low due to:

- Historic quarrying at the site that removed a large amount of the shallow perched system
- The water table below the ridge being estimated to be greater than 6 metres deep, from which dewatering activities may only impact deep rooted vegetation (trees).

Surplus material from the project is unlikely to be available to backfill the site post excavation, therefore the site would be rehabilitated as an open void. Drawdown of the local water table would continue due to ongoing seepage into the excavation pit causing ponding within the site. Direct rainfall would also contribute to ponding within the site. The depth of the ponded water would be influenced by inflow rates from the fractured bedrock system, intensity and frequency of rainfall events and evaporation rates. If surplus material is available to backfill the site to or above the height of the groundwater table, then the drawdown depression would dissipate as the water levels recover. Section 8 outlines rehabilitation of the site.

One registered landholder bore, located approximately 170 metres to the south west of the site, may be impacted by the excavation works at the Jali and adjacent Gibsons Borrow Site. The bore is used for domestic, farming and stock purposes. Impacts may include reduced supply due to drawdown and deterioration in water quality from potential salt concentration accumulation in the excavation ponds. Project staff met with the landholder in February 2017 to discuss property access to establish a monitoring bore to test the water quality and levels on his private bore. The landholder was advised that this would assist in the planning process for the use of quarries in the adjacent property (known to the project as Gibson and Jali Borrow Sites) as well as the ongoing monitoring during the operations of the quarries. The landholder advised that he had no objections to the proposed use of the quarries.

During this meeting project staff asked a number of questions in relation to the use and existing condition of the bore. The landholder indicated that he had not used the bore for many years and that rainwater tanks were his primary source of water. The landholder also advised that he believed the water quality was not good.

Monitoring bore GW04 (identified in the Groundwater Review (Appendix A)) has been installed between the borrow site and the landholder bore to monitoring impacts during the operation of the site.

The adjacent Gibsons Borrow Site was assessed in the SPIR to have a high potential of impact to the local groundwater table due to the interception of the local groundwater table, potentially resulting in localised drawdown. These were considered to be localised impacts and wouldn't result in impacts to the regional groundwater table. As the Jali Borrow Site is considered to result in localised drawdown, due to the interception of the groundwater table, the impacts are considered to be consistent with those assessed and approved under the EIS and SPIR.

5.2.1 Further assessment and management

Clean water would generally be directed away from the site due to the existing terrain that slopes away from the site boundaries. Where required clean water drains would be established

in accordance with the *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004), known as the 'Blue Book' to divert clean water around the site.

Diversion drains and erosion and sediment controls would be implemented in accordance with the Blue Book and the approved Pacific Complete Construction Soil and Water Quality Management Plan (sections 3 to 11) (CSWQMP), Appendix B4 of the CEMP to manage the flow of water around the site.

An erosion and sediment control plan (ESCP) for the borrow site would be prepared by the contractor's soil conservationist prior to the works commencing in accordance with the Blue Book and the CSWQMP, Appendix B4 of the CEMP. Site water currently drains to the north east corner of the site and then flows north onto the western side of Old Bagotville Road. Site water would be channelled towards a sediment basin, or similar, and used for construction activities such as dust suppression and, if required, discharged from the north east corner of the site to the current drainage line used at the site. Treatment and discharge of site water would be in accordance with the project EPL.

Management of groundwater seepage and rainfall runoff into the excavation pit would be required after excavation works progress below the existing floor level and the groundwater table is intersected. These management measures would include the following:

- Dewatering of the pit in accordance with Roads and Maritime Technical Guideline – Environmental Management of Construction Site Dewatering (Roads and Maritime, 2011) and in accordance with project environment protection licence (EPL) conditions, as outlined in the Submissions/ Preferred Infrastructure Report (SPIR) mitigation measure SSW44. the construction contractor would be required to develop a Dewatering EWMS or similar.
- Groundwater seepage and rainfall runoff would be collected in a sump within the excavation pit. SPIR mitigation measure SSW42 prescribes that the preferred option for groundwater management is for the transfer of groundwater to grassy swales for infiltration back into the groundwater source. Where possible these swales would divert groundwater around the construction area so that groundwater does not further mix with construction runoff. In accordance with SPIR mitigation measure SSW43 where infiltration cannot be achieved through grassy swales then groundwater is to be collected and treated, where applicable, within sedimentation basins (to capture suspended solids) before discharge into natural waterways.

Monitoring of groundwater level/quality would be undertaken from monitoring bore GW04. GW04 would be monitored to provide early warning of potential impacts from dewatering at the quarry site on the landholder bore. Following consultation with the landholder the monitoring of groundwater level/quality from bore GW056965 would also be conducted. Monitoring of water levels and key field water quality parameters (EC, pH) would be undertaken in accordance with the existing monitoring program for the project and the Groundwater Memo included in Appendix A. If adverse impacts to bore supply or quality occurs, a compensation ("make good") agreement would be negotiated between the landholder and NSW Roads and Maritime Services. This may include the construction of a new bore with similar performance and requirements to the existing bore at the property.

The Groundwater Review, Appendix A, has been provided to DPI-Water for their review and endorsement. The management plan has been updated to address feedback received.

Soils, sediments and water impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the

development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.2.2 Contamination

A Phase 1 Contamination Assessment was completed for the Gibsons and Jali Borrow Sites to assess the potential for soil and/or water contamination at the site (refer to Appendix B). A review of historical aerial photographs of the area determined that the site was developed into quarries between 1958 and 1967, with continued expansions until approximately 2009. Additional quarries were also established in the area between 1967 and 1987. Prior to the establishment of the quarry, the site consisted of undisturbed vegetated land.

Based on a desktop review and site inspection, the potential sources of contamination at the site include:

- Spillage or leakage of oils, fuel, herbicides, pesticides and other chemicals previously stored or used on the Sites.
- Potential spills or leaks of oils or fuels from machinery or vehicle previously used on the sites.
- Historical use of herbicides and pesticides both on and on the adjoining agricultural land.
- Waste materials including potential ACM, contents from discarded drums/AST/derelict cars, plastic, wood, tyres, glass, metal and general household waste.
- Potential use of fill from unknown sources.
- Potential hazardous building materials present within buildings on the site.
- Potential leaks from on-site septic tank.

The assessment determined that the potential for significant contamination at the site is likely to be low. Due to the historic use of the site and results of the site inspection the following would be undertaken:

- General building waste and rubbish would be removed from the site and a detailed inspection for asbestos containing material would be undertaken.

5.3 Biodiversity

The borrow site is located on predominantly cleared, highly degraded land due to historical quarrying at the site. Extensive areas of exposed earth are evident at the site with patches of grassed area, recolonising vegetation and two shallow artificial ponds that hold water after rain.

Vegetation surveys were carried out during the preparation of the EIS. This included a buffer surrounding the project boundary and the vegetation surrounding the borrow site. An additional ecological assessment was prepared for the Jali Borrow Site in October 2016, due to its location outside the approved project boundary (Refer to Appendix C). This assessment included a desktop assessment and field survey of the borrow site footprint and a 5 to 10 metre buffer surrounding the site within the adjacent vegetation.

The EIS identified the vegetation surrounding the site to consist of Blackbutt grassy open forest of the lower Clarence Valley of the North Coast. Two endangered ecological communities (EEC) were identified in the EIS within the general area of site. Swamp Sclerophyll Forest on Coastal Floodplains was identified approximately 30 metres to the north of the site and Subtropical Coastal Floodplain Forest on Coastal Floodplains was identified to be located 60 metres to the south of the site.

The more recent ecology assessment identified the surrounding vegetation to be consistent with the EIS findings of Blackbutt grassy open forest of the lower Clarence Valley of the North Coast surrounding the site, however it also identified a patch of Narrow-leaved Red Gum woodlands of the lowlands of the North Coast on the north side of the site (Figure 5-1). Much of the surrounding forest, particularly on the western and northern sides of the quarry is considered to be regrowth. One hollow-bearing tree was identified outside the survey area. No threatened flora species were identified and none are known to occur within 50 metres of the site. The ecology assessment also outlined that, based on the desktop assessment, the vegetation identified as EEC in the EIS is unlikely to be floodplain EEC after reviewing the 100 year event flood map and soils at the site.

The desktop assessment included a search of threatened fauna species listed under the *Threatened Species Conservation Act 1995 (TSC Act).* The assessment determined that the majority of these species do not and would not occur at the site due to the absence of suitable habitat, with the potential exception of Koalas and Grey-headed Flying-Fox that have been recorded in the area. During the survey, Koala scats were recorded under a number of Tallowwood trees within the vegetation on the southern margins of the site.

The Mammal Management Plan for the project identifies records of Long-nosed Potoroo to the west of the site and on the opposite side of the project alignment. Wallum Sedge Frog breeding and foraging/dispersal habitat is also outlined in the Frog Management Plan on the opposite side of the project corridor, approximately 600 metres from the site.

The works at the Jali Borrow Site would occur within the footprint of the pre-existing quarry, therefore no removal of vegetation adjacent to the site would be required. Vegetation to be removed would consist of exotic grasses, herbaceous weeds and a limited number of common shrubs and tree species. As such biodiversity impacts are not anticipated to result from the works at the site.

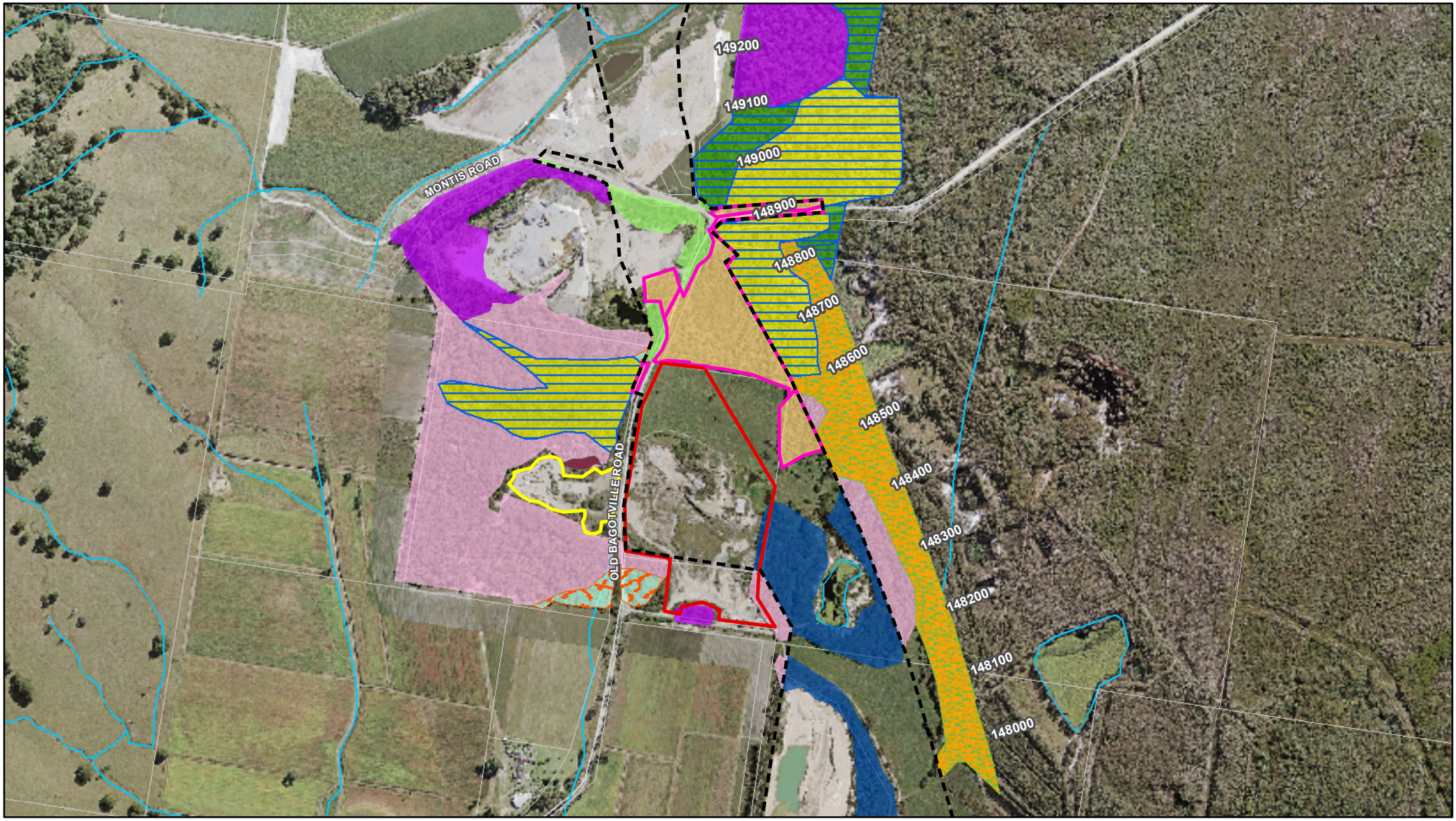
Temporary fauna (koala) exclusion fencing would be established around the boundary of the site, as shown in Figure 3-2. Fauna (koala) fencing is considered to be appropriate for the exclusion of Potoroos. Koala grids would be implemented at all entry points to allow traffic movements in and out of the site whilst maintaining a barrier between the site and any koalas potentially in the area. Mitigation measures outlined in the approved Koala Management Plan (RMS, 2016) with regards to speed zones and traffic requirements would be implemented for traffic entering and leaving the site. Any clearing of remnant/ regrowth vegetation within the site would also be carried out in accordance with the Koala Management Plan and the approved Pacific Complete Construction Flora and Fauna Management Plan (sections 3 to 11) (CFFMP), Appendix B8 of the CEMP.

Temporary fauna (koala) exclusion fencing has already been installed along the western end of Old Bagotville Road to reduce the likelihood of collisions between construction vehicle and koalas. The placement of this fencing was done in consultation with the Environment Protection Authority (EPA).

Biodiversity impacts associated with the proposed borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the relevant requirements of the Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites Flora Biodiversity Constraints

Figure 5-1

- Approved Project Boundary Version 11 (June 2016)
- Gibsons Borrow Site
- Jali Borrow Site
- Narrow-leaved Red Gum woodlands of the lowlands of the North Coast
- Swamp Mahogany Swamp Forest Of The Coastal Lowlands Of The North Coast (post EIS Aug 2015)
- Narrow-leaved Red Gum woodlands of the lowlands of the North Coast (EIS 1/7/2013)
- Paperbark swamp forest of the coastal lowlands of the North Coast (EIS 1/7/2013)
- Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (EIS 1/7/2013)
- Swamp Oak swamp forest of the coastal lowlands of the North Coast (EIS 1/7/2013)
- Blackbutt grassy open forest of the lower Clarence Valley of the North Coast (post EIS Aug 2015)
- Narrow-leaved Red Gum woodlands of the lowlands of the North Coast (post EIS Aug 2015)
- Blackbutt grassy open forest of the lower Clarence Valley of the North Coast (EIS 1/7/2013)
- Tallowwood dry grassy forest of the far northern ranges of the North Coast (EIS 1/7/2013)

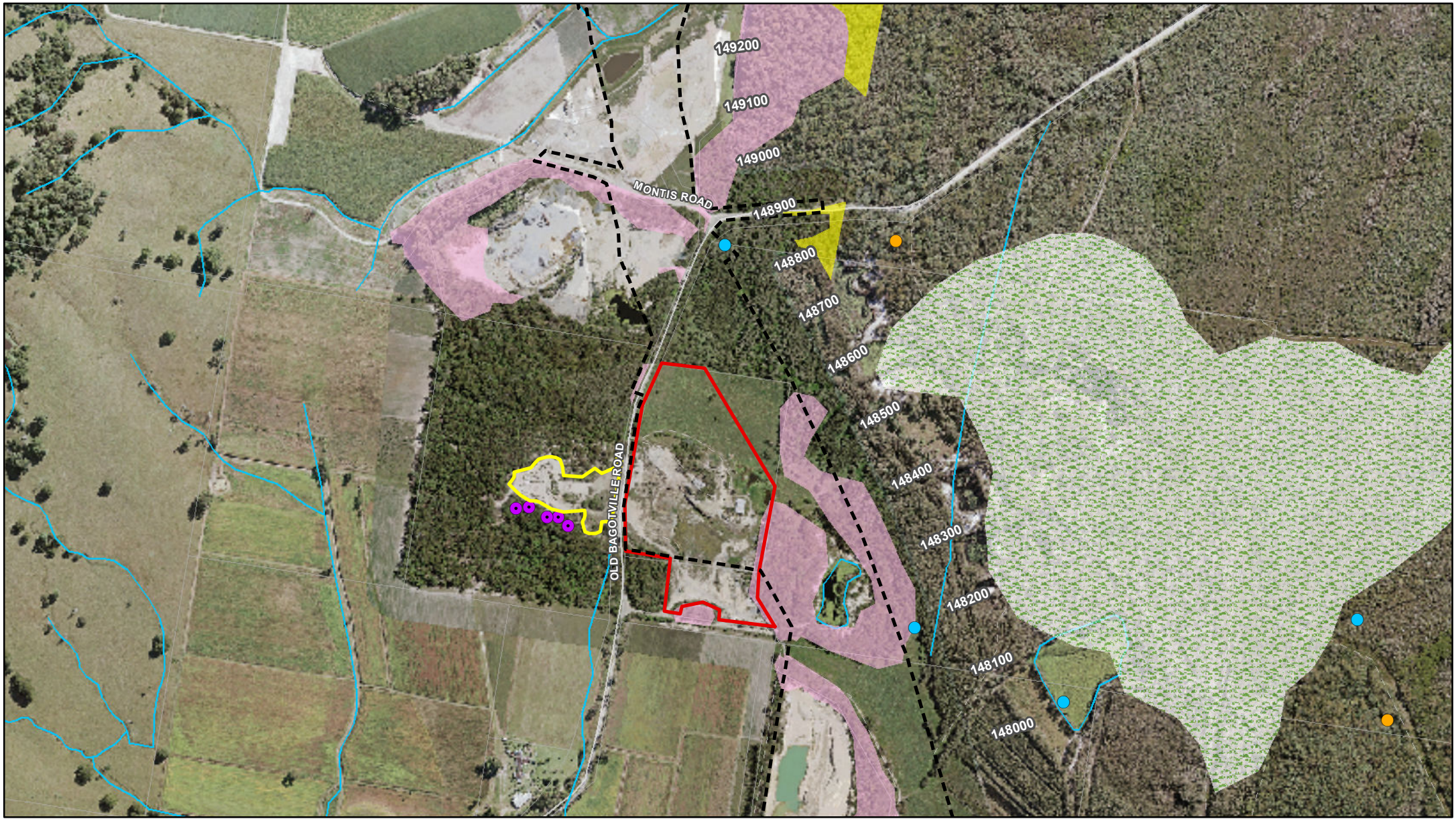
EEC

- Swamp Sclerophyll Forest on Coastal Floodplains (post EIS Aug 2015)
- Subtropical Coastal Floodplain Forest on Coastal Floodplains (EIS 1/7/2013)
- Swamp Oak Floodplain Forest on Coastal Floodplains (EIS 1/7/2013)
- Swamp Sclerophyll Forest on Coastal Floodplains (EIS 1/7/2013)

1:8,000 at A4

0 25 50 100 150 200
Metres

Print Date:	10/02/2017
Author:	LABRUYEREA



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites Fauna Biodiversity Constraints

Figure 5- 2

- Koala scat records (22/09/2016)
- Long-nosed Potoroo ATLAS Fauna records (June 2013)
- Koala ATLAS Fauna records (June 2013)
- Approved Project Boundary Version 11 (June 2016)
- Gibsons Borrow Site
- Jali Borrow Site
- Wallum Sedge Frog Habitat (2013)
- Primary koala habitat
- Secondary koala habitat

1:8,000 at A4

0 25 50 100 150 200
Metres

Print Date:	9/02/2017
Author:	LABRUYEREA

5.4 Traffic, transport and access

The Jali Borrow Site would be accessed for site establishment and early operations from Old Bagotville Road, as shown in Figure 5-3. Old Bagotville Road is currently used for the haulage of materials from nearby quarries and has been used previously for the supply of material for other Pacific Highway projects including Alstonville Bypass and Ballina Bypass. Once the construction corridor has been cleared and is accessible for construction vehicles, the material extracted from the site would be hauled for use on the project via the construction corridor, reducing the impacts on the local road network. Access to the corridor would either be via Old Bagotville Road or through the adjacent Gibsons Borrow Site located to the east. Consultation would be carried out with council for the use of local roads and road dilapidation reports would also be prepared. Once the construction corridor is operational, the borrow site is estimated to generate approximately 30 light vehicle movements and 300 heavy vehicle movements per day at peak earthworks production. These numbers are indicative and dependent on the contractor's mass haul program.

The haulage route within the construction corridor is estimated to take approximately four to six months to construct. During this time, material will be hauled along Old Bagotville Road, onto Back Channel Road then either diverted onto Carlisle Street and then onto the existing Pacific Highway or onto Bath Street as shown in Figure 5-3. It is anticipated that approximately 250 heavy vehicle movements per day and 100 light vehicle movements per day would travel along the local road network before the construction corridor is open for haulage vehicles. These movements would be from both the Gibson and Jali Borrow Sites. There may also be vehicle movements at the same time along Bath and Carlisle streets from Lumleys Borrow Site (depending on the contractor's program) which could result in a maximum of 550 combined movements at the intersection of these two streets. Where possible, this would be managed through a combination of programming and traffic controls.

The use of this haulage route may coincide with the cane harvest season. Pacific Complete and/or the contactor will continue to consult with the cane industry to manage traffic along the local road network.

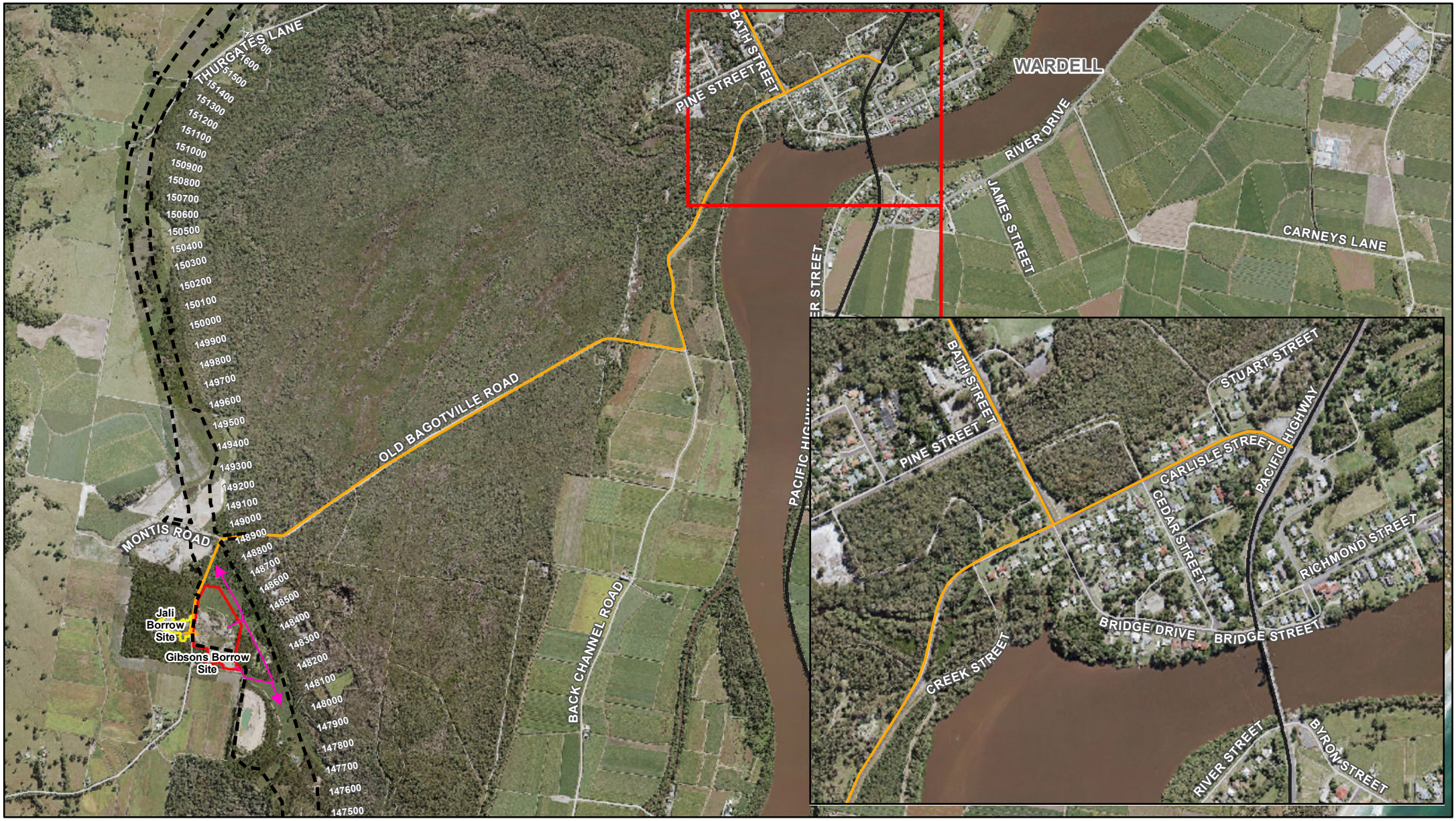
In accordance with SPIR mitigation measure T&T2 the contractor will prepare a strategy for bulk earthworks haulage between the crossing of Richmond River and the interchange at Wardell. The strategy will seek to maximise the extent of haulage with in the project boundary and limit the need to haul material through the township of Wardell. This strategy will include material being hauled from the Jali Borrow Site.

Prior to the opening of the construction corridor and where vehicles require access along the local road network, traffic control plans would be prepared by the contractor in accordance with the approved Pacific Complete Construction Traffic and Access Management Plan (CTAMP) (sections 3 to 11), Appendix B1 of the CEMP.

Traffic impacts associated with the borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites traffic access

Figure 5-3

- Access during establishment and prior to the opening of the construction corridor
- Access once construction corridor is operational
- Approved Project Boundary Version 11 (June 2016)
- Gibsons Borrow Site
- Jali Borrow Site

1:25,000 at A4

0 125 250 500 750 1,000 Metres

Print Date:	9/02/2017
Author:	LABRUYEREA

5.5 Noise and vibration

A Construction Noise and Vibration Management Plan (sections 3 to 11) (CNVMP) was produced as part of the Pacific Complete CEMP for the approved project. The management plan divides the project into a number of noise catchment areas (NCA) and outlines their associated rating background levels (RBL) and noise management levels (NML). An RBL represents the average background/ existing noise level anticipated to occur in a given NCA during different periods of the day. An NML represents the level where receivers may feel discomfort/ agitation from construction noise. For standard construction hours the NML is based on the RBL calculated for the area plus 10 dBA. Jali Borrow Site is located within Noise Catchment Area J (NCA-J) outlined in the CNVMP. The rating background level (RBL) and construction noise management level (NML) for NCA-J are outlined in Table 5-1.

Table 5-1 RBLs and NMLs for noise catchment area J (NCA-J) in dBA

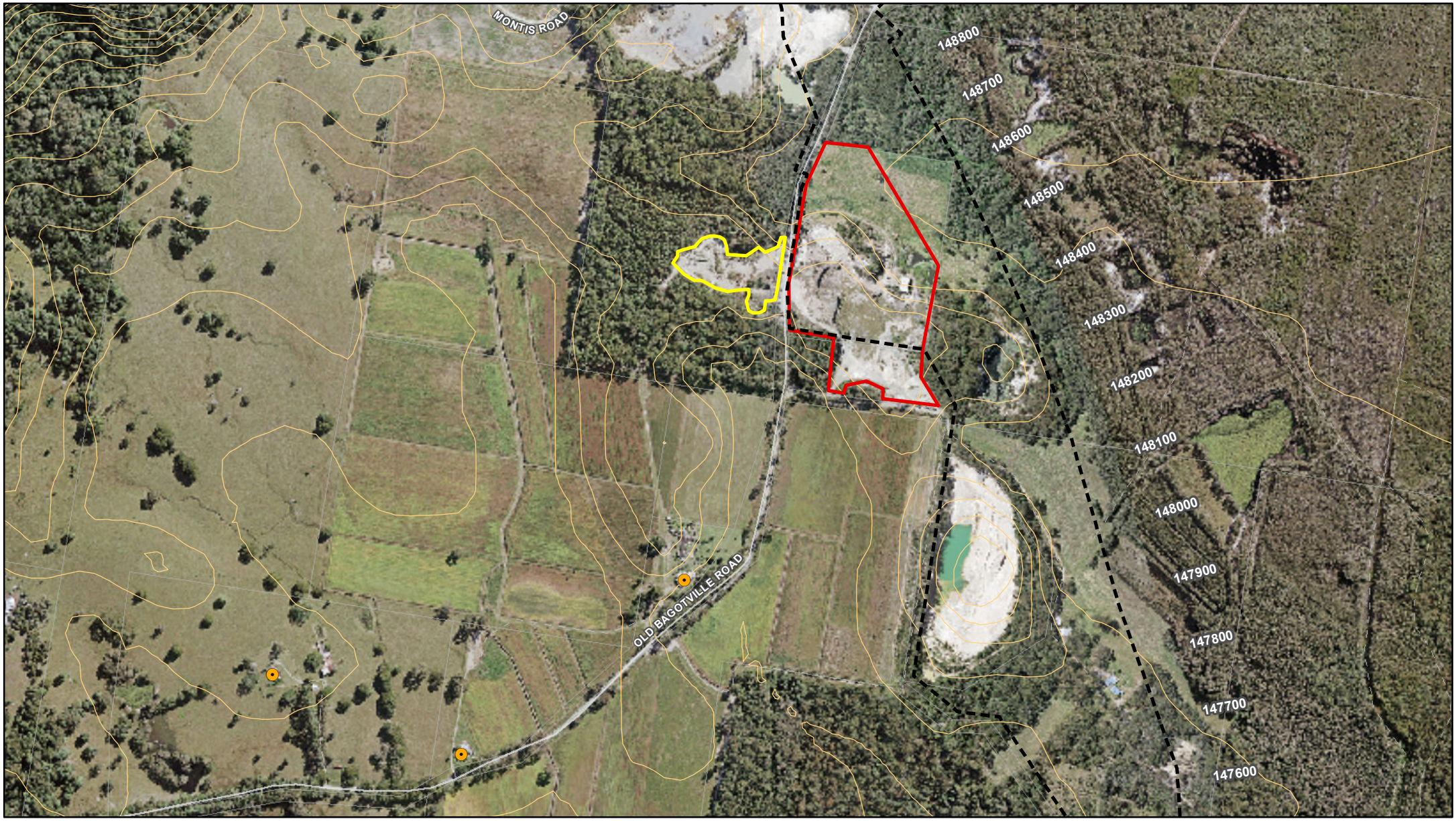
Standard-Daytime (7am-6pm)		OOHWs – Evening (6pm-10pm)		OOHWs – Night-time (10pm-7am)		Sleep disturbance	
RBL	NML	RBL	NML	RBL	NML	RBL	NML
41	51	42	47	38	43	38	53

Construction noise modelling was undertaken to assess the noise impacts associated with the operation of the Gibsons Borrow Site and the Jali Borrow Site. A combined noise assessment was undertaken due to the close proximity of the two sites. The closest sensitive receiver is located approximately 350 metres to the south of the site. Other scattered rural receivers are located more than 800 metres to the south east. Figure 5-4 identifies the sensitive receivers surrounding the site. As outlined in Section 4.3, the borrow site would operate during the approved standard-daytime hours.

A number of scenarios were modelled for the activities proposed at the Gibsons and Jali Borrow Sites. Extraction works and crushing and screening are the most noise intensive activities to occur at the borrow sites. The modelling predicted that one sensitive receiver is anticipated to experience noise exceedances of up to 6 dB above the standard-daytime NML during extraction works and 7 dB above the standard-daytime NML during crushing and screening. Refer to Appendix D for the Construction Noise and Vibration Impact Assessment for the borrow site and noise contour maps that outline the level of impacts to sensitive receivers in the vicinity of the borrow site.

An investigation was carried out to understand the noise impacts of crushing and screening, the most noise intensive activities proposed at the borrow site, if the activity was restricted to the northern portion of the site, away from the closest sensitive receivers. The model predicts that an exceedance of up to 3 dB, a reduction of 4 dB, would be experienced by the closest receiver if crushing and screening was restricted to the northern portion of the site, as shown in Figure 2 in Appendix D. Crushing and screening activities may need to be relocated around the site during the operation of the borrow site, depending on where the excavation works are being undertaken. Where feasible, crushing and screening activities would be limited to the northern portion of the site to reduce noise impacts to sensitive receivers.

The CNVMP outlines general construction noise mitigation and management measures. Where NMLs are expected to be exceeded, the relevant management measures would be implemented where appropriate.



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites sensitive receivers

Figure 5-4

- Sensitive receivers
- 5m Contour
- Approved Project Boundary Version 11 (June 2016)
- Gibsons Borrow Site
- Jali Borrow Site

1:8,000 at A4

0 25 50 100 150 200 Metres

Print Date:	21/12/2016
Author:	LABRUYEREA

The contractor would carry out ongoing noise monitoring as outlined in Section 8.3 of the approved CNVMP that would include the following:

- Periodic noise monitoring at nominated sensitive receiver locations to determine the effectiveness of mitigation measures.
- Where complaints are received, additional noise monitoring would be undertaken at sensitive receivers to determine if the actual construction noise levels are appropriate.
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise.
- Ongoing spot checks of noise intensive plant and equipment would be undertaken through construction to ensure compliance with manufactures specifications.

5.5.1 Cumulative noise assessments

There is potential for multiple activities to occur simultaneously across both Gibsons and Jali borrow sites. A cumulative assessment of the most noise intensive activities, extraction and crushing and screening, was undertaken to assess the worst case potential impacts from works at the borrow sites. The modelling predicted that four sensitive receivers are anticipated to experience noise exceedances of up to 9 dB above the standard-daytime NML.

Mainline construction scenarios from the CNVMP were utilised to predict the cumulative impacts of the borrow site and mainline construction activities that may occur concurrently. These are based on worst-case scenarios. Noise levels during the most noise intensive activities from the borrow site and mainline construction occurring concurrently are predicted to have a cumulative impact at the worst affected receiver location with the borrow site being the dominant noise source during the lesser noise intensive mainline activities.

Refer to Appendix D for the construction noise and vibration impact assessment and noise contour maps that outlines the level of impacts to sensitive receivers in the vicinity of the borrow site.

Noise and vibration impacts associated with the borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a Contractor's Construction Environmental Management Plan that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.5.2 Vibration

Vibration intensive plant and equipment are not proposed for use within the safe working distances outlined in Section 4.2.1 of the Construction Noise and Vibration Impact Assessment, Appendix D.

Noise and vibration impacts associated with the borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a Contractor's Construction Environmental Management Plan that would be

reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.5.1 Traffic noise assessment

As outlined in Section 5.4 there will be approximately 4 to 6 month where material from both Gibson and Jali Borrow Sites would need to be hauled through the local road network. During this time material would be hauled along Old Bagotville Road, onto Back Channel Road then either diverted onto Carlisle Street and then onto the existing Pacific Highway or onto Bath Street as shown in Figure 5-2. There are sensitive receivers located along Carlisle Street and Bath Street who would potentially be affected by construction traffic.

It is estimated that at peak 250 heavy vehicle movements per day and 100 light vehicle movements per day from both the Gibsons and Jali Borrow Sites would use this route during the early operation of the site. Existing traffic levels for this area are unknown, however the likely worst-case construction traffic noise levels has been predicted to be approximately 60 dB $LA_{eq(1hour)}$. This is an exceedance of the daytime criteria for local roads by 5dB.

To achieve the road traffic noise criteria for local roads, the number of heavy vehicle movements would need to be reduced to 16 heavy vehicle movements per hour, which is equivalent to 176 vehicle movements per day. This would cause significant disruption to the project program and likely prolong the duration of vehicles using this route. The construction corridor would be operational to construction vehicles as soon as practicable to reduce the length of time access along the local road network is required. During community consultation with local residents, the impacts associated with vehicle movements including noise exceedances and duration of impacts would be explained.

5.5.2 Blasting

All blasts would be undertaken by an experienced and licensed contractor. All blasts would be planned, executed and monitored in accordance with the Blast Management Procedure, Appendix B of the CNVMP and would ensure the overpressure and vibration limits outlined in MCoA B22 and B23 are not exceeded. This would be achieved through the preparation of a site specific blast management plan prior to any blast. A trial blast would be undertaken to determine the site specific blast criteria. Each blast would have a specific blast design which would be prepared by the contractor and would address potential risks and control measures.

5.6 Visual

The borrow site is located in a rural landscape approximately 4 kilometres south west of the township of Wardell surrounded by agricultural activities, forested land and a number of extractive industries. The site itself is cleared, highly degraded land due to the historic quarrying activities at the site. The Blackwell Range is located to the west of the site and dominates the landscape in this region. To the east of the site is low lying forested land.

The closest sensitive receiver is located approximately 350 metres to the south of the site. Other scattered rural receivers are located more than 800 metres to the south west. Figure 5-3 identifies sensitive receivers surrounding the borrow site. The closest receiver is anticipated to experience some visual impacts. The other receivers are anticipated to have limited to no visibility of the site due to the topography of the area, the distance from the site and vegetation between the receivers and the borrow site. Due to historic quarrying at the site, the increase in visual impacts for the closest receiver is considered to be minimal.

The borrow site would be excavated to an estimated 15 metres from the highest elevation at the site and approximately seven metres below the existing quarry floor to a depth of approximately 2.5 metres AHD, depending on the final mass haulage quantities for the project.

Post excavation, the site may be backfilled with surplus material from the project. The rehabilitation of the site is outlined in Section 8.

There would be an increase in heavy and light vehicles travelling along Old Bagotville Road and then diverting onto other local roads within the township of Wardell. This would result in visual impacts to residents located along these routes. These impacts would be short term, until the construction corridor has been cleared and traversable for construction vehicles.

Visual impacts associated with the borrow site are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.7 Heritage

5.7.1 Aboriginal heritage

A Stage 1 Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI) was undertaken by an RMS Aboriginal Cultural Heritage Officer for the southern section of the borrow site located outside of the project boundary. The assessment outlines that the site is unlikely to have an impact on Aboriginal cultural heritage based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate any known Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.
- A stage 1 PACHCI Physical assessment was carried out on the 13/10/16 with all areas cleared for Aboriginal places and objects.

Refer to Appendix E for a copy of this assessment.

5.7.2 Non- Aboriginal heritage

A search on the Australian Heritage Database and the Ballina Local Environment Plan (LEP) was undertaken on 18 November 2016. No non-Aboriginal heritage items were identified within or adjacent to the borrow site.

Heritage impacts associated with the borrow site and access track are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

5.8 Air quality

Activities at the borrow site that may impact on air quality include excavation activities, blasting, crushing and screening, vehicles movements and emissions. The closest sensitive receiver is located approximately 350 metres to the south of the site. Other scattered rural receivers are located more than 800 metres from the site. Dust suppression techniques outlined in the approved Pacific Complete Construction Air Quality Management Plan (sections 3 to 11) (CAQMP), Appendix B6 of the CEMP would be implemented to ensure that impacts to air quality are minimal.

To assist in monitoring air quality, a dust deposition gauge would be established and monitored for closest receivers in accordance with the dust deposition gauge procedure, Appendix B of the CAQMP and the EPL for the project.

Air quality impacts associated with the borrow site and access track are considered to be consistent with those assessed and approved under the EIS and SPIR. These impacts would be managed in accordance with this borrow site management plan.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a CCEMP that would be reviewed by Pacific Complete to ensure its compliance with the approved Pacific Complete CEMP.

Management measures identified in this borrow site management plan would be incorporated into site or activity specific EWMS prepared by the contractor.

6 Management and mitigation

A range of environmental requirements and control measures are identified in the various environmental documents, including additional mitigation measures included in the Submission / Preferred Infrastructure Report (November 2013)(SPIR), the Conditions of Approval and additional studies conducted post approval of the SPIR. The Jali Borrow Site would be established, operated, maintained and decommissioned in accordance with the requirements included in the Pacific Complete Construction Environmental Management Plan and sub-plans.

As outlined in Section 4.2.3 of the approved Pacific Complete CEMP, contractors would be required to develop project specific environmental management documentation to address the operational control requirements outlined in the Pacific Complete CEMP. This includes the development of a Contractor's Construction Environmental Management Plan (CCEMP) that would be reviewed by Pacific Complete to ensure its compliance with the relevant requirements of the Pacific Complete CEMP.

In accordance with the Project CEMP an Environmental Work Method Statement would be developed by the contractor for the Jali Borrow Site. Management measures identified in this borrow site management plan would be incorporated into site or activity specific Environmental Work Method Statements (EWMS) prepared by the contractor.

Specific measures and requirements to address environmental impacts from the Jali Borrow Site that are not included in the approved CEMP documentation are listed in Table 6-1 below.

Table 6-1 Site specific mitigation measures additional to the CEMP

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
GENERAL				
JBSMP 1	The applicant shall ensure that material extracted from the borrow sites established for the SSI, is only used for the construction of the SSI subject to this approval, and no other sections of the Pacific Highway or other works.	Pacific Complete Construction Personnel Project Contractor's Project Engineer	Pre-construction Construction	MCoA B79
SOIL, SEDIMENT AND WATER				
JBSMP 2	An erosion and sediment control plan (ESCP) will be prepared prior to works on site. This will be prepared by the appointed contractor's soil conservationist in accordance with the Blue Book and the approved Pacific Complete Construction Soil	Project Contractor's Project Engineer/ Foreman/	Pre-construction	Pacific Complete Construction Soil and Water

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
	and Water Quality Management Plan (sections 3 to 11) (SWQMP), Appendix B4 of the CEMP.	Environment Representative		Quality Management Plan
JBSMP 3	Monitoring of groundwater level/quality will be undertaken from monitoring bore GW04 prior to, during and at the cessation of excavation works. Following consultation with landholder the monitoring of groundwater level/quality from bore GW056965 will also be conducted. Monitoring of water levels and key field water quality parameters (EC, pH) would be undertaken in accordance with the existing monitoring program for the project and the groundwater memo included in Appendix A). If adverse impact to bore supply or quality occurs, a compensation ("make good") agreement would be negotiated between landholder and NSW Roads and Maritime Services. This may include the construction of a new bore with similar performance and requirements to the existing bore at the property. Groundwater monitoring will be incorporated into the Water Quality Monitoring Program for the project as an addendum. This will be done on five groundwater monitoring bores located near the borrow site as listed in the groundwater memo for this BSMP.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Pre-construction Construction Post-construction	Groundwater Review – Appendix A
JBSMP 4	Erosion and sediment controls will be established around the boundary of the site to ensure runoff and sediments are managed appropriately within the boundary of the site.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Good practice
JBSMP 5	Soil and water management at borrow source sites will be in line with Volume 2E of the Blue Book which covers water management of mines and quarries.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	SPIR SSW39
JBSMP 6	Site water will be channelled towards a sediment basin, or similar, and used for construction activities such as dust suppression and if required discharged from the	Project Contractor's Project Engineer/	Construction	Environment Protection

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
	north east corner of the site to the current drainage line used at the site. Treatment and discharge of site water will be in accordance with the project EPL.	Foreman/ Environment Representative		Licence (20713)
JBSMP 7	Dewatering of the pit will be undertaken in line with Roads and Maritime (formerly RTA) Technical Guideline – Environmental Management of Construction Site Dewatering (Roads and Maritime, 2011) and in accordance with project environment protection licence (EPL).	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	SPIR SSW44
JBSMP 8	Where groundwater is released, recharge of the water table is the preferred option of managing groundwater. This will be facilitated by collecting groundwater in grassed swales for infiltration back to the groundwater source. Where possible, these swales will divert the groundwater around the construction area so that the groundwater does not further mix with construction runoff.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	SPIR SSW42
JBSMP 9	If recharging is not possible or suitable, then discharging groundwater will be collected via sedimentation basin before discharge into natural waterways. If discharging to downstream groundwater, then the potential effects of mounding will be mitigated.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	SPIR SSW43
CONTAMINATION				
JBSMP 10	General building waste and rubbish will be removed from the site and a detailed inspection for asbestos containing material will be undertaken.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Pre-construction	Phase 1 Contamination Investigation
BIODIVERSITY				

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
JBSMP 11	Induction training will be conducted for all contractors and project staff working at the borrow site. This training will be in accordance with the approved Koala Management Plan (Section 1 to 11). The training will identify areas of koala habitat, crossing zones and key threatened species. The importance of following the clearing and rehabilitation protocols will be made clear to all project personnel.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/ Foreman/ Environment Representative	Pre-construction Construction	Koala Management Plan (Sections 1 to 11)
JBSMP 12	Management measures outlined in the Koala Management Plan and the Construction Flora and Fauna Management Plan will be implemented in regards to clearing of remnant/ regrowth vegetation within the site and traffic requirements for vehicles entering and leaving the site.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Koala Management Plan (Sections 1 to 11)
JBSMP 13	Temporary fauna (koala) exclusion fencing will be established around the boundary of the site prior to construction. This fencing will be established with a 5 metre buffer between the site and adjacent vegetation to prevent disturbance and impacts to adjacent areas of existing vegetation.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Good practice
JBSMP 14	Koala grids will be implemented at all entry points to allow traffic movements in and out of the site whilst maintaining a barrier between the site and any koalas potentially in the area. If security fencing is required around the site or sections of the site this fencing will be established within the boundary of the fauna (koala) exclusion fencing.	Project Contractor's Project Engineer/ Foreman/	Construction	Good practice

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
		Environment Representative		
JBSMP 15	The Unexpected Threatened Species/ EEC Procedure, Appendix O of the approved Pacific Complete Flora and Fauna Management Plan (Sections 3 to 11), will be implemented if a koala or any other threatened species is identified at the site.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Pacific Complete Flora and Fauna Management Plan (Sections 3 to 11)
TRAFFIC AND ACCESS				
JBSMP 16	A strategy will be prepared for bulk earthworks haulage between the crossing of the Richmond River and the interchange at Wardell. The strategy will seek to maximise the extent of haulage within the project boundary and limit the need to haul material through the town of Wardell.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	SPIR T&T2
JBSMP 17	The road condition of the temporary haulage route from the borrow site along the local road network will be assessed and any upgrades implemented prior to the commencement of material haulage.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Pacific Complete Construction Traffic and Access Management Plan
JBSMP 18	Prior to the opening of the construction corridor and where vehicles require access along the local road network traffic control plans will be prepared by the contractor in accordance with the approved Pacific Complete Construction Traffic and Access Management Plan (sections 3 to 11), Appendix B1 of the CEMP.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Good practice

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
JBSMP 19	Pacific Complete and/or the contactor will consult with the cane industry to manage traffic along the local road network, particularly during the cane harvest season.	Pacific Complete Construction Personnel / Project Contractor's Project Engineer/	Construction	Good practice
NOISE AND VIBRATION				
JBSMP 20	Sensitive receivers anticipated to experience noise impacts from the use of the Gibsons and Jali Borrow Sites will be further consulted with prior to operation of the site in accordance with the approved Pacific Complete Construction Noise and Vibration Management Plan (sections 3 to 11) (CNVMP), Appendix B3 of the CEMP prior to construction.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/	Pre-construction	Pacific Complete CNVMP
JBSMP 21	Where feasible, crushing and screening activities will be limited to the northern portion of the site to reduce noise impacts to sensitive receivers.	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Construction	Construction Noise and Vibration Impact Assessment, Appendix D
JBSMP 22	The construction corridor will be operational to construction vehicles as soon as practicable to reduce the length of time access along the local road network is required.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/ Foreman	Construction	Construction Noise and Vibration Impact Assessment, Appendix D
JBSMP 23	During community consultation with local residents the impacts associated with vehicle movements including noise exceedances and duration of impacts along Old	Pacific Complete Construction Personnel	Construction	Construction Noise and Vibration

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
	Bagotville Road, Back Channel Road, Carlisle Street and Bath Street will be explained.	Project Contractor's Project Engineer/ Foreman		Impact Assessment, Appendix D
URBAN DESIGN AND LANDSCAPE				
JBSMP 24	The extent of excavation and the landscaping strategy at borrow sites will be reviewed considering material requirements on the project and the visual impact on the resultant cuttings.	Pacific Complete Construction Personnel Project Contractor's Project Engineer/ Foreman/ Environment Representative	Pre-construction	SPIR UD10
JBSMP 25	*Note: The site will be rehabilitated in accordance with the commitments to site rehabilitation and the following principles outlined in section 6.8 of the Urban Design and Landscape Plan for Richmond River to Ballina – Sections 10 and 11 (RMS, 2016):* 1. *Establish landowner requirements and identify rehabilitation objectives* 2. *Consideration of the location context and amenity requirements* 3. *Integrate rehabilitation with adjacent landform, topography* 4. *Consider fauna connectivity and wildlife corridors and enhance where possible* *Apply landscape treatments consistent with the project UDLP to ensure an integrated outcome.*	Project Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Urban Design and Landscape Plan
REHABILITATION				
JBSMP 25	Roads and Maritime Services/ Pacific Complete will prepare a detailed rehabilitation strategy in consultation with the Jali Local Aboriginal Land Council.	RMS/ Pacific Complete	Construction	Good practice

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
		Construction Personnel		
JBSMP 26	Post extraction, groundwater levels in bore GW056965 and the nearby monitoring bore will be assessed for the recovery of water levels if impacted by drawdown during borrow site excavations.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Groundwater Review – Appendix A
JBSMP 27	Batter slopes will be stabilised and designed to ensure that they can withstand the impacts of heavy rainfall events.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Good practice
JBSMP 28	Ponded water in the final pit will be monitored to assess conditions for plant species selection for rehabilitation. Riparian/ aquatic vegetation will be selected to create an appropriate wetland environment for the pooling of water within the site and to provide habitat for local wetland birds and other fauna. Plant species will also be considered based on their ability to withstand brackish to borderline saline conditions.	RMS Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Groundwater Review – Appendix A
JBSMP 29	Mulch may be used to assist in the rehabilitation of the site. This mulch will be sourced from the clearing of similar vegetation to reduce the introduction of weeds and pathogens as well as species that are not endemic to the area.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Good practice
JBSMP 30	The final design will include a culvert under Old Bagotville Road that would allow collected water within the site to flow into the Gibsons Borrow Site to then be discharged to the open and cross drainage structures associated with the new highway to the north east of the site during rainfall events.	Contractor's Project Engineer/ Foreman/	Post construction	Good practice

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
		Environment Representative		
JBSMP 31	Appropriate riparian/ aquatic plant species will be selected to assist in the control of salinity levels in the ponded water to minimise the discharge of saline water from the site during rainfall events from the overflow.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Good practice
JBSMP 32	Sediment controls will not be removed from the area until the site vegetation cover has been reinstated to 70 percent ground cover.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Good practice
JBSMP 33	A maintenance plan will be implemented until the area is stable and full groundcover has been achieved.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Good practice
JBSMP 34	Material identified for backfilling would be managed in accordance with the following documents as outlined in the approved Pacific Complete Construction Waste, Resource and Energy Management Plan (sections 3 to 11) (CWREMP), Appendix B7 of the CEMP: • Excavated Natural Material Exemption 2014 (EPA, 2014) • Guidelines on Resource Recovery Exemptions – Land Application of Waste Materials as Fill (2011, DECCW). • RMS Waste Fact Sheets: Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) and Waste Sampling.	Contractor's Project Engineer/ Foreman/ Environment Representative	Post construction	Pacific Complete CWREMP

	Measure/Requirement	Responsibility	Timing/ frequency	Reference
	• RMS Technical Guide: Management of road construction and maintenance wastes.			

7 Consultation

7.1 Community

7.1.1 During the preparation of the EIS and SPIR

The SPIR outlines that Roads and Maritime undertook consultation with a number of property owners in the vicinity of the site.

7.1.2 Post SPIR and project approval

Community consultation was carried out in April 2017 to discuss the use of the Jali Borrow Site. The adjacent Gibsons Borrow Site was also included in this consultation process.

About 300 letters were delivered to local residents, businesses and stakeholders to provide an overview of the proposed operations at the Gibson and Jali Borrow Sites and invite feedback on this proposal. Refer to Appendix F for a copy of this letter.

Comments were received from nine people and two organisations. Three responses were in support of the proposal, one was against and seven were neutral. Six different matters were raised in relation to the proposal. The key matters raised included:

- Traffic and access
- Noise and vibration
- Hours of operation
- Biodiversity
- Rehabilitation
- Impacts of this proposal on the use of the Lumleys Hill Borrow Site located north of Jali Borrow Site.

All feedback has been considered to assist in the preparation of this management plan. Responses have been provided to all feedback received for the proposal. The Community Consultation Report for the Gibsons and Jali Borrow Sites is attached in Appendix G.

Sensitive receivers anticipated to experience noise impacts from the use of the Gibsons and Jali Borrow Sites will be further consulted with prior to the operation of the site in accordance with the approved Pacific Complete Construction Noise and Vibration Management Plan (sections 3 to 11) (CNVMP), Appendix B3 of the CEMP prior to construction.

7.2 Government agencies

The EPA, OEH and DPI (Fisheries) were provided with a briefing memo describing the location and activities that would be carried out at the Gibsons and Jali Borrow Sites. Their comments have been considered and incorporated into this management plan where required.

8 Rehabilitation

8.1 Existing landscape

The borrow site is located in a rural landscape approximately 4 kilometres south west of the township of Wardell surrounded by agricultural activities, forested land and a number of extractive industries. The Blackwell Range is located to the west of the site and dominates the landscape in this region. To the east of the site is low lying forested and agricultural land dominated by sugar cane.

The existing Pacific Highway is currently located on the opposite side of the Richmond River to the south and crosses the Richmond River to the north west of the site as it passes through the township of Wardell. The new highway alignment bypasses Wardell and crosses the Richmond River approximately 2.5 kilometres south of the site and passes to the east of the site.

8.2 Visual impacts

As outlined in Section 5.4 the closest receiver, the south of the site, is anticipated to experience some visual impacts. The other receivers are anticipated to have limited to no visibility of the site due to the topography of the area and the distance from the site. The excavation works would occur within the footprint of the pre-existing quarry located at the site, therefore the increase in visual impacts for the closest receiver is considered to be minimal.

The borrow site is located approximately 230 metres west of the new highway alignment, separated by the Gibsons Borrow Site and Old Bagotville Road, therefore the site would be visible once the new highway is open to public traffic.

8.3 Rehabilitation

The excavation works would leave a void of approximately seven metres below the existing quarry floor to a depth of approximately 2.5 metres AHD. Surplus material from the project is unlikely to be available to backfill the site post excavation, therefore the site would be rehabilitated as an open void.

As outlined in Section 5.2 drawdown of the local water table would continue due to ongoing seepage into the excavation pit causing ponding within the site. Direct rainfall would also contribute to ponding within the site. The depth of the ponded water would be influenced by inflow rates from the fractured bedrock system, intensity and frequency of rainfall events and evaporation rates.

The final design of the site would incorporate a culvert under Old Bagotville Road that connects the Jali and Gibsons Borrow Sites. This would allow for water that collects within the void during rainfall events to flow into the Gibsons Borrow site. Once the water within Gibsons Borrow Site reaches the height of the overflow weir (6 metres AHD) on the north eastern boundary, water would be discharge into the open drain and cross drainage lines associated with the new highway to the north east of the site. The Gibsons Borrow Site is proposed to be backfilled to 4.5 metres AHD, therefore the culvert connecting the two sites will be designed above 4.5 metres AHD. During periods of heavy rainfall, there is potential for up to a maximum of 3.5 metres of water to pond within the final void at the Jali Borrow Site before it outlets from the interconnected Gibsons Borrow Site at 6 metres AHD. This water would then be discharged from the outlet on the eastern side of the new highway, as shown in Figure 8-1.

Ponded water in the final pit would be monitored to assess conditions for plant species selection for rehabilitation. Riparian/ aquatic vegetation would be selected to create an appropriate wetland environment for the pooling of water within the site and to provide habitat for local wetland birds and other fauna.

Salinity levels in the ponded water may increase over time during periods of low rainfall due to evaporation. Plant species would be considered based on their ability to withstand brackish to borderline saline conditions and assist in the control of salinity levels in the ponded water.

As discussed above during rainfall events water from the two borrow sites will flow into the open and cross drainage lines associated with the new highway alignment via a spillway or weir. Surface water runoff from surrounding vegetated area will also flow into this drainage network. If the water from the borrow sites has become saline, due to evaporation, dilution from the other runoff entering the drainage system would occur, reducing salinity levels prior to discharge.

The site would be rehabilitated in accordance with the Urban Design and Landscape Plan for sections 10 and 11 (UDLP) (RMS, 2016). Riparian/aquatic vegetation would be selected to rehabilitate the edges of the excavation area to generate an appropriate wetland environment for the pooling of water within the site and to provide habitat for local wetland birds and other fauna.

Topsoil would be used to assist in the rehabilitation of disturbed areas and grasses and groundcover species would be planted. Mulch may also be used to assist in the rehabilitation of the site, this mulch would be sourced from the clearing of similar vegetation to reduce the introduction of weeds and pathogens as well as species that are not endemic to the area.

It is anticipated that revegetation would occur over a number of years. The rate of regeneration would be dependent on climatic factors such as rainfall, seasonal temperatures and bushfires that can influence the rate of regeneration. Figure 8-1 provides an indicative plan for the drainage design for both the Gibsons and Jali Borrow Sites.

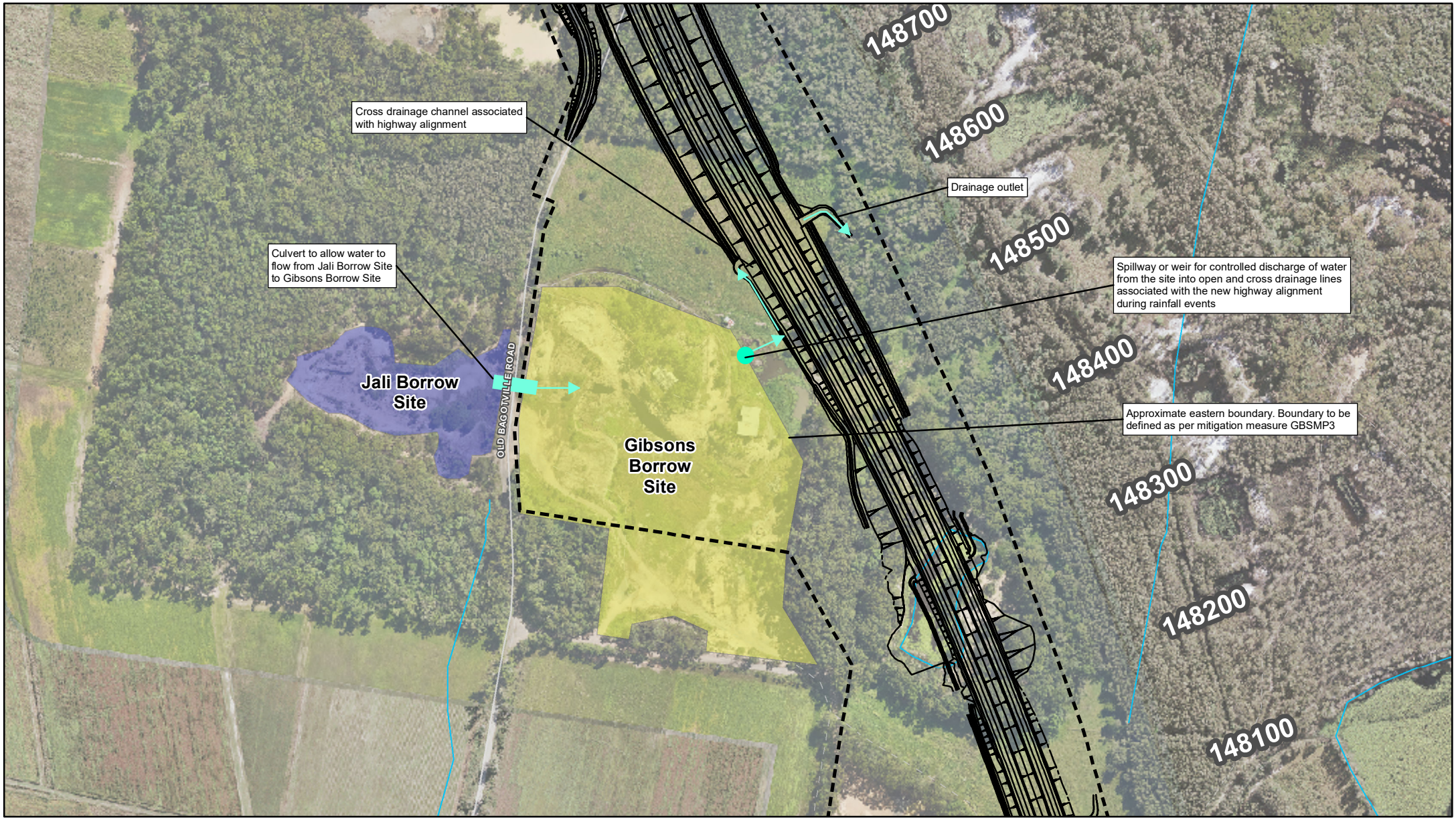
Figure 8-2 to Figure 8-19 provide indicative graphical illustrations of the Jali Borrow Site prior to excavation, post excavation and with the predicted maximum water depth post excavation. Contouring and revegetation of the sites is not currently shown and would lessen the visual impacts shown. These figures are indicative only, any backfilling of the site would be dependent on the availability of unsuitable material generated from the project.

Sediment controls would remain operational on the site until the site vegetation cover has established 70 percent ground cover. Monitoring of the site and waterway would continue until the vegetation has stabilised.

Material identified for backfilling would be managed in accordance with the following documents as outlined in the approved Pacific Complete Construction Waste, Resource and Energy Management Plan (sections 3 to 11) (CWREMP), Appendix B7 of the CEMP:

- Excavated Natural Material Exemption 2014 (EPA, 2014)
- Guidelines on Resource Recovery Exemptions – Land Application of Waste Materials as Fill (2011, DECCW).
- RMS Waste Fact Sheets: Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) and Waste Sampling.
- RMS Technical Guide: Management of road construction and maintenance wastes.

Roads and Maritime Services/ Pacific Complete will prepare a detailed rehabilitation strategy in consultation with the Jali Local Aboriginal Land Council.



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Gibsons and Jali Borrow Sites Post excavation drainage design

Figure 8-1

- Spillway or weir
- Water discharge direction
- PSC Design 16/11/2016
- Drainage
- Approved Project Boundary V12 draft (8/05/2017)
- Gibsons Borrow Site excavation area
- Jali Borrow Site excavation area
- Water culvert

1:4,000 at A4

0 25 50 100 150 Metres

Print Date: 26/06/2017

Author: LABRUYEREA

Figure 8-2 Viewpoint 1 – Aerial images looking North West at Gibson and Jali Borrow Sites

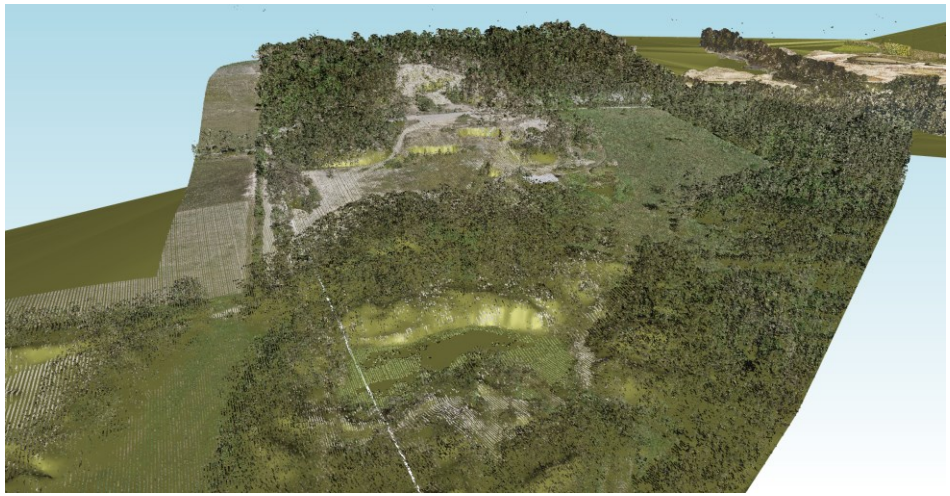


Figure 8-2a Existing environment

Figure 8-2b Post excavation

Figure 8-2c Post excavation with maximum water depth

Figure 8-3 Viewpoint 2 – Looking South West from Old Bagotville Road at Jali Borrow Site

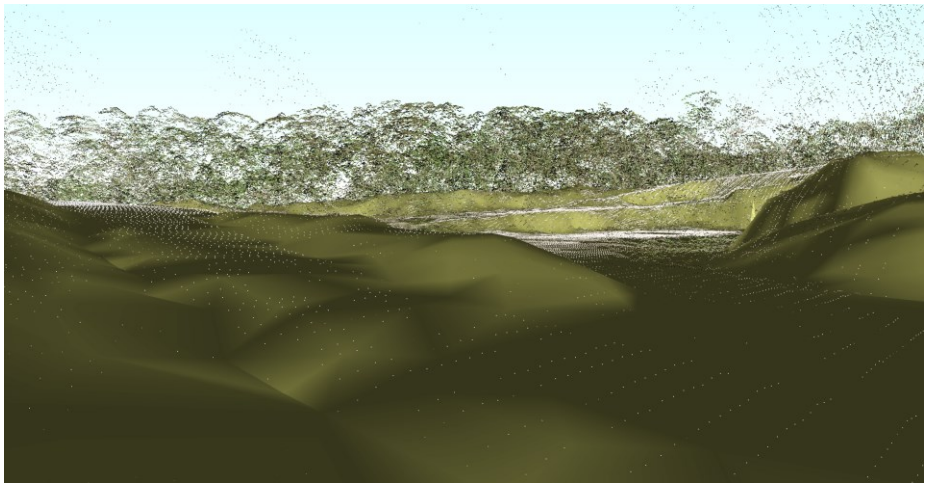


Figure 8-3a Existing environment

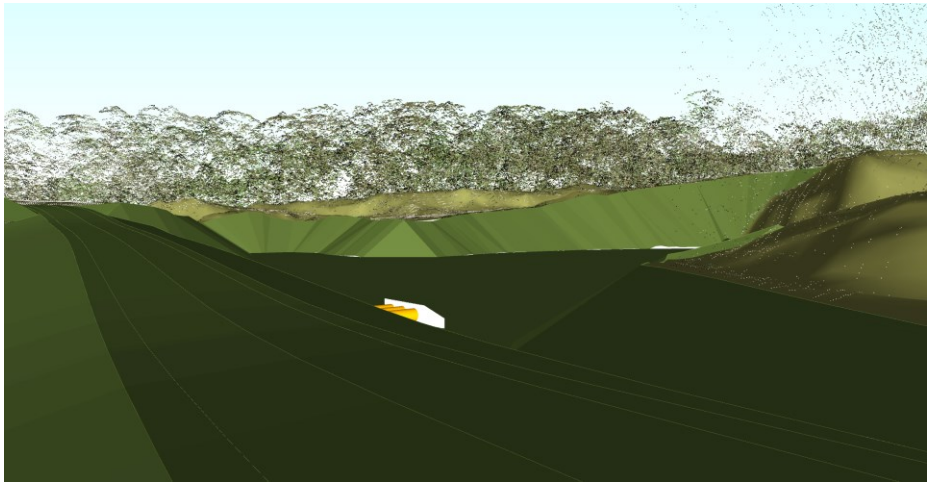


Figure 8-3b Post excavation

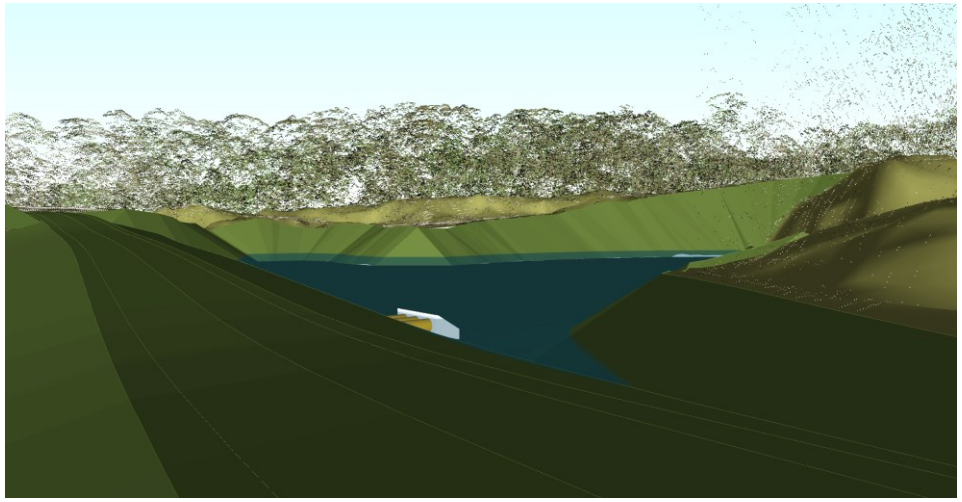


Figure 8-3c Post excavation with maximum water depth

Figure 8-4 Viewpoint 3 – Looking North West from Old Bagotville Road at the Jali Borrow Site

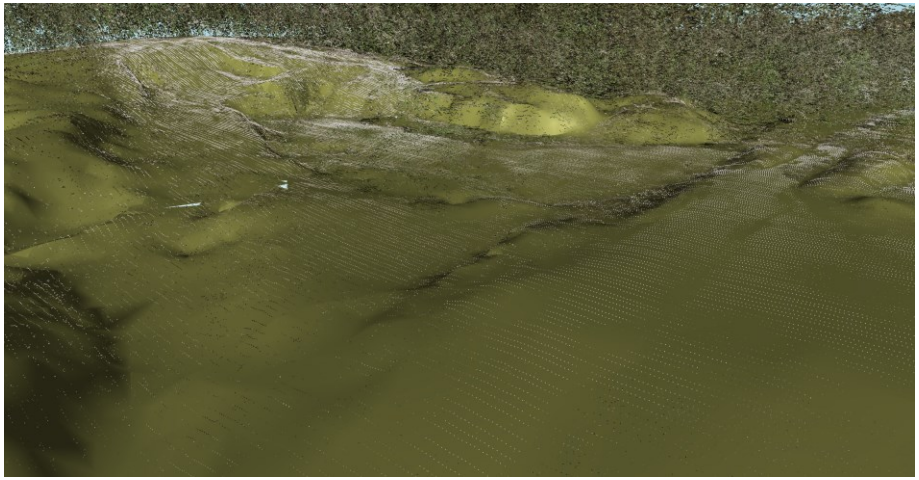


Figure 8-4a existing environment

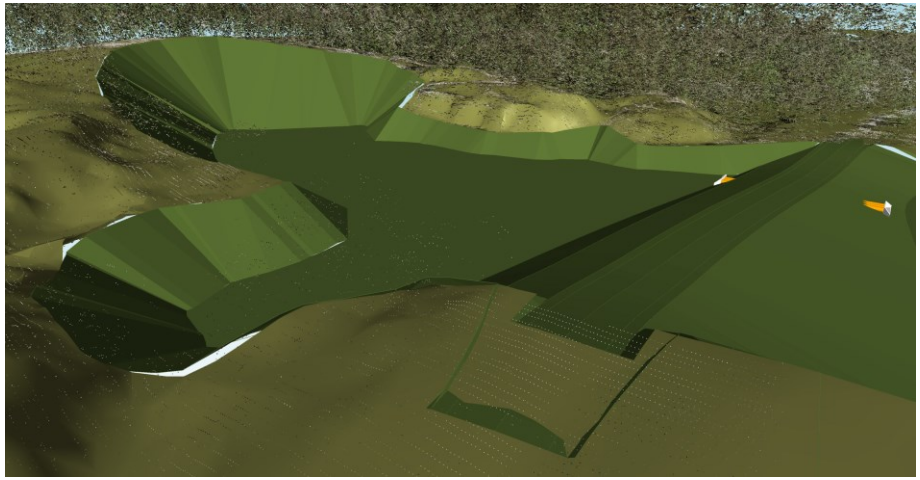


Figure 8-4b Post excavation

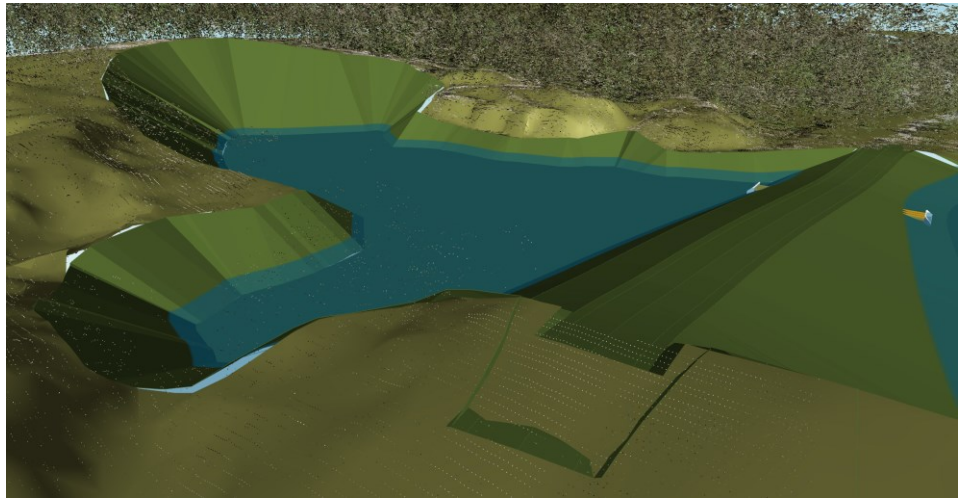


Figure 8-4c Post excavation with maximum water depth

Figure 8-5 Viewpoint 4 – Looking North from Old Bagotville Road

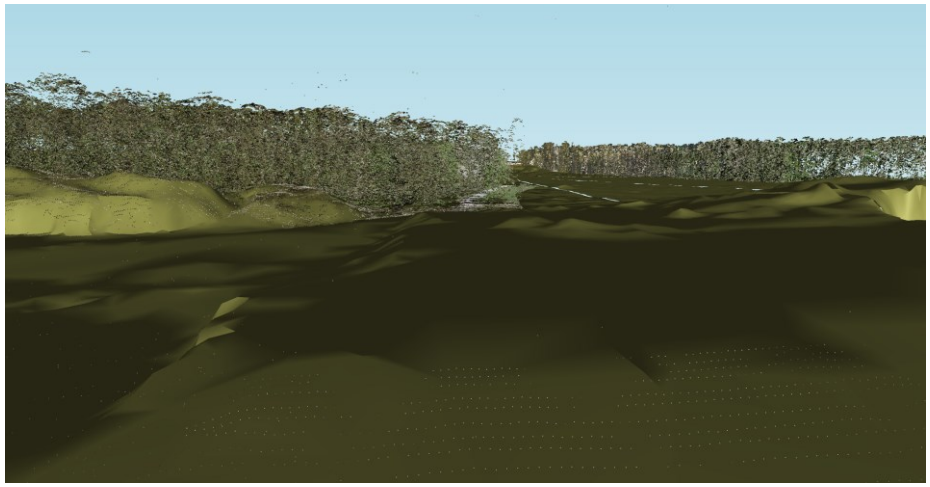


Figure 8-5a Existing environment

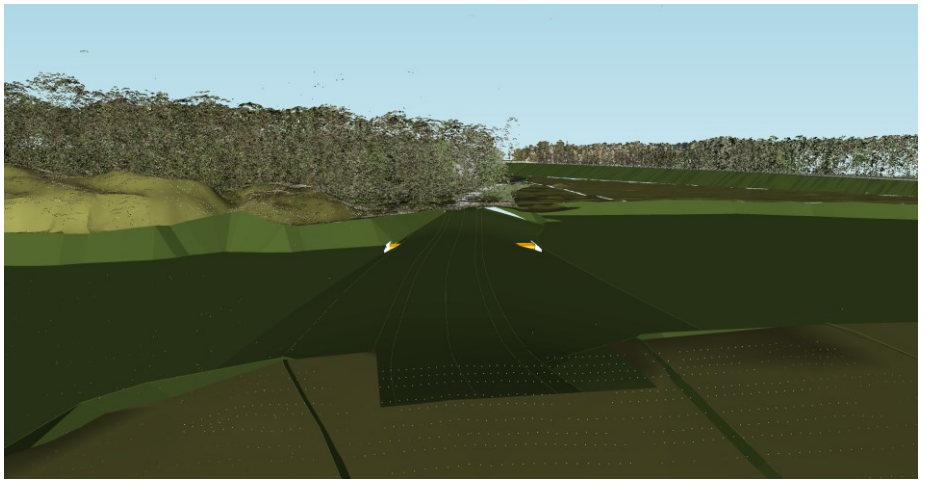


Figure 8-5b Post excavation

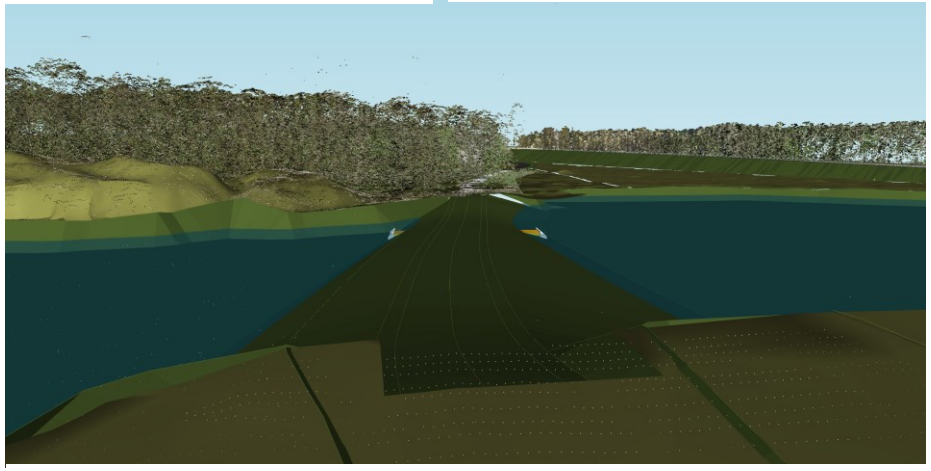


Figure 8-5c Post excavation with maximum water depth

Figure 8-6 Viewpoint 5 – Looking East from the western end of Jali Borrow Site

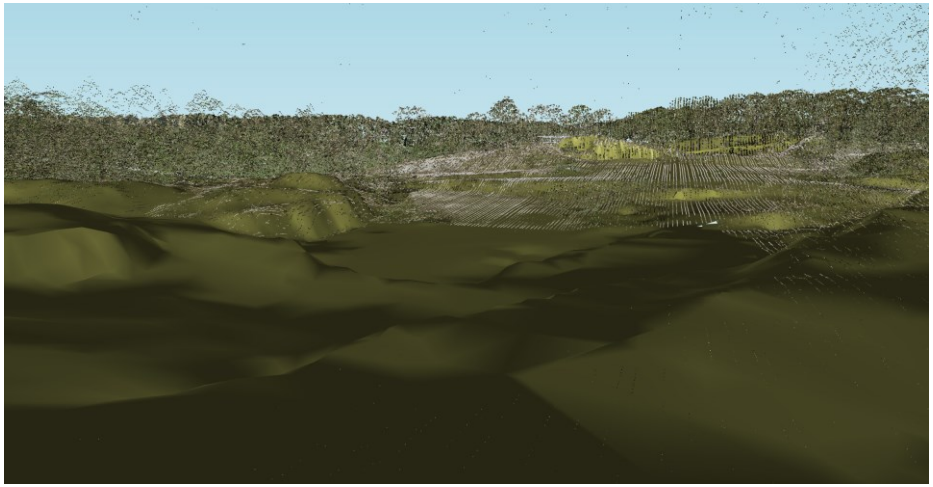


Figure 8-6a Existing environment

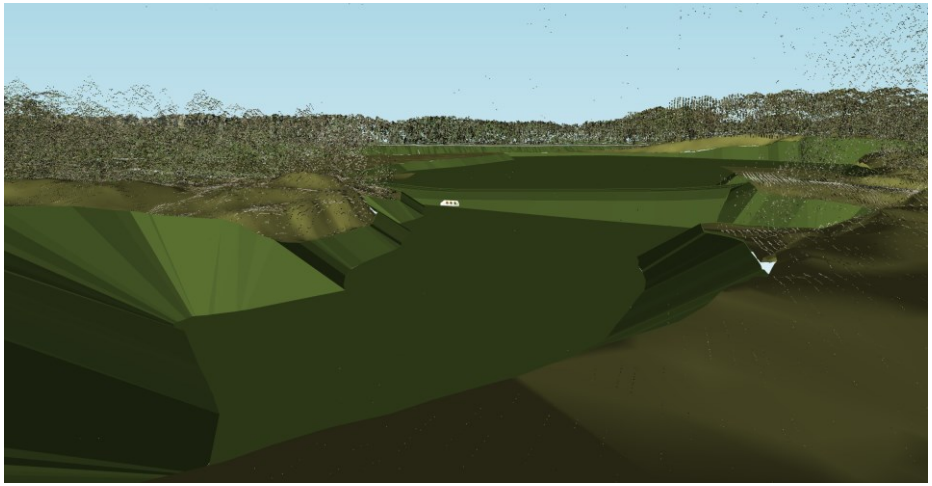


Figure 8-6b post excavation

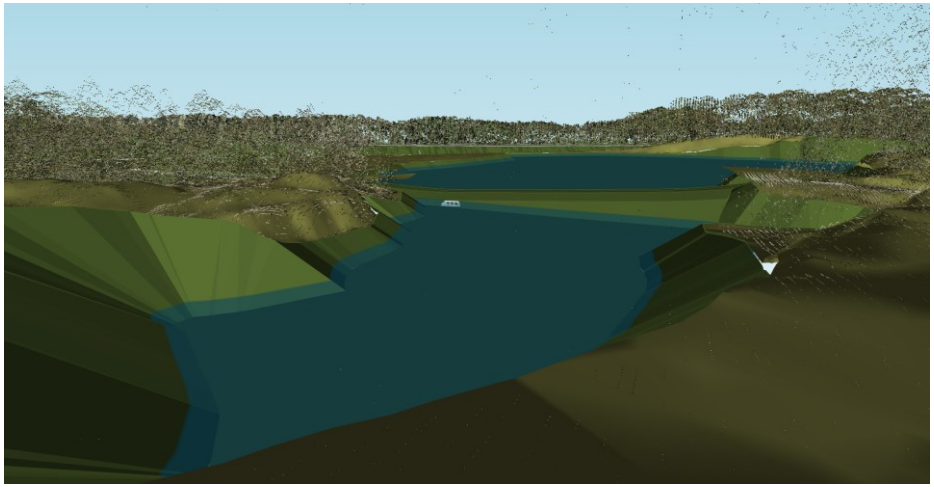


Figure 8-6c Post excavation with maximum water depth

Figure 8-7 Viewpoint 6 – Looking North West from the new highway towards Gibson and Jali Borrow Sites

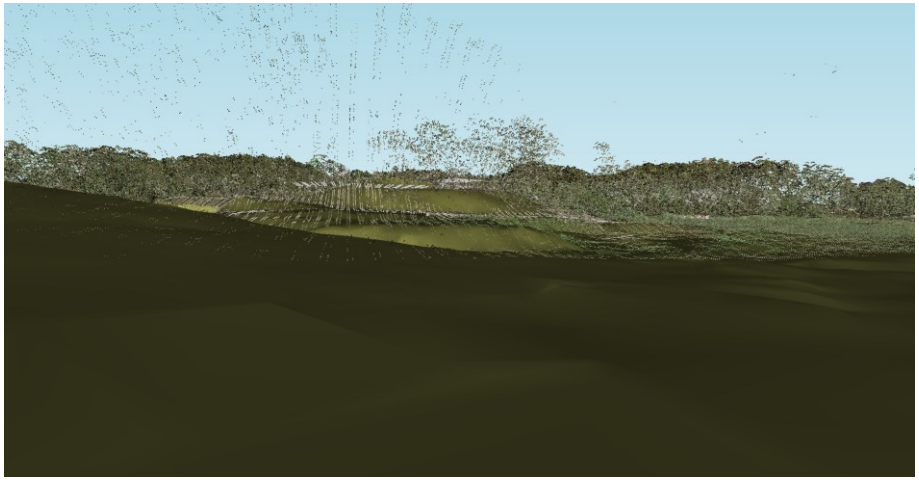


Figure 8-7a Existing environment

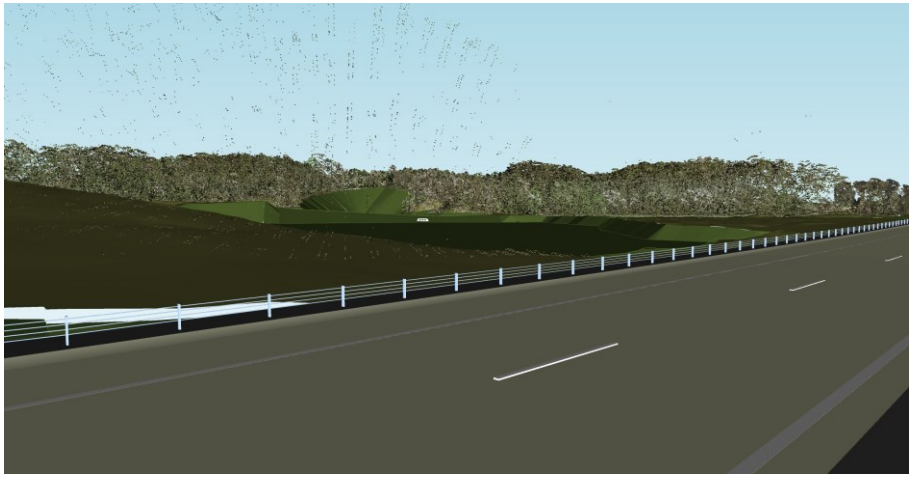


Figure 8-7b Post excavation

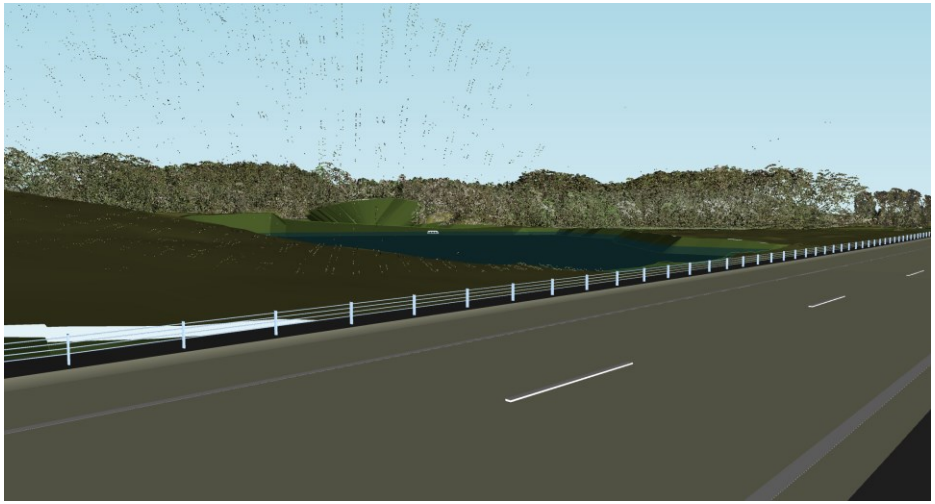


Figure 8-7c Post excavation with maximum water depth

9 Review and improvement

9.1 Continuous improvement

Continuous improvement of this plan would be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process would be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventive actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

9.2 Borrow Site Management Plan update and amendment

The processes described in Chapter 8 and Chapter 9 of the CEMP may result in the need to update or revise this plan. These updates would occur as required.

Any revisions to the Jali Borrow Site Management Plan would be in accordance with the process outlined in Section 1.6 of the CEMP.

A copy of the updated plan and changes would be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

Appendix A Groundwater memo

TO:	Chris Greenaway – Sustainability and Environment Manager	**FUNCTION:**	Environment
FROM:	David Whiting – Principal Hydrogeologist	**FUNCTION:**	Environment
CC:	Georgia Harmey	**DATE:**	21 March 2017
REF:		**NO. OF PAGES:**	24
SUBJECT:	**W2B Gibsons Borrow Site - Groundwater Review Update**		

Abstract/Summary

This review of the groundwater systems present in the vicinity of the proposed Gibsons-Jali Borrow Site Area, indicates that two (2) groundwater regimes operating there, one associated with shallow sand and minor gravels alluvium which includes coastal barrier sands and a second within the bedrock of the Neranleigh Fernvale Beds underlying the alluvium. The borrow pit site is located on a low ridge comprising the Neranleigh Fernvale Beds. The coastal sands and Richmond River Alluvium are located within 100 metres to the east, northeast and south in lower lying areas. Coastal barrier sands have been identified on the northeastern margin of the Gibsons Quarry.

The shallow sand (gravel) aquifer is located on the east – north-eastern margins of the quarry occurring in topographical low areas and is linked to the broader Richmond River alluvium that is located east on the Richmond River floodplain. All investigation boreholes east of the Gibsons Borrow Site area intersected this shallow aquifer indicating it is likely to be laterally well connected eastwards and thickens towards the east. Two investigation boreholes (GW01 and GW02) intersected the sand (gravel) aquifer near the northeastern boundary and was approximately 2 to 3 m thick. The northeastern margins of the pit will be defined further to the west to avoid intersecting the saturated sand aquifer and hence reduce the risk of unmanageable inflows into the pit.

The Neranleigh Fernvale Beds, the material to be quarried, itself sustains three groundwater systems, (a) a shallow perched (within 5 m below ground level) in the thin weathered regolith profile, (b) a porous regolith aquifer in some topographical low areas and (c) a deeper fractured bedrock groundwater system. The shallow perched regolith system is absent over a lot of the site due to pre-existing quarry activities. The porous regolith aquifer may be intersected on the margins of the Gibsons Borrow Site on the eastern side at the quarry where the regolith zone occurs below the water table, although it is inferred to be unlikely. The Gibsons and Jali borrow sites will be excavated several metres (2 to 6 m) below the water table to a depth of 2.5 m AHD.

Groundwater flow within the local deeper bedrock aquifer occurs within the fracture/joint plane conduits in the rockmass, however the rock mass is largely considered to be an aquitard with low permeability conditions. The perched groundwater system is surficial and has limited connection to the deeper bedrock groundwater system, and, is predominantly sustained by direct rainfall recharge. The porous regolith aquifer is variable in lateral distribution, dependant on underlying geology and is connected to Richmond River alluvium aquifer systems and coastal sand barrier facies. The dewatering of the bedrock aquifer may be anticipated as a localised drawdown affect, due to the expected low permeability of the bedrock mass. However in the unlikely event the regolith porous aquifer is intersected on the eastern pit margin then drawdown may extend several 100s of metres to the east through interconnection with the coastal barrier sands and Richmond River alluvium. Boreholes GW01 and GW02 drilled close to the northeastern margin did not intersect the regolith porous aquifer.

Management intentions are to use clay capping on this boundary to retard groundwater inflows in the unlikely circumstance that the porous regolith aquifer or sand (gravel) aquifer systems are intersected.

There are scattered patches of remnant and regrowth vegetation adjacent the Borrow site area. On the basis that (a) the ecological communities are sustained by the shallow perched groundwater and to a limited degree by b) deep groundwater underlying the ridge it is envisaged that adjoining vegetation to the Gibsons Borrow site would incur minimal impacts from the excavation. This is due to a large portion of the thin regolith profile within the borrow pit area has already been removed from pre-existing quarry activities and the water table below the ridge is estimated to be greater than 6 m deep which from dewatering activities may only impact deep rooted vegetation (trees). In the unlikely event that hydraulic connectivity occurs on the eastern margin of the quarry through the occurrence of a porous regolith aquifer or shallow alluvial and coastal barrier sands, then drawdown may potentially extend up to a couple of 100 metres to the east from the pit boundary and possibly affect water levels in the Richmond floodplain alluvium and shallow rooted plants to the east of the road alignment.

The quarry pit environment will provide a localised groundwater sink which will alter groundwater flow in the area such that instead of flowing away from the ridge high to lower topographic areas it will instead be directed towards the pit. Reductions to the groundwater flow flux to areas adjacent to the Gibson-Jali Borrow Site area can be anticipated by virtue of dewatering of the excavation below the water table, and removal of perched regolith aquifer systems where they may exist in an existing quarried environment.

As the excavation will advance below the water table there will be required management of pit inflow seepage and discharge which includes runoff following rainfall events. On cessation of quarrying activities the likely closure management scenario adopted is for the Gibsons Borrow Site to be backfilled to 4.5 m AHD, however the Jali Borrow site will not be backfilled and will remain with a floor depth of 2.5 m AHD. A drawdown depression of the local water-table will persist due to ongoing in-pit seepage and as such, ponding from groundwater seepage into the pits will occur in areas. The void is likely to produce a permanent groundwater sink at closure. In this circumstance the pond water quality may deteriorate over time due to accumulation of salts from evaporation processes. Plant species selected for rehabilitation purposes will be able to tolerate brackish to borderline saline conditions. *For the possible closure scenario where the pits are backfilled at/above the height of the pre-existing water table, then this will eventuate in the drawdown depression dissipating as the water levels recover.*

There is one registered landholder bore (GW056965) near the Gibson-Jali Borrow Site area which will possibly be impacted by the borrow site excavation. The bore is used for domestic, farming and stock purposes and is located 177 m to the south of the Jali Borrow Site with water sourced from bedrock aquifer in a quartz – shale unit. Impacts may include reduced supply from drawdown and deterioration in water quality from potential salt concentration accumulation in the excavation ponds. Management processes will be required to determine if there will be impacts to this bore from quarrying activities and require monitoring of water levels and quality.

Issue

This memo has been prepared to consider the potential for local and regional impacts to the groundwater regime of the Gibsons Borrow Pit and Jali Borrow Pit (referred to as the *Gibsons-Jali Borrow Site Area*) such that existing bore water users and groundwater dependant ecosystems might be adversely affected. It provides substantiating information on the potential for groundwater levels and water quality impacts to the local ecology (including groundwater dependent ecosystems, GDE's) and existing bore water users (consumptive use) based on existing data available for the area. The Jali Borrow Pit is located immediately adjacent and west of the Gibsons Borrow Pit.

The memo and accompanying assessment will be provided to DPI-Water for consideration.

Background

The Woolgoolga to Ballina Pacific Highway Upgrade involves upgrading approximately 155 kilometres (km) of highway to four-lane dual-carriageway road between Woolgoolga (north of Coffs Harbour) and Ballina (near the NSW/Queensland border) on the NSW north coast.

The Pacific Complete CEMP (sections 3 to 11) describes the overall system for environmental management of the project being delivered by Pacific Complete in partnership with Roads and Maritime.

The purpose of the *Woolgoolga to Ballina (sections 3-11) Pacific Highway Upgrade Gibsons Borrow Site Management Plan and Jali Borrow Site Management Plan* (State Significant Infrastructure: SSI-4963) is to describe how Pacific Complete would manage the establishment, operation and rehabilitation of the two borrow sites (Figure 1) which would be used to provide fill material for the construction of the Woolgoolga to Ballina Pacific Highway Project (sections 9 to 11).

The BSMPs will be prepared to address the requirements of the Minister's Conditions of Approval (MCoA), specifically MCoA D22, the mitigation measures listed in the Pacific Highway Upgrade: the Submissions / Preferred Infrastructure Report November 2013 (SPIR) and all applicable legislation.

The BSMPs should be consulted when considering the detail of this memo as it provides the detailed background to the Gibsons-Jali Borrow Site Area, the objectives of the plan, the site setting, environmental safeguards, legislative requirements, EPBC Act requirements, and staffing competencies, and the Ministers requirements (particularly, D22(b)).

Proposal

The project EIS indicates that if nearby road projects and quarries cannot supply the material required for the project, other material sources near the project would be investigated. The Gibsons-Jali Borrow Site Area fulfils these needs in this section of the W2B project. Gibsons Borrow Site was identified in the SPIR as a borrow site location and is owned by NSW Roads and Maritime Services. The footprint of the site proposed in the SPIR was located within the existing quarry located within the project boundary (refer to Figure 1). The current design extends the boundary of the site to the south, north and south-east (refer to Figure 2). Jali Borrow Site is a newly proposed borrow site, separated from Gibsons Borrow Site by Old Bagotville Road.

The Gibsons-Jali Borrow Site Area is located approximately 2.5 kilometres north of the Richmond River and southwest of the township of Wardell on old Bagotville Road. The site is located on the western side of the highway alignment and is mostly within the approved project boundary except for the Jali Borrow Pit area located to the west and a section to the south of the project. The Gibsons Borrow site is located on Lot 2/DP585377 and Lot5/ dp843369 and the Jali Borrow site is located on Lot 244/DP755691.

The majority of the Gibson and Jali Borrow Pit area is located on disturbed land, being a previous quarry site (refer to Figure 2). The current proposal for the Gibson and Jali Borrow Pit area includes an excavation area, access track and staff offices/amenities. The borrow site would provide largely weathered to fresh bedrock material for use in project sections 9, 10 and 11. It would be operational for 3 years, and operate during the proposed construction hours.

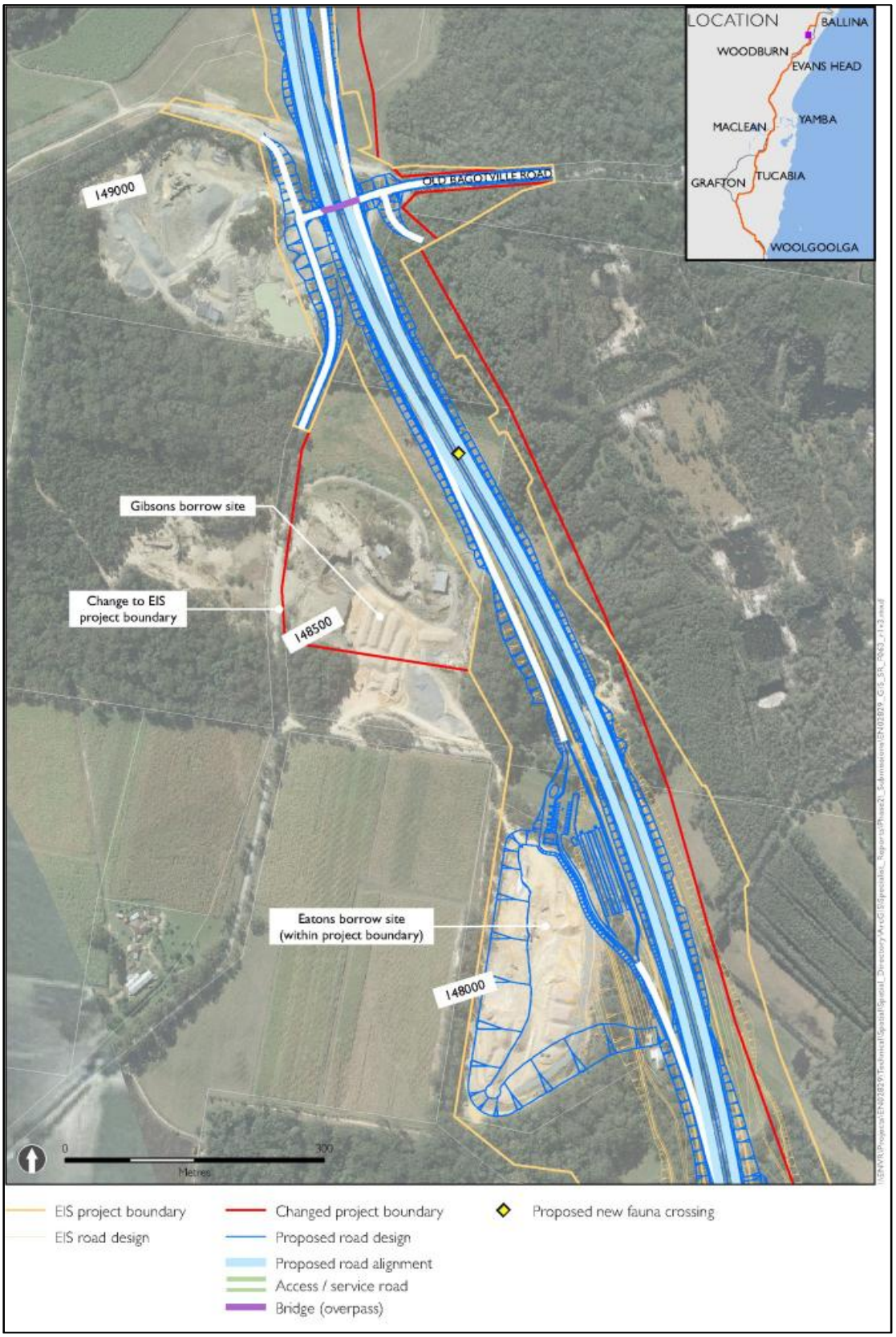


Figure 1 Original SPIR proposed Gibsons borrow site which has been superseded

The Gibson Borrow Pit area is located on a low NW – SE orientated ridge with elevations ranging from about 6 m to 27 m AHD (Australian Height Datum) with lower areas being those excavated during previous quarrying activities.

There is remnant vegetation around the perimeters of the proposed borrow site area. To the west of the site is remnant forested land. To the east of the Gibson Borrow Pit area and east of the road alignment the land is relatively low lying and forms the alluvial floodplain of the Richmond River. The landscape of the surrounding area is mainly rural with agricultural activities and the Wardell Heath located to the northeast and the Blackwall Ranges to the west.

The borrow site covers an area of approximately 7.5 hectares and excavations depths of up to 16.5 metres will occur providing an estimated 384,000 m^3 of material. Cross-sections of the Gibsons-Jali Borrow Site Area are provided in Figure 3. The excavation works will reduce elevation to approximately 2.5 m AHD at both borrow sites. The Old Bagotville Road will be retained at its current location separating the Jali Borrow Site from the Gibsons Borrow Site. The Old Bagotville Road runs along the ridge-line of a saddle landform above the borrow pits. The road on this saddle is proposed to be lowered by approximately 2m to 10.9 m AHD.

The Gibson Borrow Pit area is located above the 20 year and 100 year ARI flood levels for the area and the site would not result in any changes to flood impact, duration or velocity characteristics.

The Gibson Borrow Pit area is located outside of the Richmond River floodplain and use of the site is not expected to change the local flooding behaviour of the area. The nearest watercourse is Bingal Creek, located around 750 metres north of Gibson Borrow Pit area. The Richmond River is located approximately 2.3 km to the east.

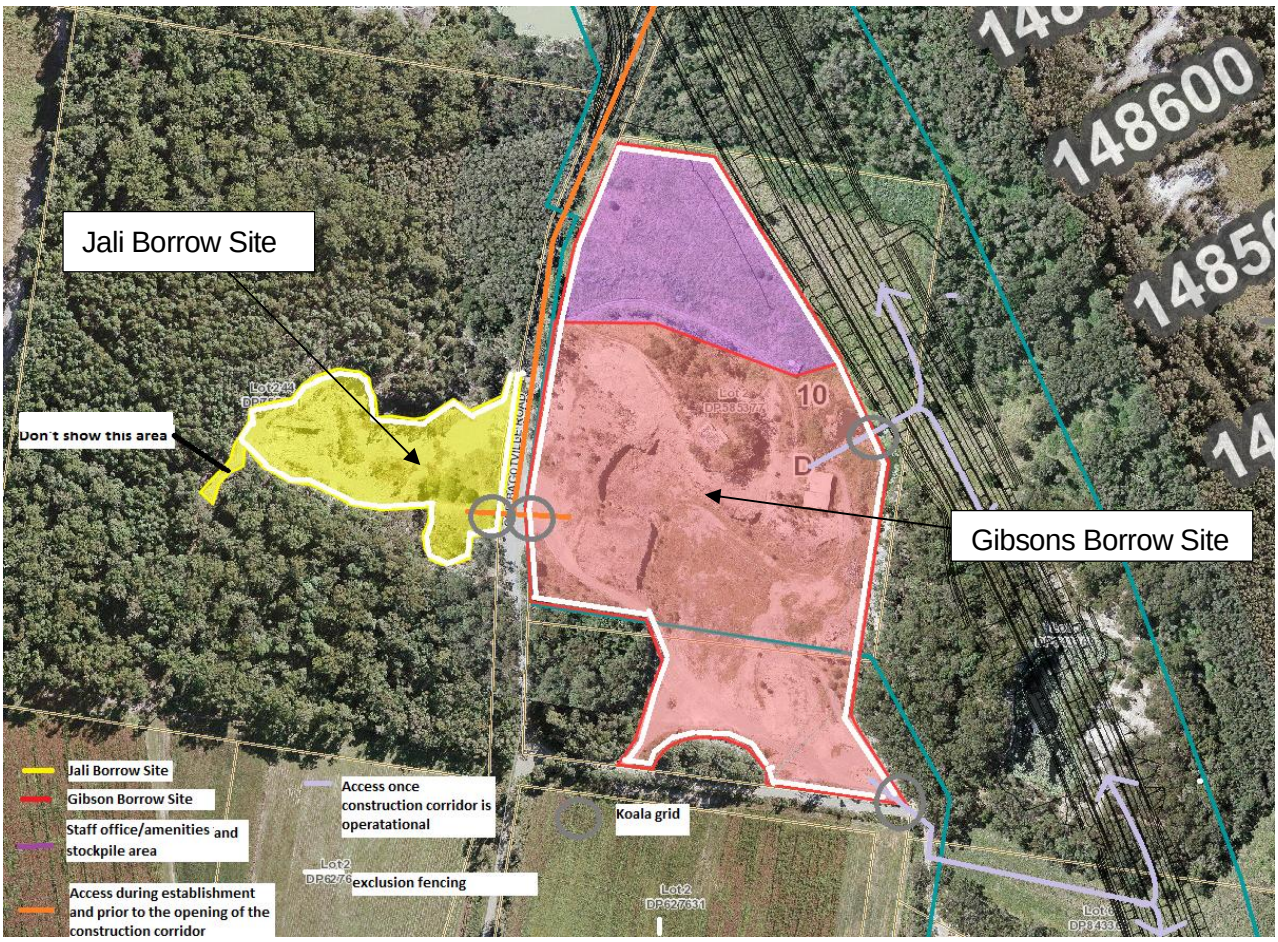


Figure 2 Extent of the proposed Jali and Gibson Borrow sites

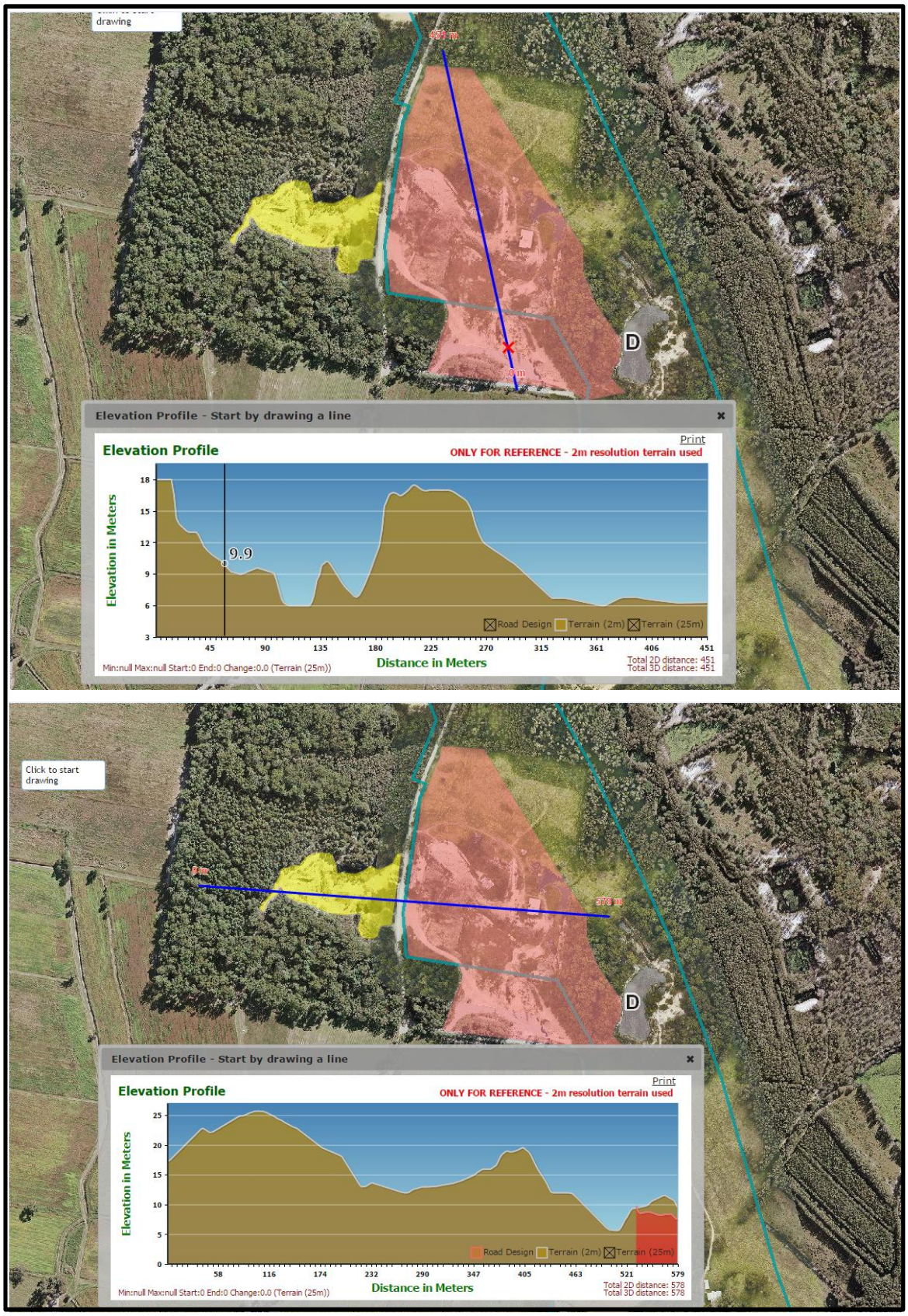


Figure 3 Cross sections through the extents of the proposed Gibsons-Jali Borrow Site Area, north-south, and west-east

The location of geotechnical investigation boreholes and monitoring wells (GWB10-04 and GWB10-05, GW01 – GW04) used to collect groundwater information at Gibsons-Jali Borrow Site Area are presented in Figure 4. GW056965 is a landholder water supply bore.

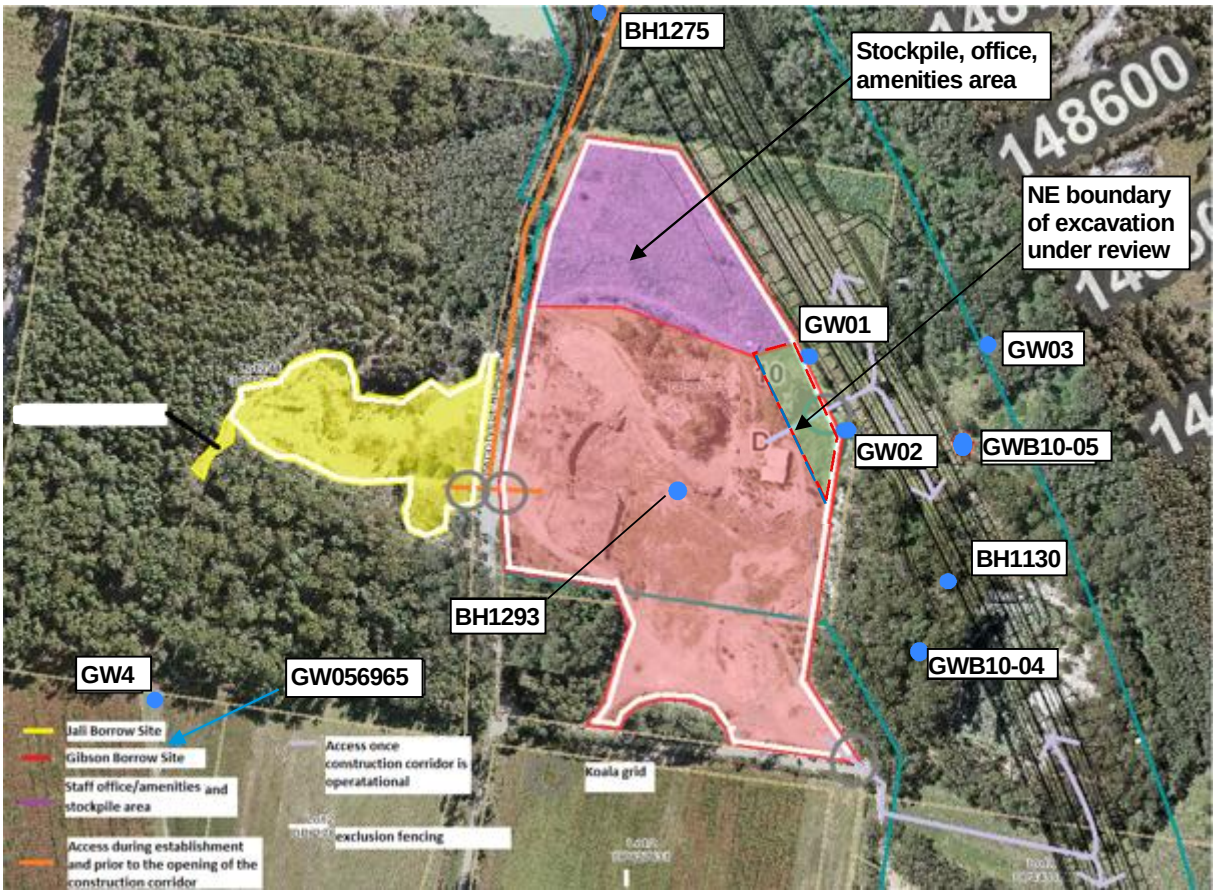


Figure 4 Location of groundwater monitoring bores and geotechnical holes

Hydrogeology

The Gibsons-Jali Borrow Site Area is located near the eastern margin of the Clarence-Moreton Basin which is an extensive sediment basin in north east New South Wales and southern Queensland. Two groundwater regimes are present in the vicinity of the borrow pit site and include: Quaternary Richmond River Alluvium; and underlying bedrock comprising metamorphosed Palaeozoic aged sedimentary rocks of the Neranleigh Fernvale Beds (New England Fold Belt). The borrow pit site is located on a low ridge comprising the Neranleigh Fernvale Beds with the Richmond River Alluvium located within 100 to 200 metres to the east, northeast and south. Table 1 summarises the key features of the *Richmond River Alluvium system*, while the bedrock materials in general is not considered as an aquifer except where structural deformity zones occur providing the occurrence of fractured rock aquifer systems.

Table 1 Groundwater and related characteristics of the Richmond River Alluvium system

Underlying aquifers (GMU)	Richmond Coastal Sands; New England Fold Belt
Water Sharing Arrangements	Richmond River Area Alluvial Aquifer Water Sharing Plan
Acid sulfate soils	Majority of section mapped as having a low probability of occurrence. Northern portion of route mapped as having no known occurrence of acid sulfate soils.
Groundwater levels	Shallow watertables recorded along the entire section.

Source: extracted from "Upgrading the Pacific Highway, Woolgoolga to Ballina Upgrade - Working paper – Groundwater, November 2012 (final)"

Groundwater Occurrence

Bedrock comprising the Neranleigh Fernvale Beds (Aquitard – poor Aquifer)

The Neranleigh Fernvale Beds comprises interbedded siltstones, sandstones, greywackes and minor conglomerate and claystone with basic meta-volcanics. The indurated and cemented nature of the bedrock rockmass means that the primary porosity and permeability of the sedimentary units is very low, and is dominantly associated with secondary porosity textures (defects) in the rock. The inferred overprint of fracturing and jointing defects provide minimal improvement in porosity, permeability and storage except possibly in zones associated with localised zones of structural deformation and weathering. As such groundwater flow within the fresh rockmass is limited and the Neranleigh bedrock is considered as an *aquitard to poor aquifer systems within structural zones of higher permeability* at this location. The extremely - highly weathered residual bedrock (regolith) typically may comprise sands – clayey sands over weathered sandstones and sandy clays to clays over siltstones to claystones. Gravelly zones may also occur where the bedrock is partially decomposed. These sand-gravel regolith zones below the water table constitute an aquifer system overlying the competent bedrock aquitard. Where these regolith zones occur above the watertable, then they provide minor perched groundwater system/s following intense/prolong rainfall periods, particularly near the lower slopes.

Two geotechnical investigation boreholes BH1273 (GWB10-04) and BH1293 intersected metamorphosed siltstone of the Neranleigh Fernvale Beds within the footprint of the Gibsons Borrow Site. BH1273 was drilled to 17.7m and intersected highly weathered rock while BH1293 was drilled within the existing quarried area to 10.1 m and intersected fresh rock with generally non weathered defect faces (refer to Figure 5). The geology logs generally indicate low permeability conditions. A visual inspection of exposed bedrock at Gibsons Borrow Site by Golder Associates (2013) indicated rock types comprised of metamorphosed sandstones, greywackes and siltstones. The weathering of these rock types is variable in the exposed old quarry faces ranging from highly weathered to fresh rock with common iron oxide staining within joint sets and fracturing in weathered rock. These weathered joint sets and fractures would control the movement of groundwater vertically and laterally and in most cases would provide low permeability conditions for groundwater movement due to clay infill.

Boreholes BH1274 (GWB10-05), BH1130, BH1125, GW01 and GW02 were drilled within 150m to the east of the Gibson borrow site and intersected variable bedrock conditions below the water table with low to moderate-high permeability conditions: sands (residual sandstone bedrock) in GWB10-05, weathered siltstone in BH1130, GW01 and GW02 and clayey gravel (residual bedrock) in BH1125. The residual bedrock sands and to an extent the clayey gravel would provide aquifer conditions (porous regolith aquifer) while the siltstone mass would be expected to provide aquitard conditions.

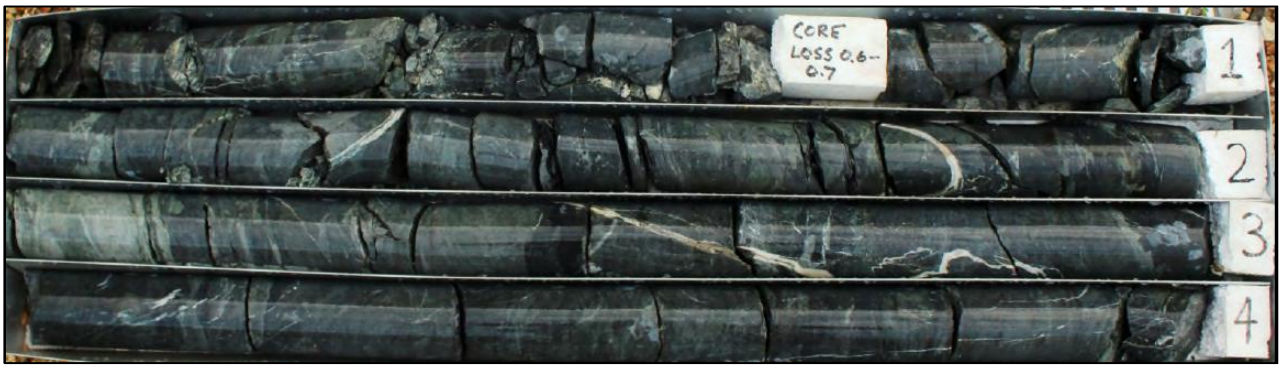


Figure 5 Neranleigh Fernvale Beds meta-siltstones intersected in the quarry pit floor at BH1293 (0.0m – 4.0m depth) comprising fine grained foliated and fractured metamorphosed siltstone (Golder, 2013). This and its weathered equivalent are the materials to be excavated for fill for roadworks.

Unconsolidated Sediments (Aquitard – Aquifer)

The unconsolidated sediments are present to the east of Gibsons-Jali Borrow Site Area and comprise estuarine mud-silt-clay sediments and sand, gravels sediments associated with the *Richmond River alluvium and coastal sands*. The mud-silt-clay sediments are of low permeability and exhibit aquitard conditions while the interbedded sand and gravels are of higher permeability and provide shallow aquifer systems. The sands and gravels have been identified in boreholes GWB10-05, GW01, GW02, GW03 and BH1275 and would provide an aquifer system with relatively permeable conditions. The bores GW01 and GW02 are located near the eastern boundary of the Gibsons Pit with sand (gravels) of 2 – 3m thickness occurring below the watertable and overlying siltstone bedrock. Further to the east (GWB10-05, GW03) and northeast (BH1275) the saturated sand (gravel) thickness is greater than 5m.

Plate 1 shows a view towards the northeast boundary of the proposed Gibsons Pit. It shows historic quarry works in the foreground with the location of the shallow sand aquifer on the Gibsons Pit margin shown in the low lying area in the background.

Soil depth is up to a few metres thick, and is largely comprised of clay, that is draped in places over the bedrock in elevated areas not previously quarried at the Gibsons-Jali Borrow Site Area.

Plate 1: Looking northeast towards the NE Gibson pit boundary located in the background behind the building structure.

Water Table Levels and Groundwater Flow

The local groundwater table is anticipated to mimic the topography, that is, the inferred groundwater levels in the unconsolidated sediments to the east of Gibsons-Jali Borrow Site Area in the low lying area are likely to be located at a shallow depth, while groundwater levels on the low hilly area of the Gibsons-Jali Borrow Site Area are deeper within the bedrock. Groundwater levels have been monitored in the investigation piezometers GWB10-04, GWB10-05, GW01, GW02, GW03, BH1130 and BH1125 located on the eastern margin of the Gibsons Borrow Site (refer to Figure 4) and GW04 located to the southwest near landholder bore GW056965. The water level and screened geological details from these bores are provided in Table 2. Water level loggers for continuous measurement recordings were used at GWB10-04 and GWB10-05 between December 2012 and March 2014 and at BH1130 from August 2012 to March 2013 and are presented as time-series hydrographs in Figures 6 to 8, respectively. These bores are located east of the borrow pit footprint. The hydrographs indicate water level rises occur following rainfall events although BH1130 response is subdued indicating poorer hydraulic connectivity. Water levels recede following major rainfall recharge events and, in the case of GWB10-04 and BH1130 the receding water levels is at a gradual rate extending over several months. The water level in bore GWB10-04 rose to a maximum height of approximately 6.7 m AHD (5.6 m below ground level). From August 2013 through to March 2014 there has been relatively dry conditions with limited rainfall and the response in groundwater levels has been a steady decline of 1.5 to 2 m. As such, the major contributor to recharge of the bedrock aquifer system is through rainfall. The exposed rock conditions associated with the existing disturbed site from previous quarrying would allow and promote direct infiltration into the bedrock.

The peak groundwater levels are above the floor excavation level of the Borrow Pits by an estimated 2 – 6 m. As the bedrock comprises low permeability siltstones and sandstones the inflows into the pit environment will be primarily through the secondary porosity features such as open fractures, weathered joints or bedding planes. However, in areas where the residual bedrock (regolith) on the lower slopes comprises sands or gravels then inflow maybe through the porous matrix. Inflows for the bulk of the siltstone and sandstone bedrock through discontinuities will be relatively low due to the limited storage and very low permeability of the bedrock aquitard. However, on lower slopes and margins of the borrow pit where possibly areas of residual sandy to gravelly regolith are intersected below the water table, the inflows are likely to be greatest due to relatively higher permeability, available storage and connectivity.

Table 2 Groundwater levels measured in monitoring bores

Bore No	Surface m AHD	Water level (m TOC)	Water level (m AHD)	Date	Screened geology
BH1130	14.76	9.87	approx. 5.95 to 5.25	August 2012 – March 2013	Weathered siltstone
BH1273 (GWB10-04)	11.84	6.89	approx. 4.7 to 6.7	December 2012 – March 2014	Weathered siltstone
BH1274 (GWB10-05)	6.45	1.86	approx. 3.7 to 5.8	December 2012 – March 2014	Pleistocene barrier sand and underlying bedrock regolith sands
BH1275	6.77	1.74	5.82	29/01/2013	Pleistocene barrier sand and underlying bedrock regolith clayey gravels
GW01	6.09	0.9*	5.19	16/02/2017	Siltstone
GW02	6.49	1.6*	4.89	16/02/2017	Siltstone
GW03	5.62	2.0*	3.62	16/02/2017	Pleistocene barrier sands/Richmond River alluvium sands
GW04	19.81	9.14*	10.67	16/02/2017	Siltstone

Note * - metres below ground level.

Source: Bores BH1130, BH1273, BH1274 and BH1275 data from geotechnical investigations by Golder and Associates (2013). Bores GW01 – GW04 data is from additional groundwater investigations undertaken in February 2017 by Pacific Complete.

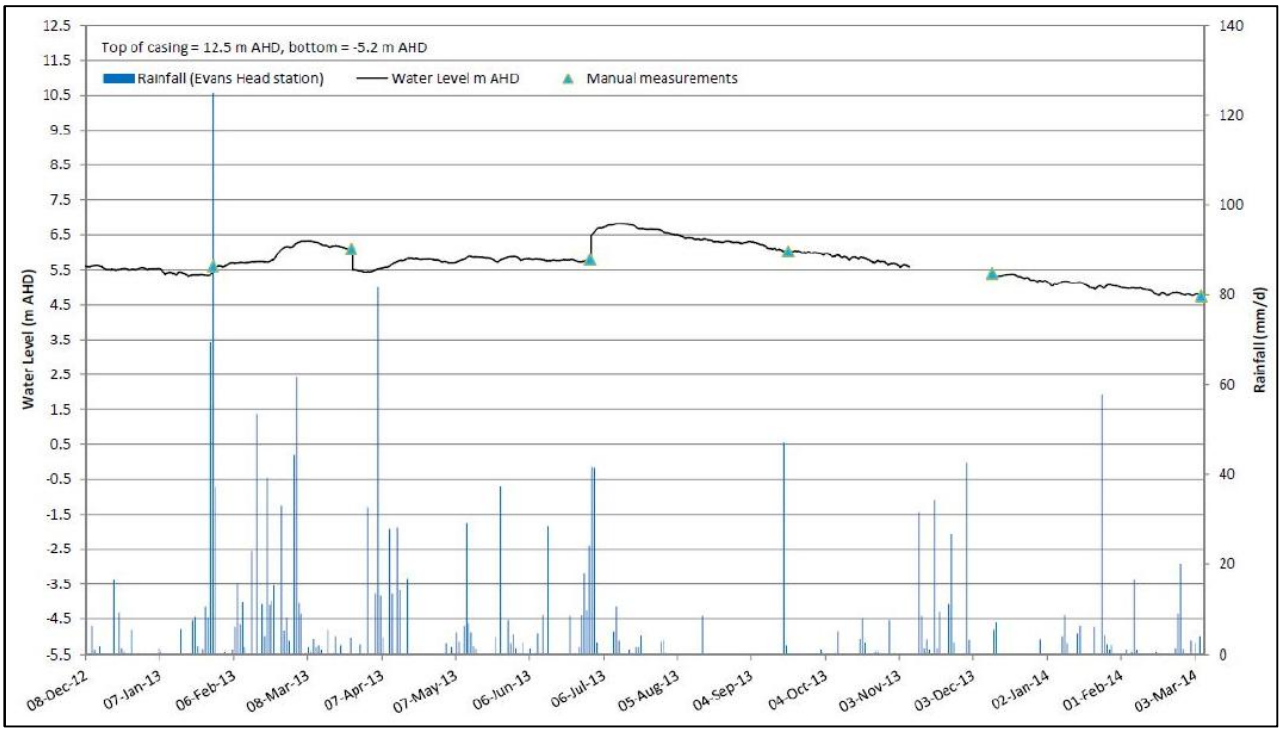


Figure 6 Bore GWB10-04 groundwater levels and response to rainfall

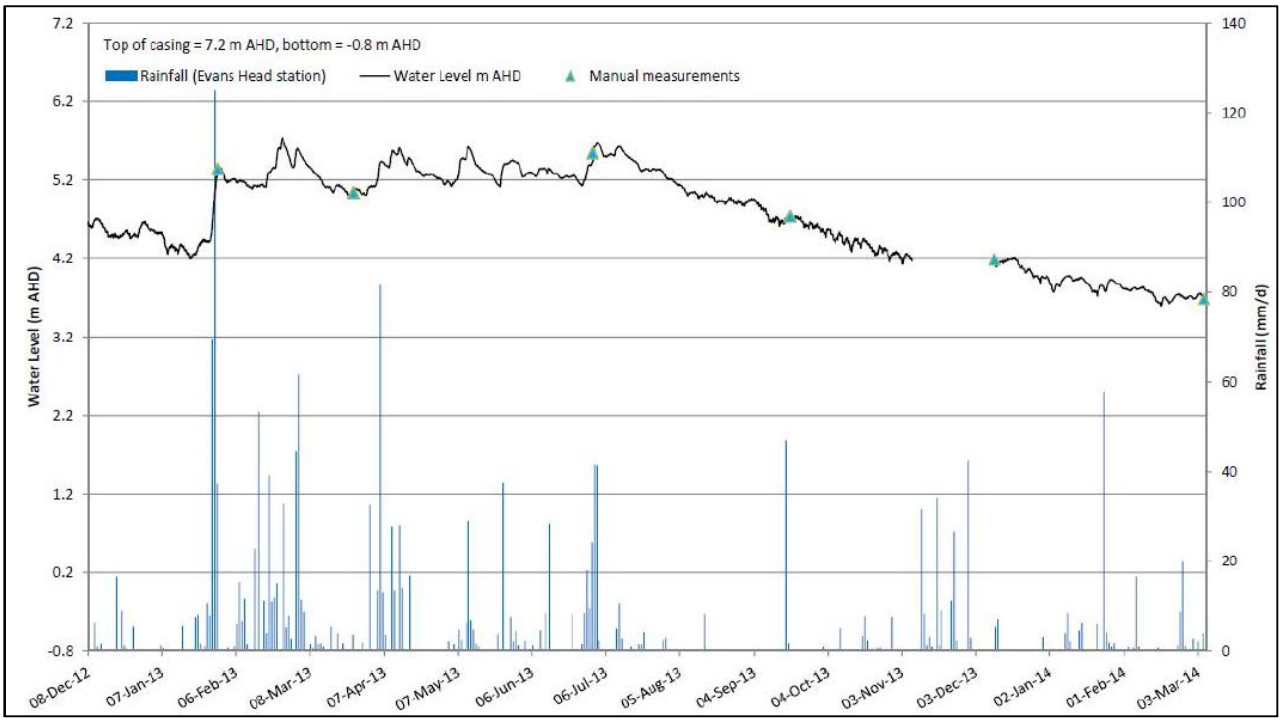


Figure 7 Bore GWB10-05 groundwater levels and response to rainfall

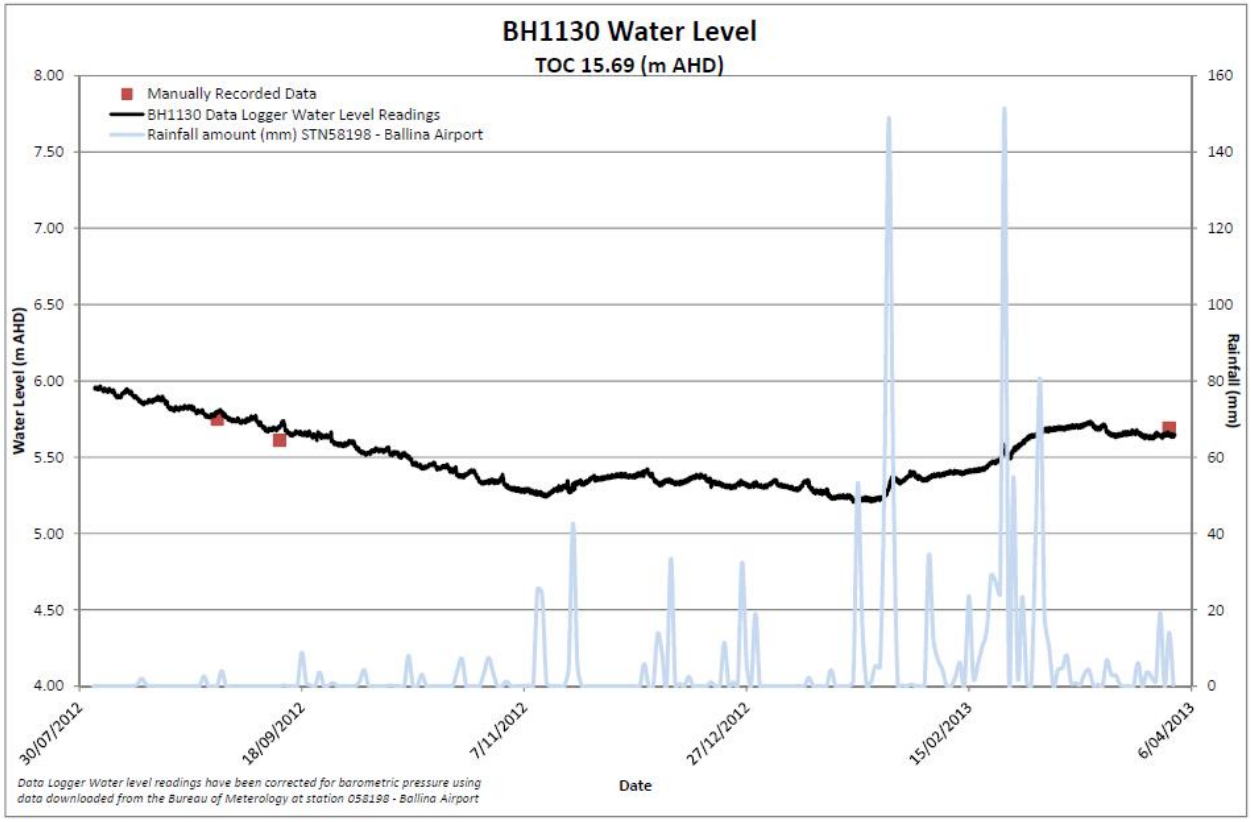


Figure 8 Bore BH1130 groundwater levels and response to rainfall (Source: Golder, 2013)

The unconsolidated sediments of the Richmond River floodplain that is present to the east of the borrow pit site sustain shallow groundwater systems. They are intimately hydraulically connected with the surface water system of the Richmond River, and sandy/gravelly regolith interface of the Neranleigh Fernvale bedrock groundwater system. To the east of the Borrow Pit area within the floodplain sediments the water table systems would be expected to be typically less than 2 m bgl.

The Gibsons-Jali Borrow Site Area is located beneath a northwest – southeast orientated ridgeline which may be considered to provide a localised groundwater divide. Groundwater flow beneath the proposed borrow site is inferred to be outward from the topographical ridge high (following the topographic slope), predominantly flowing to the east, northeast, and south resulting in a mildly mounded groundwater system in the bedrock inlier. A trend of declining groundwater elevation levels measured in the bores towards the east of the Borrow Pit area (Table 2) provides confirmation.

Groundwater recharge to the bedrock groundwater system is predominantly via rainfall infiltration at the topographic surface through largely clay regolith soils and exposed pre-existing quarried rock surfaces into the underlying bedrock percolating downwards through weathered and structural discontinuities. Rainfall on the land surface will both discharge as surface runoff and infiltrate to the subsurface. In the case of the latter, where the area has not been disturbed by previous quarrying, the thin soil-weathered rock layer (the regolith zone) *may* facilitate rapid horizontal flow within a shallow perched system, overlying the low permeable bedrock of the underlying Neranleigh Fernvale Beds (an aquitard). This may be prevalent where the regolith is significantly sandy (rare) for perched systems to form and not primarily comprised of clay which limits permeability and groundwater flow. Limited vertical infiltration from this perched system is inferred to sustain the deeper water table in the metamorphosed siltstone bedrock.

Local Bedrock Groundwater Systems

From the above discussion, three bedrock groundwater flow systems are inferred in the immediate vicinity of the proposed borrow pit site; namely:

- *Bedrock fractured aquifer system*: typically below the water table within the Neranleigh Fernvale meta-sediment rocks and occurring several metres above the proposed pit floor elevation.
- *Regolith sand-gravel porous aquifer* overlying bedrock: may occur on the margin of the borrow site on the lower slopes and potentially connected to sandy facies of the Richmond River alluvium. Investigation bore (GWB10-05) located within 100 m east of the eastern margin intersected the regolith aquifer, however GW01 and GW02 on the northeastern boundary did not intersect a porous regolith aquifer. Instead these bores intersected saturated sands overlying siltstone bedrock.
- *Perched water* may occur in places, typically at lower slopes, within the shallow veneer comprising the soil/weathered zone on top of the bedrock of the Neranleigh Fernvale Beds; and may develop after high rainfall events

Groundwater flow in the bedrock fractured aquifer system and regolith sand-gravel aquifer is controlled by regional topography (at the 100 - 1000 m scale), while perched systems are controlled at the local scale topography (at the 10 m scale). Groundwater flow within the regolith sand-gravel aquifer maybe influenced by occasional large scale flooding of the Richmond River floodplain and tributary creeks. The groundwater levels within the shallow perched systems are inferred to fluctuate considerably over time due to their dependence on rainfall recharge and their limited storage capacity.

Groundwater flow is strictly controlled by the immediate topographic profile in the bedrock inlier and discharges to local drainages, such as local creeks (Bingal Creek) and the Richmond alluvium to the east. This shallow groundwater system is located in the root zone of the local plant ecology and, as such, sustains these local communities, with evapo-transpiration contributing significantly to the water balance losses from these systems. The latter has been considerably disrupted by the previous quarrying works undertaken historically at the site.

The deeper bedrock groundwater system is a slow flowing deep system which reacts slowly to rainfall events, in most instances and, as such, do not typically fluctuate much over time (Figures 6, and 8). Because of its depth beneath the Borrow Site, this groundwater system does not sustain the local ecology to any meaningful degree.

It is noted however that recharge in the footprint of the bedrock excavation may increase infiltration into the bedrock groundwater system, particularly with ponding of water after rainfall events.

Local Alluvial Groundwater Systems

There are coastal sands (Pleistocene barrier sands) and potentially Richmond River alluvium which occur on the northeastern margin of the Borrow Pit area (identified within GW01 and GW02). These aquifer systems are only a couple metres thick in this location and thin out rapidly to the west as the bedrock rises in elevation within the quarry area. It is likely that these sand systems are hydraulically well connected to the Richmond River alluvium to the east of the road alignment as indicated by all the investigation boreholes intersecting saturated sands east of the borrow pit site. Local groundwater flow in the sands is towards the east.

Strata Permeability

Hydraulic tests (rising head test) were performed in bores GW01, GW02 and GW04 which are screened in siltstone bedrock. The bores GW01 and GW02 on the northeastern boundary provided a hydraulic conductivity (K) estimate average of 4×10^{-7} m/s (0.035 m/d) while bore GW04 located south of Jali Pit provided a K estimate of 1 x 10-6 m/s (0.1 m/d). These results may reflect minor groundwater movement through weathered joints, bedding planes or open fractures and not the inherent rock mass which would be of low permeability conditions ($K < 1 \times 10^{-8}$ m/s) allowing no flow.

No hydraulic testing has been conducted within the alluvial sands or porous regolith bedrock, however expectations are these aquifer systems are moderately to relatively permeable and would have a hydraulic conductivity estimate ranging between 1x 10^{-5} to 1 x 10^{-3} m/s (0.8 to 90 m/d).

Estimation of Pit Inflow

A coarse estimation by empirical methods was used to predict a range of inflows through the bedrock (floor and walls) of the borrow pit .This calculation of inflows assumes that no saturated sand aquifers or porous regolith aquifer systems are intersected within the borrow pit margins or floor. The method applied was a variation of the Dupuit-Forchheimer equation for an unconfined aquifer with bulk values of hydraulic conductivity which includes expected (1 x 10^{-7} m/s), upper bound (1 x 10^{-6} m/s) and lower bound (1 x 10^{-8} m/s). The expected K was assigned at 1 x 10^{-7} m/s to reflect an average between fresh rock which is expected to be of low K and weathered rock. The average saturated depth assigned varied between 2 and 4 m and the specific yield was varied between 5% and 10%. The whole pit floor was assumed at a depth of 2.5 m RL. The results of the analysis are provided in Table 3.

Inflows in the Gibsons Pit for expected bulk K were estimated to range between 0.8 and 2 L/s after 90 days and this may reach a potential maximum inflow of 5.8 L/s after 90 days if consider upper K bounds of 1 x 10^{-6} m/s, however these conditions are extremely unlikely. Inflows would continue, at a declining rate, dewatering the local aquifer until a steady state inflow condition is reached. A proportion of this inflow will be lost through evaporation and this will vary due to climatic conditions, seepage rate and seepage area. It is envisaged for average K rock conditions that the void will have ponded water during most seasonal conditions with the possible exception during prolonged drier hotter periods. In this instance the factors of depleted groundwater storage from lack of rainfall recharge, lower groundwater levels, higher evaporation rate and no direct rainfall capture in the void may lead to dry floor conditions.

For proposed backfilling from pit floor depth of 2.5 m RL to 4.5 m RL, assume an average of 2m saturated depth and therefore inflows would probably be less than 1 L/s but possibly may range up to approximately 3 L/s, but this is highly unlikely.

Inflows into the Jali Pit for expected bulk K were estimated to range between 0.4 to 0.8 L/s after 90 days and this may reach a potential maximum inflow of 2.5 L/s after 90 days if consider upper K bounds of 1 x 10^{-6} m/s, however these conditions are extremely unlikely. As the Jali Pit is located on the ridge it has been assumed that the saturated depth may vary between 4 to 6 m depth, although 6m depth is upper bound of saturated thickness. In this instance there is required an excavation depth of approximately 6.5 m below the existing pit floor (approx. 9 m RL) to reach a final depth of 2.5 m RL. Note after 90 days the inflows would continue at a declining rate, dewatering the local aquifer until a steady state inflow condition is reached. A proportion of this inflow will be lost through evaporation and this will vary due to climatic conditions, seepage rate and seepage area. There is no proposed backfilling of the Jali Pit, and therefore the floor will remain at 2.5 m RL.

Table 3 Predicted Range of Inflow into Gibson and Jali Pits

Total Inflow for Gibson Pit after 90 days (L/s)				
		Estimated Inflow rate (L/s) for:		
Dewater Depth (m)	Specific yield (%)	Expected bulk K (1 x 10^{-7} m/s)	Lower bound K (1 x 10^{-8} m/s)	Upper bound K (1 x 10^{-6} m/s)
2	10	1.2	0.4	3.6
4	10	1.8	0.5	5.8
2	5	0.8	0.3	2.6

4	5	1.3	0.4	4.1
Total Inflow for Jali Pit after 90 days (L/s)				
Dewater Depth (m)	**Specific yield (%)**	**Estimated Inflow rate (L/s) for:**		
		Expected bulk K (1×10^{-7} m/s)	**Lower bound K (1×10^{-8} m/s)**	**Upper bound K (1×10^{-6} m/s)**
4	10	0.6	0.2	1.9
6	10	0.8	0.2	2.5
4	5	0.4	0.1	1.3
6	5	0.5	0.2	1.7

Local Ecosystems Sustained or Dependant on Groundwater

The ecological studies undertaken to date (refer to the BSMP) report that the footprint of the proposed Gibsons-Jali Borrow Site Area is located predominately on an elevated existing quarried location with scattered patches of remnant and regrowth vegetation. It is envisaged that adjoining vegetation to the borrow pit area would incur limited additional impacts beyond the pre-existing impacts from historical quarrying works.

The proposed excavation works to be carried out at the borrow site largely lie within the boundaries of pre-existing quarry work and as such are unlikely to further impact on sensitive local ecological communities near the Borrow Site to any meaningful degree. Reductions to the groundwater flow flux to areas downgradient of the Gibson Borrow Pit area can be anticipated by virtue of dewatering of the excavation up to a couple of metres below the water table, and removal of perched regolith aquifer systems where they may exist in an existing quarried environment.

Drawdown Impact Assessment

The dewatering of the bedrock aquifer is likely to induce a localised drawdown affect (relatively tight drawdown cone around the pit extents is inferred) due to the expected relatively low permeability of the bedrock mass. However, in the unlikely event that sands or porous regolith aquifer is intersected below the water table on the north eastern margin of the Gibsons Borrow Site and there is lateral good connection through to Richmond floodplain alluvium (including coastal sand barrier facies), then the drawdown may extend further out to the east than anticipated. Intentions on the northeastern side of the Gibsons quarry is to move the excavation boundary further to the west from where bores GW01 and GW02 are located to avoid the saturated sand aquifer and reduce volumes of spoil. Currently this is under review and the potential boundary is indicated on Figure 4.

Areas adjacent to the Gibsons Borrow site to the east – northeast and south largely comprise existing cleared land or land which will be disturbed by the road alignment corridor. The distance from the Gibson Borrow site to the project EIS project boundary on the eastern side of the road alignment corridor is over 150 m distant. Potential impacts to groundwater levels in the alluvium east of this EIS boundary from drawdown are envisaged to be limited unless the sand aquifer or regolith porous aquifer is intersected and is well connected over a lateral extent. The remnant vegetation bordering the proposed Jali Borrow Site may be exposed to some impact due to less available soil rock water uptake by their root systems arising from draining of perched systems into the pit and lowering of the water table in the bedrock from dewatering (affecting deep rooted plants which access water greater than 7 to 10 m deep). The low permeability of the groundwater systems involved would infer that this would be of limited aerial extent and effect.

The presence of the proposed borrow pit may enhance rainfall recharge marginally to the bedrock groundwater system. This will be limited due to the low permeability of the bedrock mass and dewatering of the pit once it advances below the water table. The limited mass flux of infiltrating

rainfall water is unlikely to adversely impact the water quality of the regional groundwater for similar reasons. The limited density (broad spacing) and tightness of fracture/joint flow pathways would effectively filter any suspended solids (turbidity) arising from quarry activities (considered the primary contaminant type associated with quarrying), and eventually clog up, to further reduce the recharge potential over the footprint of the quarry extents.

In summary, the dewatering of the water-table within the pit environment is likely to be localised due to low permeability of the rockmass and will not have a notable impact on vegetation due to the depth of plant rooting to reach this water (expected greater than 6 m in elevated areas). However, in the *unlikely* event the porous regolith aquifer or sand aquifer is intersected below the water table by quarrying on the eastern margin lower slopes of the Gibsons Borrow Site then the drawdown may extend up to 200 metres to the east and possibly affect water levels in the Richmond floodplain alluvium and shallow rooted plants to the east of the road alignment. If saturated sands is intersected by quarrying on the pit margins and, is relatively thin and at a higher elevation than the alluvium to the east then water table drawdown is locally likely to be limited due to the difference in water level elevation, i.e. the water level elevation decreases to the east and the base of the sands on the pit margin may equate to the watertable elevation nominally 10 to 50 m downslope. The current vegetation in elevated areas on the pit rim is not anticipated to be meaningfully impacted since these ecosystems are largely sustained by the recharge-in/recharge-out processes associated with rainfall infiltration which typically characterise the behaviour of shallow perched water table flow systems.

Pit Inflow Management

When the depth of the quarry penetrates the existing water-table there will be required management measures to control pit inflow seepage. Such management initiatives will predominantly require the collection and disposal of pooled water from within an in-pit sump which is proposed to be located in the northeast of both the Gibsons and Jali quarry sites. Water discharge from the sump into the environment will be carried out in accordance with project environment protection licence (EPL) to meet applicable discharge criteria. The in-pit sump will also be used for collection of surface runoff during rainfall events.

In the event that the excavation works intersect porous substrata on the eastern boundary below the watertable, then clay capping will be placed on the walls of the borrow site to reduce pit inflows and minimise potential drawdown extending out to the east of the site into the permeable coastal sands and Richmond River alluvial sands.

Groundwater Quality

Groundwater samples were obtained from bores located within the bedrock and include GW01 and GW02 located on the north-eastern boundary within siltstone and GW04 located within siltstone south of the Jali Pit. The results indicate fresh conditions at GW01 and GW02 and slightly brackish conditions at GW04. The pH is neutral to slightly acidic. Laboratory results for conductivity, total dissolved solids, pH, anions, cations, fluoride, ammonia, iron, manganese, alkalinity and hardness are provided in Attachment A.

Closure Rehabilitation of Quarry

Current intentions, subject to expected limited availability of backfill and operational costs, is for the Gibsons Borrow Site to be backfilled to 4.5 m AHD, and the Jali Borrow Site not to be backfilled. The borrow sites will be rehabilitated by landscaping using indigenous plant species following completion of quarrying activities. A drawdown depression of the local water-table will persist after cessation of quarrying works due to ongoing in-pit seepage from adjacent groundwater systems proximal to the borrow pit (since the final depth of the bedrock excavation will remain at a depth below the water table). These pits will not be free draining and as such, ponding from groundwater seepage into the

pits will occur in areas, although the depth of the ponded water will be influenced by inflow rates from the fractured bedrock system, evaporation rates and direct rainfall capture. A coarse estimation of inflows following rehabilitation to 4.5 m RL has been discussed above in “Estimation of Pit Inflows” section. It is envisaged that the ponds may form part of the project urban design and landscape plan. The void is likely to produce a permanent groundwater sink with local flow directed into the pit. In this circumstance the pond water quality may deteriorate over time, largely due to accumulation of salts from evaporation processes and biological processes (stagnation). Plant species selected for rehabilitation purposes will be able to tolerate brackish to borderline saline conditions.

In the event that sufficient fill is sourced to backfill the pits to the height of the pre-existing water table at the seasonal water level high, then this will eventuate in the drawdown depression dissipating as the water levels recover. The fill is anticipated to be of greater permeability than the pre-existing bedrock which may induce some degree of change in groundwater flow and water levels. For example, temporary ponding may occur on the fill during high rainfall events as the material is 100% saturated and drainage maybe restricted at the downslope boundary by banking of water against low permeable bedrock at the pit margin.

Groundwater Users

Registered groundwater bores within 2.5 km of the proposed Gibsons Borrow pit area are shown in Figure 9. There are a total of thirteen (13) bores within 2 km of the Borrow Pit area of which six (6) bores are active for groundwater usage and seven (7) bores are used for monitoring purposes along the road alignment by Roads and Maritime Services. Details of registered bores obtained from NSW Office of Water borecards and within 2 km of the Gibsons-Jali Borrow Site Area are provided in Table 3. Shallow water supply bores intersect sand aquifer associated with the Richmond River floodplain alluvium while deep bores intersect fractured bedrock comprising shale, quartz and sandstone of the Bundamba Group, Walloons Coal Measures or Neranleigh-Fernvale beds. Bore yields within the alluvium are less than 0.5 L/s while bores in bedrock are variable and may be greater than 1 L/s.

The nearest active landholder bore GW056965 is located 177 m from the Jali Borrow Site with water sourced from a fractured quartz-shale unit in the bedrock at 24 to 28 m depth. A standing water level was measured from this bore at 9.7 m bgl on the 15 February 2017. This bore may be impacted by drawdown arising from the borrow site excavation in the instance there is connectivity of the fractured rock aquifer system between locations. Also, there is a possibility that the water quality of the bore may be impacted if the residual pit ponds becomes more saline over time due to evaporation processes.

A monitoring bore (GW04) was installed on 15 February 2017 between the quarry and the landholder bore at a distance of 31 m from the landholder bore. GW04 was drilled to a depth of 30.2 m with the lower section (24.2 – 30.2 m) depth screened within siltstone. The bedrock was tested for hydraulic conductivity (K) within the screened section and provided a K value of 1 x 10-6 m/s and provided a yield of 4.6 L/min (0.08 L/s) from 50 mm ND cased bore. Standing groundwater level was measured at 9.14 m below ground level. Water quality data from landholder bore GW056965 and GW04 is provided in the attachment to this memorandum. Bore GW056965 is fresh, neutral pH but has elevated ammonia at 2.4 mg/L which is above the ANZEEC guideline criteria of 0.9 mg/L for slightly – moderately systems.

The monitoring bore GW04 will be used to provide early warning of potential impacts from dewatering at the quarry site on landholder bore GW056965. It is recommended that monitoring of groundwater levels and quality is undertaken prior, during and at cessation of quarrying from the Gibson-Jali Borrow Site area. In the event the landholder bore is adversely impacted then this may lead to a negotiated compensation (“make good”) agreement between landholder and NSW Roads and Maritime Services. If the borrow pit on completion is backfilled to at or above pre-existing groundwater levels and drawn down water levels recover then impacts maybe considered temporal and “make good” arrangements may be considered temporal.

Landholder bore GW046127 is located 545 m from the Gibsons–Jali Borrow Site area and is located within the SPIR boundary on land that has been acquired by NSW Roads and Maritime Services. The bore water supply is from sand, presumably associated with the Richmond River floodplain alluvium and is likely to be destroyed during road construction.

The nearest other registered landholder water supply bores within 2 km are over a distance of 1.7 km from the borrow site and are located in the Richmond River floodplain alluvium near the Richmond River with water levels at elevations below the base of borrow site floor (2.5 m AHD). These bores consequentially will not be impacted by dewatering of the Gibson-Jali Borrow Site area.

Table 4 Details of registered bores within 2 km of Gibsons-Jali Borrow Site Area

DPI Water registration number	Distance from Borrow pit site (m)	*Purpose	Depth (m)	SWL (m bgl)	Aquifer Geology	Aquifer zone (m bgl)	Yield (L/s)	Salinity
GW046033	1953	Domestic	10.7	3.0	Sand	1.8 to 6.1 and 9.8 to 10.7	0.379	poor
GW046070	1756	Domestic	12.2	n/a	sand	6.1 to 12.2	n/a	poor
GW046080	1889	Stock and domestic	6.1	3.7	Sand	3.7 to 5.5	0.379	hard
GW046127	545	Stock and domestic	3.7	1.2	Sand	1.8 to 3.6	0.303	very brackish
GW056965	177	Farming, stock and domestic	30.0	9.7	Fractured quartz shale	24 to 28	0.52	fresh
GW300606	1226	Domestic	33.0	10.0	Shale overlying basalt	28 to 29	2.1	good
GW305763	119	Monitoring	11.9	2.25	Sandy clay	2.25 to 11.9	n/a	n/a
GW305765	562	Monitoring	9.6	n/a	Sandstone	n/a	n/a	n/a
GW305766	1005	Monitoring	4.05	1.5	Silty clay	1.5 to 4	n/a	n/a
GW305767	809	Monitoring	8.0	n/a	Sandstone/ siltstone	n/a	n/a	n/a
GW305862	1262	Monitoring	8.25	0.5	Sandy clay	0.5 to 8.25	n/a	n/a
GW305869	356	Monitoring	10.0	n/a	Siltstone	n/a	n/a	n/a
GW306002	1808	Monitoring	8.95	0.8	Silty sandy clay	0 to 8.95	n/a	

SWL: - Standing water level; m bgl – metres below ground level; n/a - not available.
Note: * Purpose - monitoring by Roads and Maritime Services.

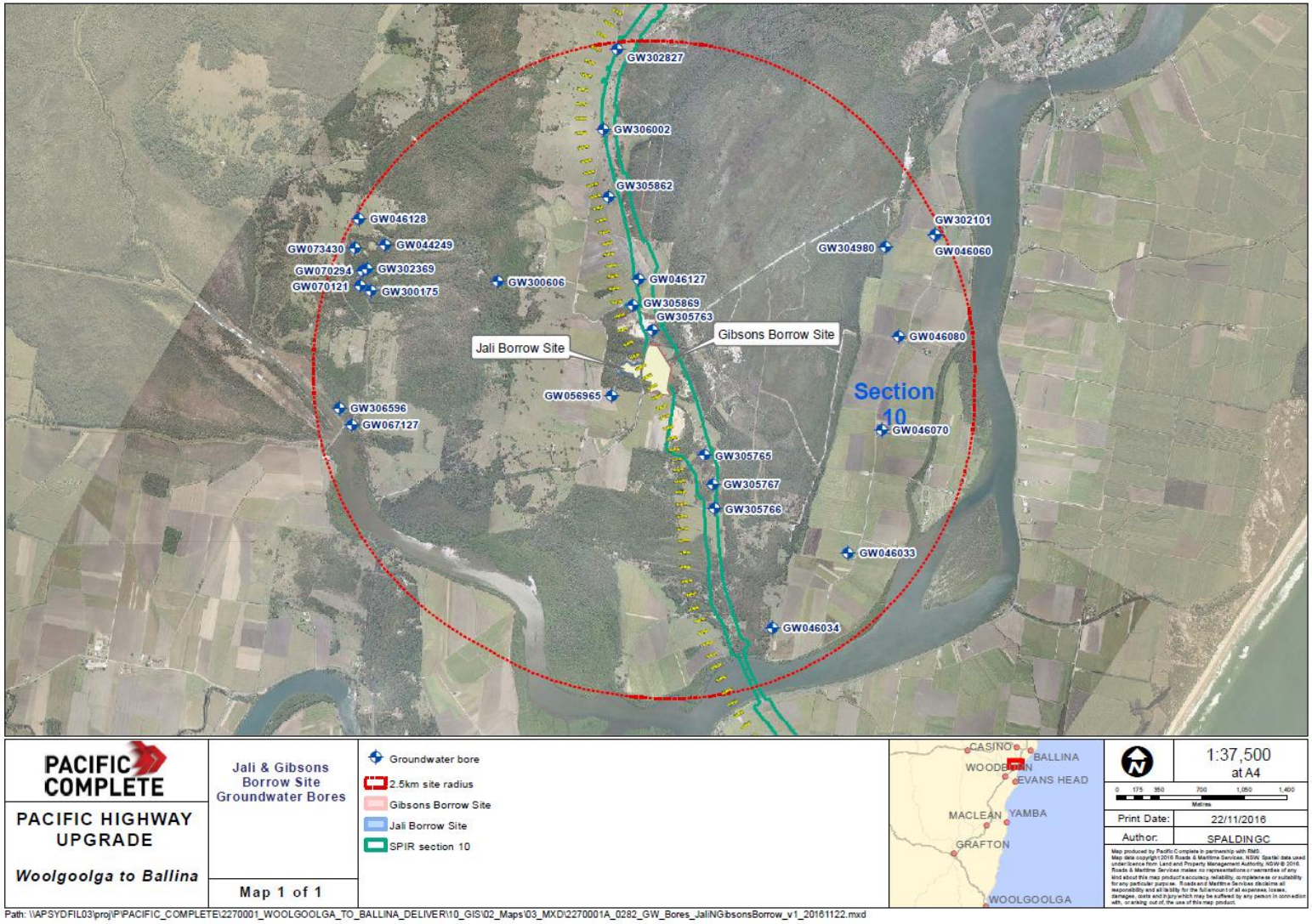


Figure 9 - Register water bores within 2.5 km radius of the proposed Gibsons-Jali Borrow Site Area (DPI-Water, Pinneena database)

Conclusion

This review of the groundwater systems present in the vicinity of the proposed Gibsons-Jali Borrow Site Area, indicates that there are two (2) main groundwater regimes operating in the site area, one associated with the Neranleigh Fernvale bedrock system which is of low permeability and storage and the second is a shallow alluvial aquifers (Richmond River Alluvium and coastal sands) bordering on the north eastern margin of the Gibsons Pit and extending further to the east.

The shallow sand (gravel) aquifer is located on the east – north-eastern margins of the quarry occurring in topographical low areas and is linked to the broader Richmond River alluvium that is located east on the Richmond River floodplain. All investigation boreholes east of the Gibsons Borrow Site area intersected this shallow aquifer indicating it is likely to be laterally well connected eastwards and thickens towards the east. Two investigation boreholes (GW01 and GW02) intersected the sand (gravel) aquifer with a thickness ranging from 2 to 3 m near the northeastern boundary of the quarry. The sand (gravel) aquifer thins out rapidly to the west as the bedrock rises in elevation within the quarry area. The northeastern margins of the pit will be defined further to the west of GW01 and GW02 to avoid intersecting the saturated sand aquifer and hence reduce the risk of unmanageable inflows into the pit.

The Neranleigh Fernvale bedrock, the material to be quarried, itself sustains three groundwater systems:

- *Perched water aquifer*: a shallow perched in the thin weathered regolith profile typically at lower slopes and may develop after high rainfall events. This maybe largely absent in locations where existing quarrying has taken place;
- *Regolith sand-gravel aquifer*: *may* potentially occur on the margin of the borrow site on the lower slopes and potentially connected to sandy facies of the Richmond River alluvium. Investigation bore (GWB10-05) located within 100 m east of the eastern margin intersected the regolith aquifer, however GW01 and GW02 on the northeastern boundary did not intersect a porous regolith aquifer. Instead these bores intersected saturated sands overlying siltstone bedrock; and
- *Deep aquitard – poor aquifer system*: a deeper bedrock groundwater system which will be intersected by the borrow pit excavation by at least 5 m at the highest point of the ridgeline. The monitoring of groundwater levels over a two year period from bore GWB10-04 located halfway up the ridge line at the Gibson Borrow site provided water levels at least 4 m higher than the pit excavation depth of 2.5 m AHD.

Groundwater flow within the local deeper bedrock aquifer occurs within the defect conduits in the rock mass (fracture, joint and fault plane systems). Rising head test results from three monitoring bores screened within siltstone provided rock permeability estimates of 4×10^{-7} m/s to 1×10^{-6} m/s. There is anticipated to be localised dewatering of the bedrock aquifer by the proposed quarrying activities. However, in the unlikely event the porous regolith aquifer is intersected below the water table on the eastern lower margin of the Gibsons Borrow Site and there is lateral good connection through to the sand barrier systems associated with the Richmond floodplain alluvium, then the drawdown may extend further out to the east than anticipated. Areas adjacent to the Gibsons Borrow site to the east – northeast and south largely comprise existing cleared land or land which will be disturbed by the road alignment corridor.

In-pit seepage from the bedrock defects is expected to dwindle in flow rate over time due to poor connectivity and storage and drawdown of the water table. Similarly seepage from shallow perched systems will be temporal and will drain relatively quickly, but may restart following high intensity/prolong rainfall events. However, in the event the porous regolith aquifer or alluvial/coastal sands aquifer is intersected then it is possible that inflows will persist and require careful water management with one mitigation option including the use of clay capping to retard inflow into the pit environment.

The ecological studies undertaken to date report that the footprint of the proposed Gibsons-Jali Borrow Site Area is located predominately on an elevated existing quarried location with scattered patches of remnant and regrowth vegetation. It is envisaged that adjoining vegetation to the Gibsons Borrow site would incur minimal additional impacts beyond the pre-existing impacts from historical quarrying works. Adjoining land is largely disturbed and excludes threatened/endangered communities or will be disturbed by the road alignment corridor. The remnant vegetation adjacent to the Jali Borrow Site may incur limited impacts due to dewatering and pre-existing quarry activities would have already influenced perched systems in the regolith with drainage into the pit environment.

The quarry pit environment will provide a localised groundwater sink which will alter groundwater flow in the area such that instead of flowing away from the ridge high to lower topographic areas it will instead be directed towards the pit. Reductions to the groundwater flow flux to areas adjacent to the Gibson-Jali Borrow Site area can be anticipated by virtue of dewatering of the excavation below the water table, and removal of perched regolith aquifer systems where they may exist in an existing quarried environment.

When the depth of the quarry penetrates the existing water-table there will be required management of pit inflow seepage and discharge. Such management will primarily be the collection and disposal of pooled water from within an in-pit sump. The in-pit sump will also be used for collection of surface runoff during rainfall events. In the event that the excavation works intersect porous substrata on the eastern boundary below the watertable, then clay capping will be placed on the walls of the borrow site to reduce pit inflows and minimise potential drawdown extending out to the east of the site into the permeable coastal sands and Richmond River alluvial sands.

On cessation of quarrying activities, the likely closure scenario is for the Gibsons Borrow Site to be backfilled to 4.5 m AHD, however the Jali Borrow site will not be backfilled and will remain with a floor of 2.5 m AHD. A drawdown depression of the local water-table will persist due to ongoing in-pit seepage and as such, ponding from groundwater seepage into the pits will occur in areas. It is envisaged that the ponds may form part of the project urban design and landscape plan. For the possible closure scenario where the pits are backfilled at/above the height of the pre-existing water table, then this will eventuate in the drawdown depression dissipating as the water levels recover.

There is one registered landholder bore (GW056965) near the Gibson-Jali Borrow Site area which will possibly be impacted by drawdown from the borrow site excavation. The bore is used for domestic, farming and stock purposes and is located 177 m to the south of the Jali Borrow Site with water sourced from bedrock aquifer in a quartz–shale unit. Impacts may include reduced supply from drawdown and deterioration in water quality from potential salt concentration accumulation in the excavation ponds. Ongoing monitoring prior, during and post quarry operations will be required to determine if there will be impacts to this bore from quarrying activities.

Recommendations

When the depth of the quarry penetrates the existing water-table there will be a requirement for management of pit inflow seepage and discharge. Dewatering of the pit will be undertaken in line with Roads and Maritime (formerly RTA) Technical Guideline – Environmental Management of Construction Site Dewatering (Roads and Maritime, 2011) and in accordance with project environment protection licence (EPL) conditions, as outlined in the Submissions/ Preferred Infrastructure Report (SPIR) mitigation measure SSW44. This will require the construction contractor developing a Dewatering Work Method Statement (WMS). Such management will be predominantly through the collection and disposal of pooled water from within an in-pit sump. SPIR mitigation measure SSW42 prescribes that the preferred option for groundwater management is for the transfer of groundwater to grassy swales for infiltration back into the groundwater source. Where possible these swales will divert groundwater around the construction area so that groundwater does not further mix with construction runoff. In accordance with SPIR mitigation measure SSW43 where infiltration cannot be achieved through grassy swales then groundwater is to be collected and treated, where applicable, within sedimentation basins (to capture suspended solids) before discharge into natural waterways. Water discharge into the environment will be carried out in accordance with EPL

conditions and include monitoring of quality to meet discharge criteria. Mitigation measures will be required to eliminate the following incidents occurring:-

- intakes dropping into deposited sediments and discharging sediment laden waters;
- erosion of the discharge locations and downstream environment; and
- inadvertent or intentional controlled discharge of untreated waters.

Intentions on the northeastern side of the Gibsons quarry is to move the excavation boundary further to the west from where bores GW01 and GW02 are located to avoid the saturated sand aquifer and reduce volumes of spoil. It is recommended to define the boundary of the shallow sand aquifer on the northeastern perimeter, such that quarry excavation will not intersect this aquifer. This can be achieved by using an excavator to dig trenches along 2 - 3 east-west transects in the north-western area of the pit. An additional option, once the sand aquifer boundary is defined, is to use a small rig to drill approximately 3 to 6 investigation boreholes to 6 m depth along this defined boundary to determine conditions of the underlying bedrock and to provide the basis for deciding whether the rock conditions may provide concerns for inflows, namely intersecting a porous regolith aquifer. A management process is to apply clay capping on the walls of the borrow site to reduce pit inflows and minimise potential drawdown extending out to the east of the site into the permeable coastal sands and Richmond River alluvial sands.

Monitoring of groundwater levels from bores located outside the Jali-Gibson Borrow site footprint during and at closure of the quarry excavations. This should include GW04 and possibly GWB10-04, GWB10-05 and GW03. It is recommended that monitoring is conducted in accordance of the water quality monitoring program.

Landholder bore GW056965 potentially will be impacted by dewatering of the borrow site excavation (causing lowering of the water table and loss of available water column depth). It is therefore recommended that routine monitoring of groundwater level/quality be undertaken from monitoring bore GW04. Following consultation with landholder the monitoring of groundwater level/quality from bore GW056965 should also be conducted. It is recommended that monitoring of water levels and key field water quality parameters (EC, pH) occurs on a three monthly basis and a detailed laboratory analysis of water chemistry (as provided in attachment A) be completed on a yearly basis. If adverse impact to bore supply or quality occurs then will need a compensation (“make good”) agreement negotiated between landholder and NSW Roads and Maritime Services.

Pit Closure Scenarios

1) Likely scenario of limited pit backfill with pit floors below pre-existing water table (Gibsons Pit – 4.5 m AHD; Jali Pit 2.5 m AHD).

The Gibsons Pit and Jali Pit voids are likely to produce a permanent groundwater sink with local flow directed into the pits. In this circumstance the pond water quality may deteriorate over time due to accumulation of salts from evaporation processes. Plant species selected for rehabilitation purposes will be able to tolerate brackish to borderline saline conditions. Assess groundwater levels in landholder bore GW056965 and monitoring bore GW04 for recovery if impacted by drawdown during borrow site excavation. A temporal make good arrangement for the landholder maybe required for this scenario. Assess groundwater level recovery in GW04 and possibly GWB10-04 and GWB10-05 if shown drawdown trends associated with pit excavation.

2) Scenario of pit backfill at or above pre-existing water table.

No ongoing monitoring required within pit environment. Assess groundwater levels in bore GW056965 and monitoring bore GW04 for recovery if impacted by drawdown during borrow site excavation. A temporal make good arrangement for the landholder maybe required for this scenario.

Assess groundwater level recovery in GW04 and possibly GWB10-04 and GWB10-05 if shown drawdown trends associated with pit excavation.

Should you have any questions please contact David Whiting (Principal Hydrogeologist) or Ray Hatley (Capability Executive Hydrogeologist).

References

Golder Associates 2013 HW10 Pacific Highway Upgrade, Woolgoolga to Ballina Geotechnical Investigation Report – Section 10, Richmond River to Coolgardie Road (30 April 2013).

RTA, 2011 Technical Guideline Environmental Management of Construction Site Dewatering. EMS-TG-011, Issued 2 April 2011.

Attachment A

Groundwater Chemistry Analyses

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Coffey Environments Pty Ltd QLD
47 Doggett St
Newstead
QLD 4006

Attention: **Christian Atkinson**

Report **534775-W**
Project name W2B
Project ID GEOTLCOV24443AN
Received Date Feb 17, 2017

Client Sample ID			1	2	3	4
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			M17-Fe19087	M17-Fe19088	M17-Fe19089	M17-Fe19090
Date Sampled			Feb 15, 2017	Feb 16, 2017	Feb 16, 2017	Feb 16, 2017
Test/Reference	LOR	Unit	GW056965	GW02	GW01	GW04
Ammonia (as N)	0.01	mg/L	2.4	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	240	160	340	510
Conductivity (at 25°C)	1	uS/cm	890	710	1300	2200
Fluoride	0.5	mg/L	< 0.5	-	-	< 0.5
Nitrate (as N)	0.02	mg/L	0.68	< 0.02	< 0.02	0.04
pH	0.1	pH Units	7.0	6.5	6.5	6.6
Sulphate (as SO4)	5	mg/L	33	11	64	140
Total Dissolved Solids	10	mg/L	350	330	670	1200
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	40	88	80	140
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Total Alkalinity (as CaCO3)	20	mg/L	40	-	-	140
Heavy Metals						
Iron	0.05	mg/L	0.53	-	-	6.6
Manganese	0.005	mg/L	0.86	-	-	3.6
Alkali Metals						
Calcium	0.5	mg/L	6.8	27	39	54
Magnesium	0.5	mg/L	12	11	21	27
Potassium	0.5	mg/L	2.5	1.8	5.3	6.1
Sodium	0.5	mg/L	98	61	130	280
Hardness Set						
Hardness mg equivalent CaCO3/L	5	mg/L	65	-	-	240

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B11			
Ammonia (as N)	Melbourne	Feb 20, 2017	28 Day
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Chloride	Melbourne	Feb 20, 2017	28 Day
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Nitrate (as N)	Melbourne	Feb 20, 2017	7 Day
- Method: APHA 4500-NO3 Nitrate Nitrogen by FIA			
Sulphate (as SO4)	Melbourne	Feb 20, 2017	28 Day
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Feb 20, 2017	14 Day
- Method: APHA 2320 Alkalinity by Titration			
Alkali Metals	Melbourne	Feb 20, 2017	180 Day
- Method: USEPA 6010 Alkali Metals			
Conductivity (at 25°C)	Melbourne	Feb 20, 2017	28 Day
- Method: LTM-INO-4030			
Fluoride	Melbourne	Feb 21, 2017	28 Day
- Method: LM-LTM-INO-4300 (Fluoride by Ion Chromatography)			
pH	Melbourne	Feb 20, 2017	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Total Dissolved Solids	Melbourne	Feb 20, 2017	7 Day
- Method: LM-LTM-INO-4110 (Total Dissolved Solids @ 178°C - 182°C)			
Heavy Metals	Melbourne	Feb 21, 2017	180 Day
- Method: LTM-MET-3040 Metals in Waters by ICP-MS			
Hardness Set			
Calcium	Melbourne	Feb 20, 2017	180 Day
- Method: LTM-MET-3010 Alkali Metals, S, Si and P by ICP-AES			
Magnesium	Melbourne	Feb 20, 2017	180 Day
- Method: LTM-MET-3010 Alkali Metals, S, Si and P by ICP-AES			
Hardness mg equivalent CaCO3/L	Melbourne	Feb 20, 2017	28 Day
- Method: APHA 2340B Hardness by Calculation			

eurofins | mgt

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NATA # 1261
Site # 18217

Company Name: Coffey Environments Pty Ltd QLD
Address: 47 Doggett St
Newstead
QLD 4006

Project Name: W2B
Project ID: GEOTLCOV24443AN

Order No.:
Report #: 534775
Phone: 073608 2500
Fax: 073852 2805

Received: Feb 17, 2017 5:00 PM
Due: Feb 21, 2017
Priority: 2 Day
Contact Name: Christian Atkinson

Eurofins | mgt Analytical Services Manager : Mary Makarios

Sample Detail						Conductivity (at 25°C)	Fluoride	HOLD	Iron	Manganese	pH	pH (1:5 Aqueous extract)	Resistivity*	Sulphide (Soluble)	Total Alkalinity (as CaCO3)	Total Dissolved Solids	Hardness Set	Eurofins | mgt Suite B11	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217																			
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 18217																			
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	1	Feb 15, 2017		Water	M17-Fe19087	X	X		X	X	X				X	X	X	X	
2	2	Feb 16, 2017		Water	M17-Fe19088	X					X					X		X	
3	3	Feb 16, 2017		Water	M17-Fe19089	X					X					X		X	
4	4	Feb 16, 2017		Water	M17-Fe19090	X	X		X	X	X				X	X	X	X	
5	IOTP 4302 1.0-1.2M	Feb 16, 2017		Soil	M17-Fe19091							X	X	X				X	X
6	IOTP 4300 1.0-1.2M	Feb 16, 2017		Soil	M17-Fe19092							X	X	X				X	X
7	IOTP 4302 2-2.1M	Feb 16, 2017		Soil	M17-Fe19093			X											

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Sample Detail						Conductivity (at 25°C)	Fluoride	HOLD	Iron	Manganese	pH	pH (1:5 Aqueous extract)	Resistivity*	Sulphide (Soluble)	Total Alkalinity (as CaCO3)	Total Dissolved Solids	Hardness Set	Eurofins | mgt Suite B11	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217																			
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 18217																			
8	IOTP 4300 2-2.1M	Feb 16, 2017		Soil	M17-Fe19094			X											
9	IOTP 4302 2.5-2.6M	Feb 16, 2017		Soil	M17-Fe19095			X											
10	IOTP 4300 2.5-2.6M	Feb 16, 2017		Soil	M17-Fe19096			X											
Test Counts						4	2	4	2	2	4	2	2	2	2	4	2	6	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Fluoride	mg/L	< 0.5			0.5	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Total Dissolved Solids	mg/L	< 10			10	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 20			20	Pass	
Carbonate Alkalinity (as CaCO3)	mg/L	< 10			10	Pass	
Total Alkalinity (as CaCO3)	mg/L	< 20			20	Pass	
Method Blank							
Heavy Metals							
Iron	mg/L	< 0.05			0.05	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Ammonia (as N)	%	94			70-130	Pass	
Chloride	%	113			70-130	Pass	
Fluoride	%	97			70-130	Pass	
Nitrate (as N)	%	94			70-130	Pass	
Sulphate (as SO4)	%	122			70-130	Pass	
Total Dissolved Solids	%	115			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	103			70-130	Pass	
Total Alkalinity (as CaCO3)	%	109			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Iron	%	96			80-120	Pass	
Manganese	%	98			80-120	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	96			70-130	Pass	
Calcium	%	86			70-130	Pass	
Magnesium	%	101			70-130	Pass	
Magnesium	%	89			70-130	Pass	
Potassium	%	91			70-130	Pass	
Sodium	%	82			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M17-Fe19087	CP	%	87			70-130	Pass	
Chloride	M17-Fe17208	NCP	%	126			70-130	Pass	
Nitrate (as N)	M17-Fe19087	CP	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Sulphate (as SO4)	S17-Fe17344	NCP	%	111			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Total Alkalinity (as CaCO3)	M17-Fe18817	NCP	%	83			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Manganese	S17-Fe15924	NCP	%	102			75-125	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	M17-Fe19087	CP	%	88			70-130	Pass	
Magnesium	M17-Fe19087	CP	%	88			70-130	Pass	
Potassium	M17-Fe19087	CP	%	84			70-130	Pass	
Sodium	M17-Fe19087	CP	%	91			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M17-Fe19088	CP	%	90			70-130	Pass	
Nitrate (as N)	M17-Fe19088	CP	%	97			70-130	Pass	
Spike - % Recovery									
				Result 1					
Fluoride	M17-Fe19090	CP	%	90			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Bicarbonate Alkalinity (as CaCO3)	M17-Fe19090	CP	%	80			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M17-Fe19087	CP	mg/L	2.4	2.5	1.0	30%	Pass	
Conductivity (at 25°C)	M17-Fe19087	CP	uS/cm	890	890	1.0	30%	Pass	
Fluoride	M17-Fe19087	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Nitrate (as N)	M17-Fe19087	CP	mg/L	0.68	0.68	1.0	30%	Pass	
pH	M17-Fe19087	CP	pH Units	7.0	7.0	pass	30%	Pass	
Total Dissolved Solids	M17-Fe19883	NCP	mg/L	570	570	1.0	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M17-Fe18816	NCP	mg/L	< 20	< 20	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M17-Fe18816	NCP	mg/L	< 10	< 10	<1	30%	Pass	
Total Alkalinity (as CaCO3)	M17-Fe18816	NCP	mg/L	< 20	< 20	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Iron	S17-Fe15924	NCP	mg/L	1.9	2.0	3.0	30%	Pass	
Manganese	S17-Fe15924	NCP	mg/L	0.033	0.034	3.0	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	M17-Fe19087	CP	mg/L	6.8	6.8	<1	30%	Pass	
Magnesium	M17-Fe19087	CP	mg/L	12	12	<1	30%	Pass	
Potassium	M17-Fe19087	CP	mg/L	2.5	2.7	7.0	30%	Pass	
Sodium	M17-Fe19087	CP	mg/L	98	97	1.0	30%	Pass	
Duplicate									
Hardness Set				Result 1	Result 2	RPD			
Hardness mg equivalent CaCO3/L	M17-Fe19087	CP	mg/L	65	65	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M17-Fe19088	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrate (as N)	M17-Fe19088	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
Chloride	M17-Fe19090	CP	mg/L	510	510	1.6	30%	Pass	
Sulphate (as SO4)	M17-Fe19090	CP	mg/L	140	140	2.4	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	No
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

TO:	Chris Greenaway – Sustainability and Environment Manager	**FUNCTION:**	Environment
FROM:	Ray Hatley – Senior Principal Hydrogeologist	**FUNCTION:**	Environment
CC:	Georgia Harmey	**DATE:**	19 July 2017
REF:		**NO. OF PAGES:**	
SUBJECT:	**W2B Gibsons-Jali Borrow Site:** Response to DPI-Water RFI regarding Gibson-Jali Groundwater Take Estimates and Monitoring Plan: • Addendum to the W2B Gibsons Borrow Site Groundwater Review Update Memo Revl (21 March 2017).		

Summary

This memorandum serves to provide supplementary information requested by Department of Primary Industries (Water)(DPI-Water) in their request for information (RFI) received on 27 June 2017 (dated 26 July 2017), in relation to groundwater take licensing requirements for the proposed borrow pits located at the Gibsons-Jali site on the Woolgoolga to Ballina (SSI-4963) and in consideration of compliance with the NSW Aquifer Interference Policy (AIP) and relevant Water Sharing Plans (WSP).

In addition, DPI-Water have requested details of the groundwater monitoring program to be instituted for the two-year duration of the borrow pit operations.

The results of the groundwater take estimates are as follows:

Gibsons Pit - Likely take: 11 ML/yr (potential maximum estimate: 14 ML/yr)

Jali Pit - Likely take: 2 ML/yr (potential maximum estimate: 6 ML/yr)

Combined Take - Gibson plus Jali: Likely take: 13 LM/yr (potential maximum estimate: 20 ML/yr)

Should the operation of the borrow pit quarrying need to extend beyond the stated 2-year period, the take calculations will need to be revised and the DPI-Water will be consulted.

Pacific Complete have elected to use the maximum estimates of groundwater 'take' for the Gibsons-Jali Borrow Pit facility to provide a response to DPI-Water's RFI dated 26 July 2017 *to ensure compliance with the AIP requirements*

A targeted groundwater monitoring program (schedule and frequency) for this borrow pit location will be included in the Water Quality Monitoring Program for the project, which will include all recently installed monitoring bores: GWB10-04, GWB10-05, GW03, GW04, GWB10-08. Trigger levels are based on P80/P20 values (outlined in section 7 of the Water Quality Monitoring Program (GeoLink, 2015).

RFI Summary

This memo has been prepared to provide supplementary information requested by Department of Primary Industries (Water) in their request for information (RFI) received on 27 June 2017 (dated 26 July 2017). This RFI follows the submission of the Pacific Complete memorandum: "*W2B Gibson Groundwater Review Update Memo, Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11*)" dated 21 March 2017 (SSI-4963). This response below will form an addendum to the W2B *Gibson Groundwater Review Update Memo.*

Required prior to approval

- Predicted annual groundwater take from each affected water source from both pits for the operational life of the project, with analysis explicitly presented, and proposed steps to be

taken to ensure compliance with the NSW Aquifer Interference Policy (AIP) and relevant Water Sharing Plans, and to estimate actual take during operation,

- A targeted groundwater monitoring program (using monitoring bore GW04) that includes action triggers and proposed duration,

and,

Not required prior to approval

- A Water Management Plan that includes a detailed description of all monitoring, including the complete details of all monitoring bores in the project area. Details should include casing top/ measuring point elevation, casing height above ground, surface elevation, screened geology, total bore depths, and screened depth intervals.
    - Proposed conditions to mitigate impacts to other users and DGE's:
        - Regarding other users:

          A targeted monitoring program as proposed in point 3 above, and commitment to 'make good' arrangements if impacts exceed agreed triggers.
        - Regarding GDE's:

          North-eastern boundary alteration, and investigation of porous regolith to inform project design and minimise the risk of excessive drawdown propagation to the east.

The responses to these items are provided in the cover sheet, *DPI-Water RFI form (27 June 2017).*

Background

The W2B *Gibson Groundwater Review Update Memo* addresses the potential groundwater impacts from the proposed Gibsons and Jali Borrow Sites, referred to in the memo as the Gibsons-Jali Borrow Site Area.

The memo provides a background of the Woolgoolga to Ballina Pacific Highway Upgrade Project and the proposal for the two borrow sites. Figure 2 illustrates the locations of groundwater monitoring bores and geotechnical boreholes discussed in the previous memo and further discussed in this response to DPI-Water. GWB10-04 GWB10-05, GW03 and GW04 were used to collect groundwater information at Gibsons-Jali Borrow Site Area. GW056965 is a landholder water supply bore that lies approximately 177m to the south/south-west of the nearest pit edge and sources water from the same source aquifer as the material to be quarried (Water Sharing Plan source: 'North Coast Fractured and Porous Rock Groundwater Sources, 2016'). The next nearest landholder water supply bore is 545m from the proposed pit edge and sources groundwater from aquifers included in the Richmond River Area Alluvial Aquifer Water Sharing Plan sources.

AIP policy applies to all aquifer interference activities (the removal of water from a water source applies to this proposal) based on risk and categorises the borrow pit activities as *'extractive industries'* (such as sand and gravel extraction, as defined in the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) As such the AIP requirements apply to the proposed quarrying activities.*

To comply with extraction limits set by water sharing plans it is important that the volumetric take of water by aquifer interference activity proposed for the Gibsons-Jali Borrow Site is appropriately accounted for (Water Act 1912 or Water Management Act 2000).

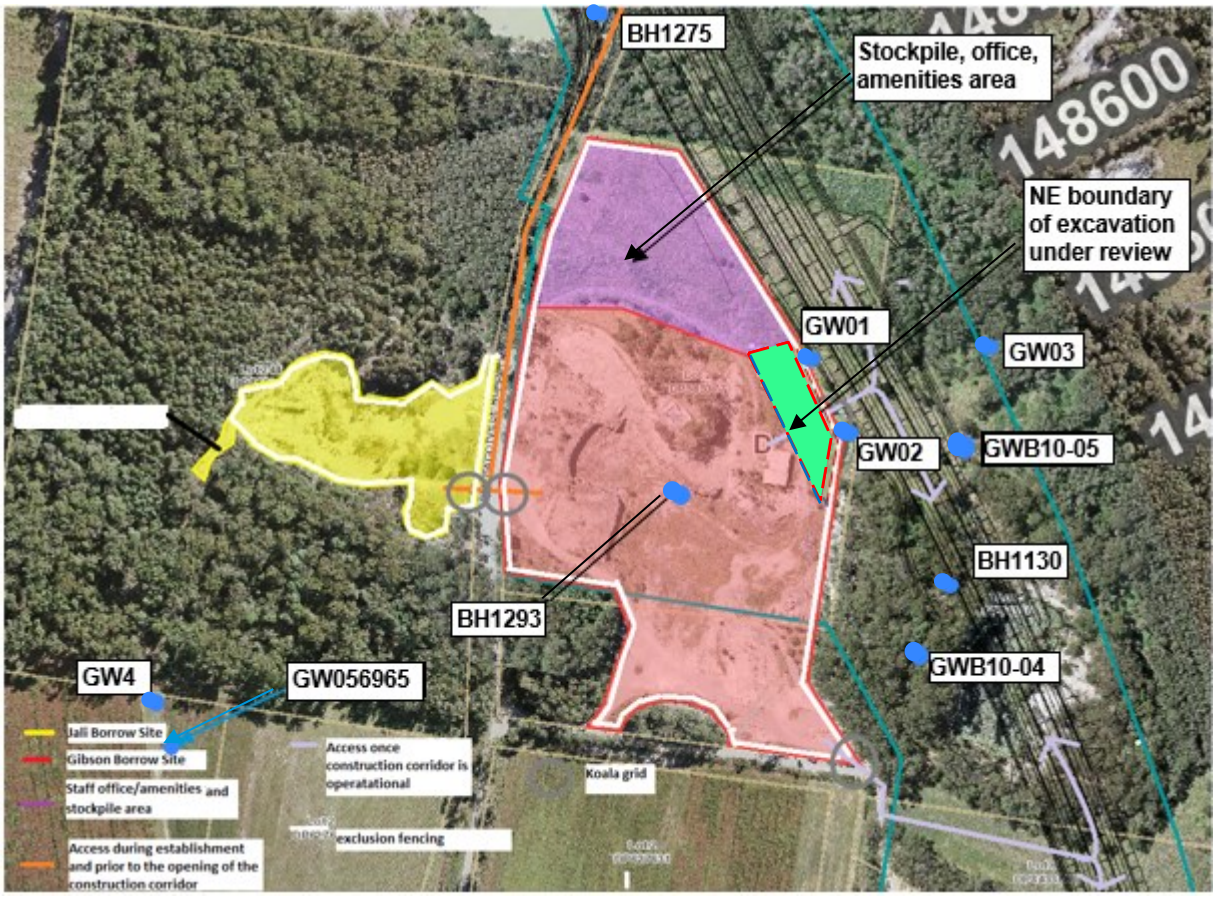


Figure 2: Location of groundwater monitoring bores and geotechnical holes

Hydrogeology

The Gibsons-Jali Borrow Site Area is located near the eastern margin of the Clarence-Moreton Basin which is an extensive sediment basin in north east New South Wales and southern Queensland. Two groundwater regimes are present in the vicinity of the borrow pit site and include: Quaternary Richmond River Alluvium; and underlying bedrock comprising metamorphosed Palaeozoic aged sedimentary rocks of the Neranleigh Fernvale Beds (New England Fold Belt). The latter will be the source of the rock materials proposed for quarrying. The former will not be intersected during quarry operations.

In relation to the local Water Sharing Plan (WSP, Table 1), the borrow pit site is located on a low ridge comprising the Neranleigh Fernvale Beds with the Richmond River Alluvium located within 100 to 200 metres to the east, northeast and south. Table 1 summarises the key features of the *Richmond River Alluvium system* (not to be quarried), while the '*Bedrock Aquifer'* materials (to be quarried) in general is not considered as an aquifer except where structural deformity zones occur providing the occurrence of fractured rock aquifer systems. As such, quarry lies with the jurisdiction of the Water Sharing Arrangements of the "North Coast Fractured and Porous Rock Groundwater Sources 20162016 / Murray Darling Basin Water Resource Plan Area – Groundwater (Triassic or Older bedrock Aquifers)".

Table 1 Groundwater and related characteristics applicable to the site

Underlying aquifers (GMU)	Richmond Coastal Sands; New England Fold Belt
Water Sharing Arrangements	BEDROCK: Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 / Murray Darling Basin Water Resource Plan Area – Groundwater (Triassic or Older bedrock Aquifers). ALLUVIUM: Richmond River Area Alluvial Aquifer Water Sharing Plan (*adjacent to the site*)
Groundwater levels	Shallow water tables recorded along the entire section.

Source: extracted from "Upgrading the Pacific Highway, Woolgoolga to Ballina Upgrade - Working paper – Groundwater, November 2012 (final)"

Summary of Groundwater Occurrence at the Gibson-Jali Site

Bedrock comprising the Neranleigh Fernvale Beds (Aquitard – poor Aquifer)

The Neranleigh Fernvale Beds (a North Coast Fractured and Porous Rock Groundwater Source), the borrow pit materials to be quarried, comprises interbedded siltstones, sandstones, greywackes and minor conglomerate and claystone with basic meta-volcanics. The Neranleigh bedrock is considered as an *aquitard to poor aquifer systems within structural zones of higher permeability* at this location. Water table levels are provided in Table 2, below.

Unconsolidated Sediments (Aquitard – Aquifer)

The overlying unconsolidated sediments are present to the east of Gibsons-Jali Borrow Site Area and comprise estuarine mud-silt-clay sediments and sand, gravels sediments associated with the *Richmond River alluvium and coastal sands*. These overlying sediments are isolated from the bedrock proposed to be quarried. Water table would be expected to be typically less than 2 m bgl.

Water Table Levels

Table 2 Groundwater levels measured in site monitoring bores

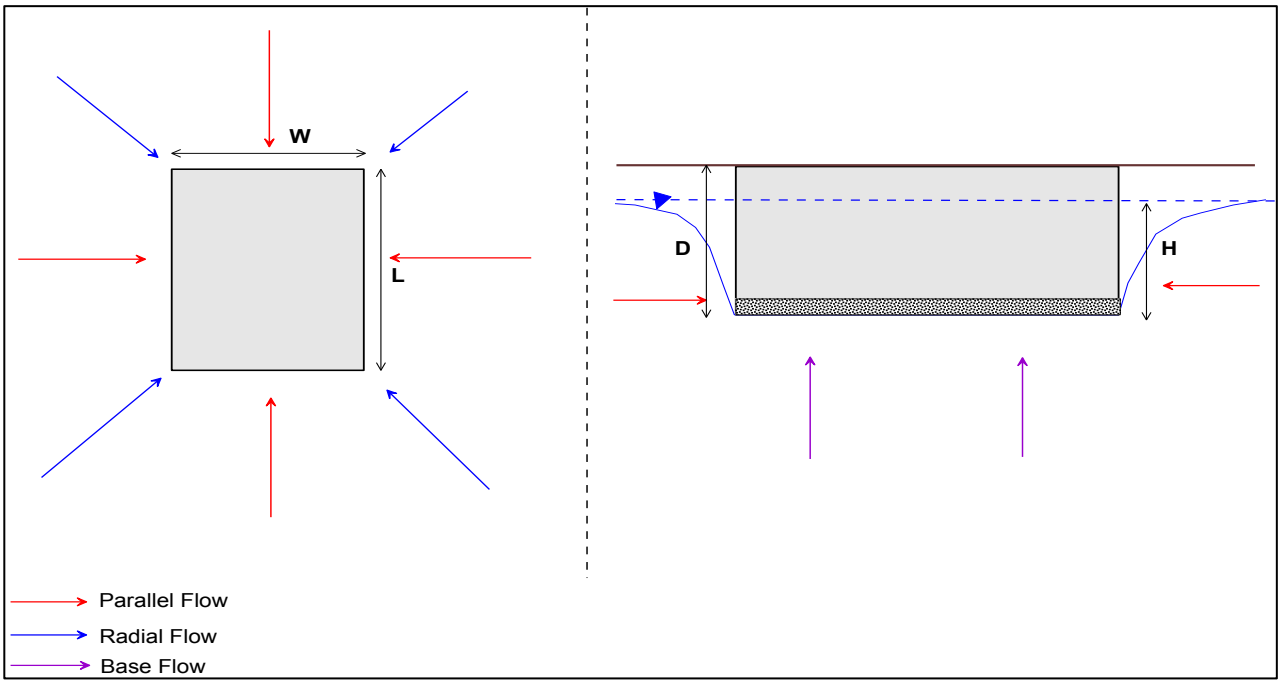
Bore No	Surface m AHD	Water level (m TOC)	Water level (m AHD)	Date	Screened geology
BH1130	14.76	9.87	approx. 5.95 to 5.25	August 2012 – March 2013	Weathered siltstone
BH1273 (GWB10-04)	11.84	6.89	approx. 4.7 to 6.7	December 2012 – March 2014	Weathered siltstone; Screened interval 6.0 - 12.0m
BH1274 (GWB10-05)	6.45	1.86	approx. 3.7 to 5.8	December 2012 – March 2014	Pleistocene barrier sand and underlying bedrock regolith sands; Screened interval 2.0 – 8.0m bgl
BH1275	6.77	1.74	5.82	29/01/2013	Pleistocene barrier sand and underlying bedrock regolith clayey gravels
GW01	6.09	0.9*	5.19	16/02/2017	Siltstone; Screened interval 12.0 - 15.0m
GW02	6.49	1.6*	4.89	16/02/2017	Siltstone; Screened interval 12.0 - 15.0m
GW03	5.62	2.0*	3.62	16/02/2017	Pleistocene barrier sands/Richmond River alluvium sands; Screened interval 5.0 - 8.0m bgl
GW04	19.81	9.14*	10.67	16/02/2017	Siltstone; Screened interval 24.2 - 30.2m bgl

Calculation of Groundwater Take

In light to the shallow nature of the quarrying activities proposed, the lack of detailed baseline water level (spatial and temporal) and the short duration of the operational take from the pit (now estimated at 2 year duration), Pacific Complete have elected to calculate the most likely take using detailed analytical methods (as more refined calculation than that provided in: "*W2B Gibson Groundwater Review Update Memo, Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)*" dated 21 March 2017 (SSI-4963).), as follows:

Figure 3 Illustration of groundwater flows to proposed borrow pits based on an approximate rectangle and calculation solution (equation for each component of flow anticipated):

Plan View (horizontal flow to pit walls): ***Cross Sectional View (vertical flow through base):***



Radius of Influence	$R = 1.5\sqrt{\frac{KH_r t}{S_y}}$	- Bear 1979.
Parallel Inflow	$Q_p = \frac{0.5KH^2P}{R}$	- Dupuit-Forchheimer assumption (disregarding vertical flow and treating flow as horizontal) for the case of a strip).
Radial Inflow	$Q_r = \frac{\pi KH^2}{\ln(R)}$	- Dupuit-Forcheimer radial well discharge eqt. (corners)
Base Inflow	$Q_b = \frac{KHA}{H+R}$	- D'Arcy equation (vertical flow through base).
Total Inflow	$Q_T = Q_r + Q_b + Q_p$	- Arithmetical summation.

K = hydraulic conductivity; S_y specific yield; t = time; Q = flow rate (into borrow pit); P = perimeter

Strata Permeability Parameters Used

Hydraulic aquifer tests (rising head test) were performed to estimate the permeability (in the case of water, hydraulic conductivity) of the respective bedrock aquifers in bores GW01, GW02 and GW04, which are screened in bedrock materials to be quarried. These results may reflect minor groundwater movement through weathered joints, bedding planes or open fractures and not the inherent rock mass which would be of lower permeability. Hydraulic conductivity values are key to calculating the groundwater inflow (in this case water 'take' affecting the proposed borrow pits).

For the analytical solution applied as described above, the following conservative parameter values were used, Table 3:

Table 3 Hydraulic Parameters used in the estimation of groundwater inflow and take for the Gibson-Jali Pits:

Hydraulic Parameters	Label	K value	Unit
High Horizontal Hydraulic Conductivity	Expected	4.0E-06	m/s
Most Likely Horizontal Hydraulic Conductivity	Upper Bound	4.0E-07	m/s
Low Horizontal Hydraulic Conductivity	Lower Bound	4.0E-08	m/s
High Vertical Hydraulic Conductivity	Expected	4.0E-07	m/s
Most Likely Vertical Hydraulic Conductivity	Upper Bound	4.0E-08	m/s
Low Hydraulic Vertical Conductivity	Lower Bound	4.0E-09	m/s
Specific Yield (S_y)		10%	

Assumptions:

1) Aquifer is Unconfined (a water table aquifer)
2) Aquifer is Isotropic Homogeneous Material (equivalent)
3) Laminar flow (Darcian flow)
4) Kv::Kh = 10 (ratio of vertical hydraulic conductivity to horizontal hydraulic conductivity)
5) Inflow Pumping from in-pit sump, Q
6) Mean Annual Rainfall = 1868.7mm/year has not been included in this calculation
7) no evaporation has been included in this calculation.

Note: *Hydraulic conductivity* (K) A measure of the capacity of rock or stratum to allow water (permeability, for other fluids) to pass through it (ie. the relative ease with which a porous medium can transmit water), and is defined as the rate of flow of water in an aquifer through a cross section of unit area under a unit hydraulic gradient, at the prevailing temperature, and is usually expressed in units of metres per second (or metres per day).

Estimation of Borrow Pit Inflows and Water Take

The analytical solution applied to estimating the groundwater inflow, and therefore 'take', are provided in Figure 3.

This calculation of inflows assumes that no saturated sand aquifers or porous regolith aquifer systems are intersected within the borrow pit margins or floor (by design). The expected horizontal hydraulic conductivity (K) was assigned at 4 x 10^{-7} m/s to reflect an average between fresh and weathered rock, while the high K case, the K used was 4 x 10^{-6} m/s. The specific yield values were assumed to be of the order of 5% and 10% (10% was used for conservatism). The average saturated depth likely to be quarried (2 m to 4 m), however, for the solution used a uniform 5 m penetration into the water table was considered, a further conservative factor.

Inflow/take estimates for the Gibsons and Jali Pits were calculated as follows:

Table 4 Estimate Inflow Rates for the Gibsons and Jali Pits

Gibson's Pit – Groundwater Take (2 year operation, Attachment A):

Case	Year 1 (cuml)	Year 2	Mean	ML/y (mean)
Expected Case	8,961 m3/yr	3,817 m3/yr	6,389 m3/yr	6.4
High K Case	19,371 m3/yr	8,898 m3/yr	14,134 m3/yr	14.1
Low K Case	5,983 m3/yr	2491 m3/yr	4,237 m3/yr	4.2

Jali Pit – Groundwater Take (2 year operation, Attachment B):

Case	Year 1 (cumul)	Year 2	Mean	ML/y (mean)
Expected Case	**2,415 m3/yr**	**1,105 m3/yr**	**1,760 m3/yr**	**1.7**
High K Case	7,391 m3/yr	3,936 m3/yr	5,664 m3/yr	5.6
Low K Case	1,156 m3/yr	792 m3/yr	824 m3/yr	0.8

Conservative estimates of groundwater *take* under the likely (expected) hydrogeological conditions are therefore *Gibson's Pit* 6.4 ML/yr *and Jali Pit* 1.7 ML/yr, with a combined take estimated at 8.1 ML/yr.

We have calculated a high K sensitivity analysis of inflow based on K of an order of magnitude more permeable than expected with the results of this scenario being: *Gibson's Pit* 14.1 ML/yr *and Jali Pit* 5.6 ML/yr, with a combined take estimated at 19.7 ML/yr. We believe this is an unlikely scenario to consider in defining a realistic take. Nevertheless, Pacific Complete have elected to use the maximum estimates (*High K Case*) of groundwater 'take' to provide a response to DPI-Water's RFI dated 26 July 2017 requesting:

- predicted annual groundwater take from each affected water source (in this case WSP: "North Coast Fractured and Porous Rock Groundwater Source"), from both pits for the operational life of the project (2 years), with analysis explicitly presented (refer to Appendices A and B), and proposed steps to be taken to ensure compliance with the NSW Aquifer Interference Policy and relevant Water Sharing Plans, and to estimate actual take during operation (to be incorporated in Water Quality Monitoring Program (WQMP)).

Time-inflow curves for the two pits provided in Figures 4 and 5, respectively (and in details in Attachments A and B), show an anticipated declining rate of inflow and therefore take, as dewatering the local aquifer occurs prior to a steady state inflow condition being approached (but not reached in the two year operational timeframe).

Figure 4 Time vs Inflow curve for Gibsons Pit

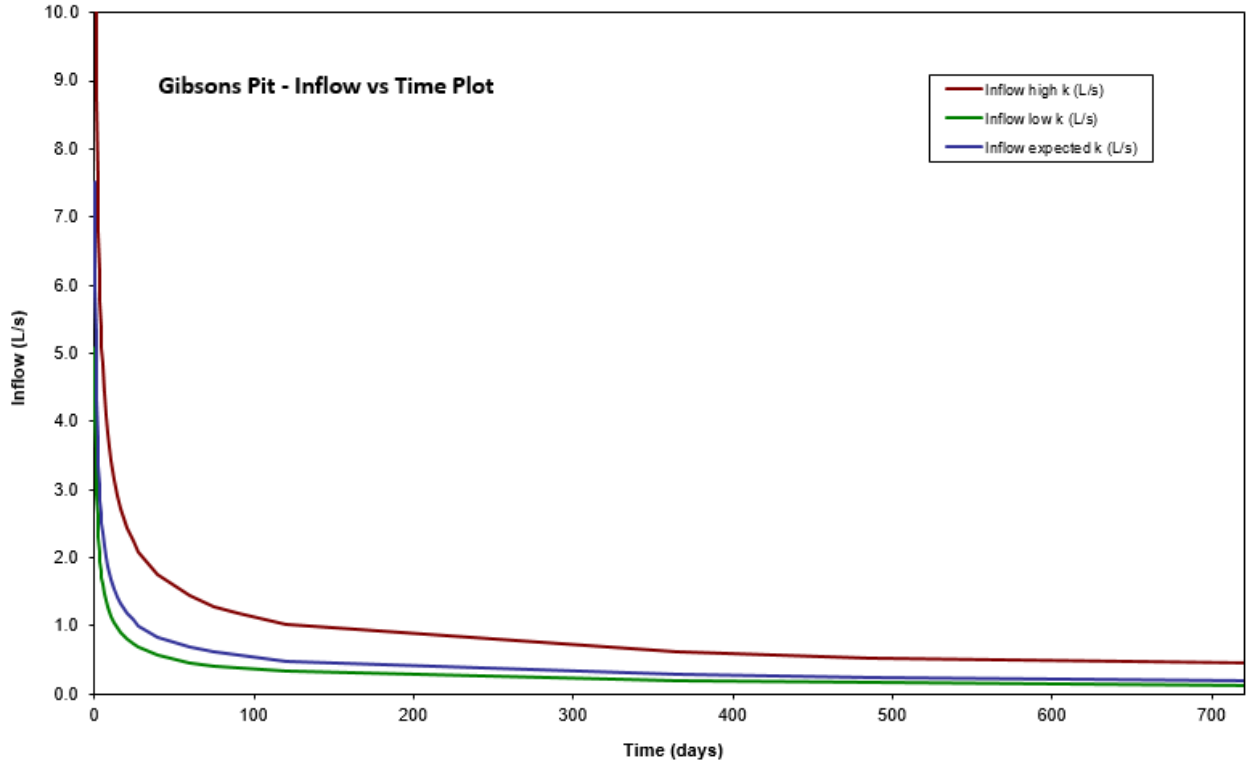
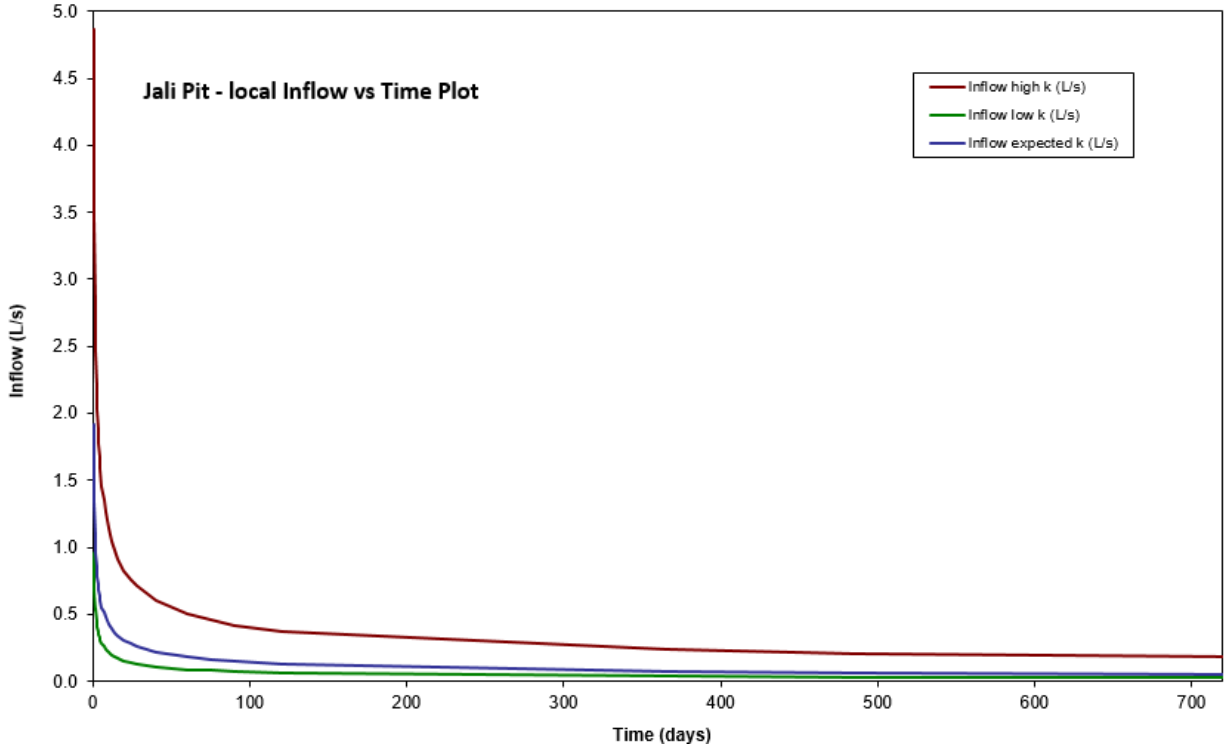


Figure 5 Time vs Inflow curve for Jali Pit



Note: groundwater inflow directly to the pit from the overlying alluvial aquifer is not included in this calculation since it is not proposed to be exposed in the pit walls in the operation of the quarry pits (test pitting prior to commencement of quarrying will determine the edge of saturated alluvium on the north-eastern edge of the Gibson Pits where it is most likely to be encountered).

Should the operation of the borrow pit quarrying need to extend beyond the stated 2-year period, the take calculations will need to be revised and the DPI-Water will be consulted.

Drawdown Impact Assessment

The dewatering of the bedrock aquifer is likely to induce a localised drawdown affect (relatively tight drawdown cone around the pit extents is inferred) due to the relatively low permeability of the bedrock mass being quarried.

As mention earlier, GW056965 is a landholder water supply bore that lies approximately 177m to the south/south-west of the nearest pit edge and sources water from the same source aquifer as the material to be quarried (Water Sharing Plan source: 'North Coast Fractured and Porous Rock Groundwater Sources, 2016'). It yields 0.52L/sec and is licenced for General Use with the Authorised Purposes being Domestic, Farming and Stock. The aquifer zone exploited by this bore is located at a depth of 24-28m, some 18-23m below the maximum borrow pit floor depth. As such, there is a very limited likelihood that this bore might be impacted by the borrow pit groundwater take.

The calculation of the total water take from the two pits and estimation of the radius of influence indicates that under likely (expected case) hydrogeological conditions, the GW056965 landholder water supply bore will not be impacted by the quarrying activities after the 2-year operation period (radius of influence is <50m at that time). In the unlikely circumstance that high inflow (*High K Case)* applies, bore GW056965 lies within the calculated radius of influence. As such it may be impacted and will therefore be the subject of groundwater monitoring, trigger criteria and 'make good (if impacted) (refer to Water Monitoring and Management Plan described in the next section). Figures 4 and 5 illustrate the likely drawdown impact extent as measured for the edge of each pit.

Figure 6 Radius of Influence curve for Gibsons Pit

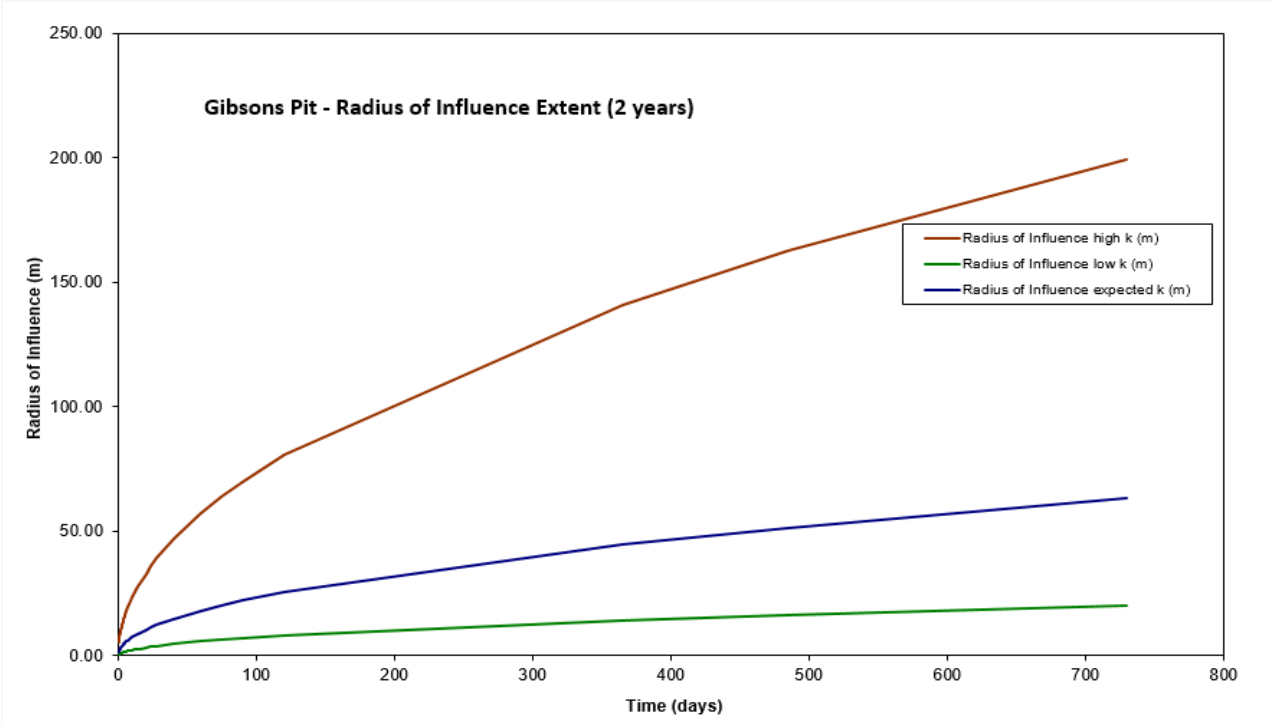
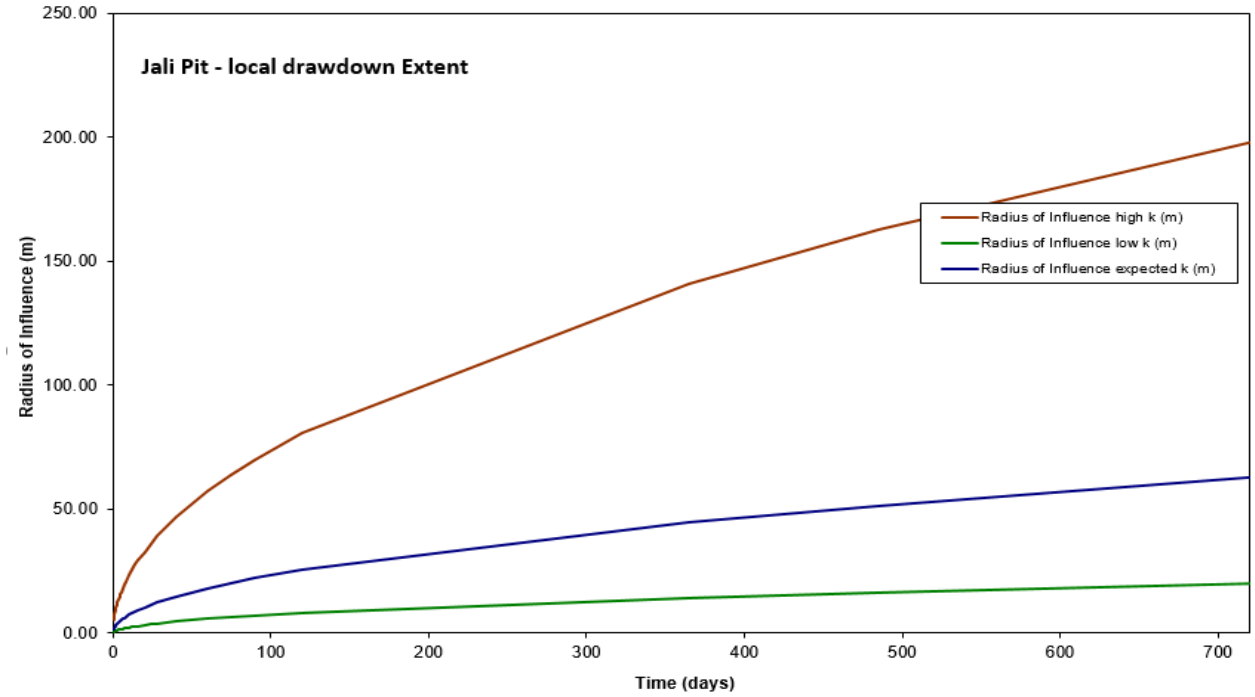


Figure 7 Radius of Influence curve for Gibsons Pit



In summary, the lowering of the water-table within and surrounding the pit environment is likely to be localised due to low permeability of the rockmass and will not have a notable impact on vegetation due to the depth of plant rooting to reach this water (expected greater than 6 m in elevated areas) and as such ensures that "no more than minimal harm" is caused (AIP). As such, the potential for local users and GDE's to suffer adverse and material impacts is negligible. That is, the current vegetation in elevated areas on the pit rim is not anticipated to be meaningfully impacted since these ecosystems are largely sustained by the *recharge-in/recharge-out* processes associated with rainfall infiltration which typically characterise the behaviour of shallow perched water table flow systems.

Predicted annual groundwater take from the affected bedrock water source for both pits for the operational life of the project have been conservatively estimated under the likely (expected) hydrogeological conditions at: (1) *Gibson's Pit* 10.9 ML/yr *and (2) Jali Pit* 1.7 ML/yr, with a combined take estimated at 11.6 ML/yr. We have also considered a high K sensitivity analysis of inflow based on K of an order of magnitude more permeable than expected with the results of this scenario being: *Gibson's Pit* 14.1 ML/yr *and Jali Pit* 5.6 ML/yr, with a combined take estimated at 19.7 ML/yr. The analysis methodology has been explicitly presented, together with estimates of actual take over the proposed two-year life of the borrow pit operations.

Closest landowner water supply bore, GW056965is not be impacted by the quarrying activities after the 2-year operational period under expected groundwater conditions. In the unlikely circumstance that high inflow (*High K Case)* applies, bore GW056965 may be impacted and will therefore be the subject of groundwater monitoring, trigger criteria and 'make good as described below.

The proposed steps to be taken to ensure compliance with the NSW Aquifer Interference Policy and relevant Water Sharing Plans, are presented in the proposed modifications to the project Water Quality Monitoring Program (WQMP, 2015), discussed in the next section.

Water Management Plan

A Water Quality Monitoring Program (WQMP), that includes surface and groundwater monitoring, was prepared in 2015 by Geolink in accordance with Ministers Conditions of Approval D12 and subsequently approved by the Department of Planning and Environment. This program was prepared in consultation with the OEH, EPA, DPI (Fisheries), DPI (Water), DoE and Rous Water.

To ensure compliance with the requirements of the NSW Aquifer Interference Policy and relevant Water Sharing Plans, a groundwater monitoring program will be incorporated in the WQMP as an addendum. This monitoring will be performed on five groundwater monitoring bores located near the two borrow sites and landholder bore GW056965 located near GW04. These bores include:-

- GWB10-04 located east of Gibsons Borrow site within SPIR project boundary
- GWB10-05 located east of Gibsons Borrow site within SPIR project boundary
- GW03 located east of Gibsons Borrow site on SPIR boundary within the Richmond River alluvium
- GW04 located immediately south of the Jali Borrow Site near the landholder bore GW056965, outside SPIR boundary.
- GWB10-08 located approximately 400 – 500m to the north of the Gibson-Jali excavation which is unlikely to be impacted but will inform regional levels and quality.

Details of the recently installed monitoring bore, such as casing top/ measuring point elevation, casing height above ground, surface elevation, screened geology, total bore depths, and screened depth intervals, were recorded during the installation of the bores.

WATER LEVEL MONITORING

The recommended frequency of monitoring of water levels in the monitoring bores GWB10-04, GWB10-05, GWB10-08, GW03 and GW04, and landowner bore, GW056965 are as follows:

- Automated water level loggers are to be used to record at hourly intervals, with data to be downloaded quarterly for time-series water level readings. Manual measurements of the standing water level are to be undertaken for calibration of logger and bore depth during quarterly monitoring round (data download events). The measurement of standing water level is to occur prior to water quality sampling.
- The recommended frequency of monitoring water quality and levels in landholder bore GW056965: Monthly leading up to excavation activities, bimonthly during excavation, quarterly for first year after cessation of excavation, and six monthly in the second and third years after cessation of excavation (Table 6).

Note: Manual groundwater level measurements are to be carried out by manually dipping with sonde device from a reference point (top of bore casing or ground level) and also recorded to ground level at the bore head.

WATER 'TAKE' MONITORING

Cumulative groundwater pumpage from the combined pit will be recorded daily using an approved flow measurement methodology (cumulative pumpage hours or flow meter), and reported in accord with WQMP requirements.

WATER QUALITY SAMPLING - FREQUANCY AND ANALYTES

The recommended frequency of monitoring water quality in the monitoring bores GWB10-04, GWB10-05, GWB10-08, GW03 and GW04 is as follows (Table 5):

Table 5 - Water Quality Sampling Frequency and laboratory Suites

Period of monitoring relative to excavation activities	Suite A	Suite B
Prior	two monthly #	two monthly #
During	quarterly	six monthly
Post first year	six monthly	six monthly
Post 2nd – 3rd year	annually	annually

Bore GWB10-04 may be maintained at a quarterly frequency for water quality sampling prior to quarry operations if there is sufficient sample events to determine P80/P20 trigger values.

Landholder Bore Monitoring

The recommended frequency of monitoring water quality and levels in landholder bore GW056965 is as follows:

Table 6 - Water Quality Monitoring Frequency and laboratory Suites for Landowner Bore

Period of monitoring relative to excavation activities	Groundwater Levels #	Water Quality Suite A	Water Quality Suite B
Prior	monthly	two monthly	two monthly
During	two monthly	quarterly	six monthly
Post first year	quarterly	six monthly	six monthly
Post 2nd – 3rd year	six monthly	annually	annually

- Groundwater levels is manually dipped with sonde device from a reference point and also recorded to ground level at the bore head.

The landholder is to be consulted prior to sampling the bore. This will include inquiries of recent usage which may influence groundwater level readings and whether there have been changes to bore configuration which may influence accessibility and monitoring performance.

WATER QUALITY SAMPLING SUITE

The water quality suite will conform to Table 4.3 in the WQMP (GeoLink, 2015) with the exclusion of phosphorous and nitrogen for all bores except GWB10-04 and includes:-

Suite A: - Field measurements

- pH
- electrical conductivity
- temperature

Suite B: - Laboratory analysis

- TPH
- Major anions/cations
- Heavy metals (Al, Cd, Cu, Pb and Zn)
- Phosphorus and nitrogen (GWB10-04 only – conform to sampling suite already identified in WQMP (GeoLink, 2015)

DATA INTERPRETATION and TRIGGER LEVELS

There is insufficient timeframe available prior to commencement of proposed quarrying activities to capture sufficient baseline data to account for seasonal variability and establish local trigger levels for water levels in landholder bore, GW03, GW04, possibly GWB10-08 (damaged?) and water quality in landholder bore, GW03, GW04, GW10-05 and possibly GWB10-08 (damaged?). Trigger levels are based on P80/P20 values (outlined in section 7 of the Water Quality Monitoring Program (GeoLink, 2015). A trend analysis which takes into account rainfall events or other local groundwater disturbances and also compare against long term monitoring data (P20/P80 values for quality and levels) from other bores located along the alignment in the region will be undertaken.

In the circumstance that there are insufficient sample events to meet the criteria for establishing baseline trigger levels (P80/P20) then an ongoing trend analysis is to be undertaken of monitoring data collected before, during and after Gibsons-Jali quarrying activities, with the AIP standard trigger level of 2m (measured at water supply bore) for "Fractured Rock Water Sources" being applied. *Note*: If the borrow pit, on completion, is backfilled to or above pre-existing groundwater levels and drawn down water levels recover to those levels, then impacts may be considered temporal and therefore, "make good" arrangements may also be considered temporal.

Local Ecosystems Sustained or Dependant on Groundwater

The ecological studies undertaken to date (refer to the BSMP) report that the footprint of the proposed Gibsons-Jali Borrow Site Area is located predominantly on an elevated existing quarried location with scattered patches of remnant and regrowth vegetation. It is envisaged that adjoining vegetation to the borrow pit area would incur limited additional impacts beyond the pre-existing impacts from historical quarrying works.

The proposed excavation works to be carried out at the borrow site largely lie within the boundaries of pre-existing quarry work and as such are unlikely to further impact on local ecological communities near the Borrow Site to any meaningful degree since they are sustained by the recharge-in/recharge-out processes associated with rainfall infiltration which typically characterise the behaviour of shallow perched water table flow systems.

Note: *Should the operation of the borrow pit quarrying need to extend beyond the stated 2-year period, the take calculations and impact assessment will need to be revised and the DPI-Water will be consulted.*

Attachment A

Gibson's Pit – Groundwater Take (2 year of operation)

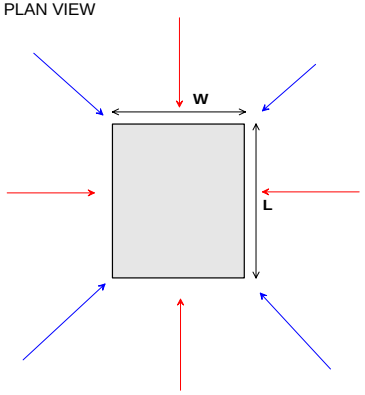
CALCULATION OF GROUNDWATER INFLOWS INTO APPROXIMATED RECTANGULAR EXCAVATION:

Gibsons Quarry

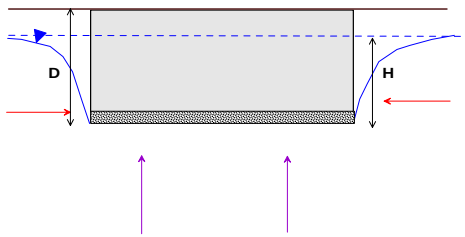
Zone A

Unconfined Uniform Formations

PLAN VIEW



SECTION VIEW



Parallel Flow
Radial Flow
Base Flow

Input Parameters

Length of Excavation	L	375	m
Width of Excavation	W	220	m
Depth of Excavation	D	8	m
Ground Elevation		10	m RL
Groundwater Elevation		8	m RL
Depth to Water (DTW)		2	m bgl
Groundwater Depth	Dgw	2.00	m
Dewatering Depth	H	7.00	m
Perimeter [P = 2x(L+W)]	P	1190	m
Area	A	82500	m2

Hydraulic Parameters

High Horizontal Hydraulic Conductivity	K1	4.0E-06	m/s
Most Likely Horizontal Hydraulic Conductivity	K2	4.0E-07	m/s
Low Horizontal Hydraulic Conductivity	K3	4.0E-08	m/s
High Vertical Hydraulic Conductivity	K1	4.0E-07	m/s
Most Likely Vertical Hydraulic Conductivity	K2	4.0E-08	m/s
Low Hydraulic Vertical Conductivity	K3	4.0E-09	m/s
Specific Yield	Sy	10%	

Radius of Influence

$$R = 1.5\sqrt{\frac{KH_r t}{S_y}}$$

- Bear 1979

Parallel Inflow

$$Q_p = \frac{0.5KH^2P}{R}$$

- Dupuit-Forchheimer assumption (disregarding vertical flow and treating flow as horizontal) for the case of a strip.

Radial Inflow

$$Q_r = \frac{\pi KH^2}{\ln(R)}$$

- Dupuit-Forcheimer radial well discharge eqt

Base Inflow

- Darcy eqt

$$Q_b = \frac{KHA}{H+R}$$

- D'Arcy equation

Total Inflow

$$Q_T = Q_r + Q_b + Q_p$$

Assumptions:
1) Aquifer is Unconfined
2) Isotropic Homogeneous Material
3) Laiminar flow (Darcian flow)
4) Kv::Kh = 10
5) Inflow Pumping from in-pit sump
6) Mean Annual Rainfall = 1868.7mm/yr

INFLOW ESTIMATES - EXPECTED K SCENARIO

Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	1.65	1.65	3.5	0.1	4.0	7.5	0.0	7.5	650	325	720
0.6	5	1.81	1.81	3.2	0.1	3.7	6.9	0.0	6.9	593	356	864
0.7	5	1.95	1.95	2.9	0.0	3.4	6.4	0.0	6.4	549	384	1008
0.8	5	2.09	2.09	2.7	0.0	3.2	5.9	0.0	5.9	513	411	1152
1	5	2.33	2.33	2.4	0.0	2.8	5.3	0.0	5.3	459	459	1440
1.5	5	2.86	2.86	2.0	0.0	2.3	4.3	0.0	4.3	375	562	2160
2	5	3.30	3.30	1.7	0.0	2.0	3.8	0.0	3.8	325	649	2880
2.5	5	3.69	3.69	1.5	0.0	1.8	3.4	0.0	3.4	290	726	3600
3	5	4.04	4.04	1.4	0.0	1.6	3.1	0.0	3.1	265	795	4320
3.5	5	4.36	4.36	1.3	0.0	1.5	2.8	0.0	2.8	245	859	5040
4	5	4.67	4.67	1.2	0.0	1.4	2.7	0.0	2.7	230	919	5760
4.5	5	4.95	4.95	1.2	0.0	1.3	2.5	0.0	2.5	217	975	6480
5	5	5.22	5.22	1.1	0.0	1.3	2.4	0.0	2.4	205	1,027	7200
6	5	5.71	5.71	1.0	0.0	1.2	2.2	0.0	2.2	188	1,126	8640
7	5	6.17	6.17	0.9	0.0	1.1	2.0	0.0	2.0	174	1,216	10080
8	5	6.60	6.60	0.9	0.0	1.0	1.9	0.0	1.9	163	1,301	11520
10	5	7.38	7.38	0.8	0.0	0.9	1.7	0.0	1.7	145	1,455	14400
12	5	8.08	8.08	0.7	0.0	0.8	1.5	0.0	1.5	133	1,594	17280
14	5	8.73	8.73	0.7	0.0	0.8	1.4	0.0	1.4	123	1,723	20160
16	5	9.33	9.33	0.6	0.0	0.7	1.3	0.0	1.3	115	1,842	23040
20	5	10.43	10.43	0.5	0.0	0.6	1.2	0.0	1.2	103	2,061	28800
24	5	11.43	11.43	0.5	0.0	0.6	1.1	0.0	1.1	94	2,259	34560
28	5	12.35	12.35	0.5	0.0	0.5	1.0	0.0	1.0	87	2,442	40320
40	5	14.76	14.76	0.4	0.0	0.4	0.8	0.0	0.8	73	2,922	57600
60	5	18.07	18.07	0.3	0.0	0.4	0.7	0.0	0.7	60	3,586	86400
75	5	20.20	20.20	0.3	0.0	0.3	0.6	0.0	0.6	54	4,014	108000
90	5	22.13	22.13	0.3	0.0	0.3	0.6	0.0	0.6	49	4,401	129600
120	5	25.56	25.56	0.2	0.0	0.3	0.5	0.0	0.5	42	5,091	172800
365	5	44.57	44.57	0.1	0.0	0.1	0.3	0.0	0.3	25	8,961	525600
485	5	51.38	51.38	0.1	0.0	0.1	0.2	0.0	0.2	21	10,362	698400
730	5	63.04	63.04	0.1	0.0	0.1	0.2	0.0	0.2	18	12,778	1051200

Input Field

INFLOW ESTIMATES - HIGH K SCENARIO

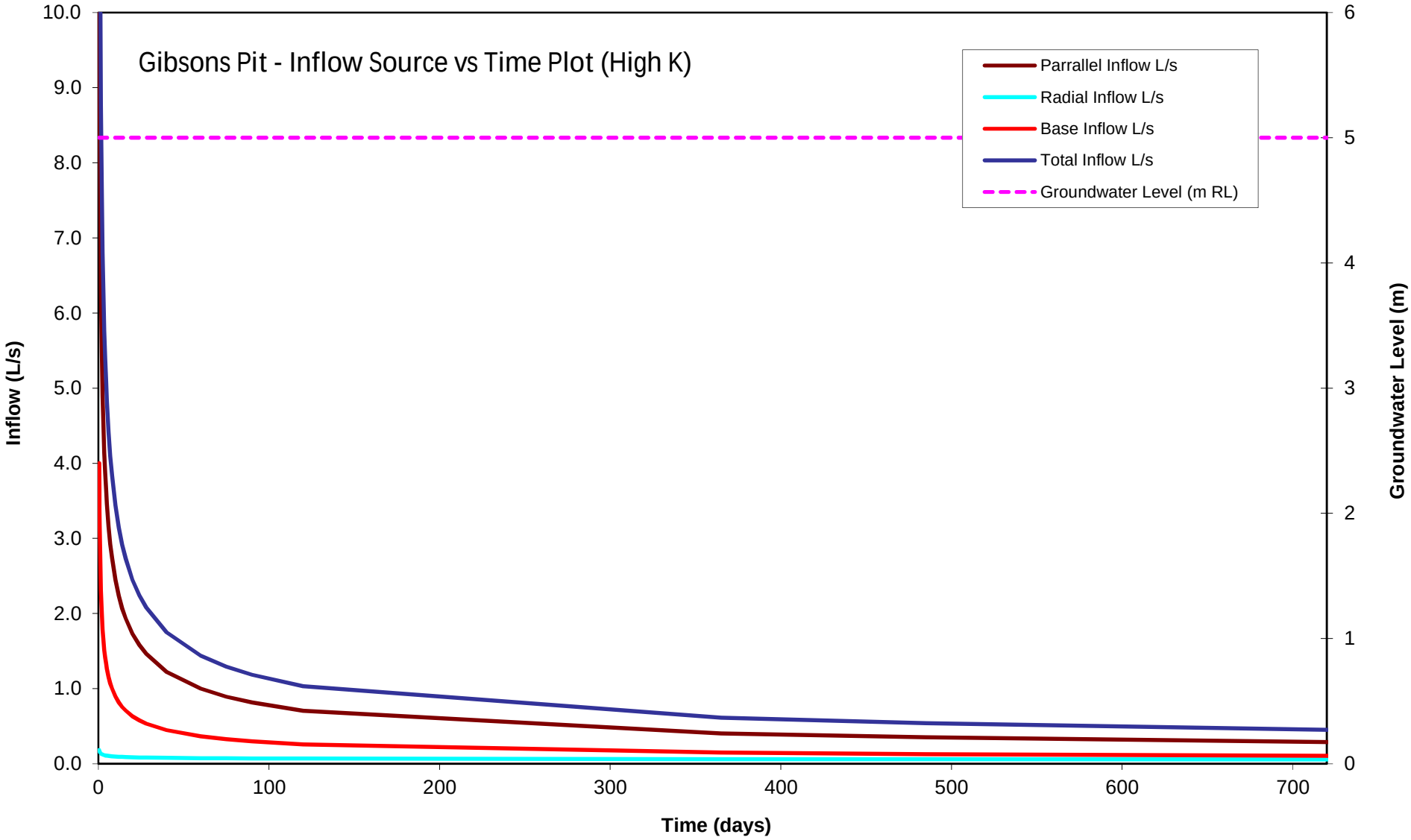
Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	5.22	5.22	10.9	0.2	4.0	15.1	0.0	15.1	1,307	654	720
0.6	5	5.71	5.71	10.0	0.2	3.7	13.8	0.0	13.8	1,194	716	864
0.7	5	6.17	6.17	9.3	0.2	3.4	12.8	0.0	12.8	1,106	774	1008
0.8	5	6.60	6.60	8.7	0.2	3.2	12.0	0.0	12.0	1,035	828	1152
1	5	7.38	7.38	7.7	0.2	2.8	10.7	0.0	10.7	926	926	1440
1.5	5	9.04	9.04	6.3	0.1	2.3	8.8	0.0	8.8	758	1,136	2160
2	5	10.43	10.43	5.5	0.1	2.0	7.6	0.0	7.6	657	1,314	2880
2.5	5	11.67	11.67	4.9	0.1	1.8	6.8	0.0	6.8	588	1,471	3600
3	5	12.78	12.78	4.5	0.1	1.6	6.2	0.0	6.2	538	1,613	4320
3.5	5	13.80	13.80	4.1	0.1	1.5	5.8	0.0	5.8	498	1,743	5040
4	5	14.76	14.76	3.9	0.1	1.4	5.4	0.0	5.4	466	1,865	5760
4.5	5	15.65	15.65	3.6	0.1	1.3	5.1	0.0	5.1	440	1,980	6480
5	5	16.50	16.50	3.5	0.1	1.3	4.8	0.0	4.8	418	2,089	7200
6	5	18.07	18.07	3.2	0.1	1.2	4.4	0.0	4.4	382	2,291	8640
7	5	19.52	19.52	2.9	0.1	1.1	4.1	0.0	4.1	354	2,478	10080
8	5	20.87	20.87	2.7	0.1	1.0	3.8	0.0	3.8	331	2,652	11520
10	5	23.33	23.33	2.4	0.1	0.9	3.4	0.0	3.4	297	2,971	14400
12	5	25.56	25.56	2.2	0.1	0.8	3.1	0.0	3.1	272	3,260	17280
14	5	27.61	27.61	2.1	0.1	0.8	2.9	0.0	2.9	252	3,527	20160
16	5	29.51	29.51	1.9	0.1	0.7	2.7	0.0	2.7	236	3,777	23040
20	5	32.99	32.99	1.7	0.1	0.6	2.5	0.0	2.5	212	4,234	28800
24	5	36.14	36.14	1.6	0.1	0.6	2.2	0.0	2.2	194	4,649	34560
28	5	39.04	39.04	1.5	0.1	0.5	2.1	0.0	2.1	180	5,032	40320
40	5	46.66	46.66	1.2	0.1	0.4	1.7	0.0	1.7	151	6,048	57600
60	5	57.15	57.15	1.0	0.1	0.4	1.4	0.0	1.4	124	7,461	86400
75	5	63.89	63.89	0.9	0.1	0.3	1.3	0.0	1.3	112	8,380	108000
90	5	69.99	69.99	0.8	0.1	0.3	1.2	0.0	1.2	102	9,217	129600
120	5	80.82	80.82	0.7	0.1	0.3	1.0	0.0	1.0	89	10,717	172800
365	5	140.95	140.95	0.4	0.1	0.1	0.6	0.0	0.6	53	19,371	525600
485	5	162.48	162.48	0.4	0.1	0.1	0.5	0.0	0.5	47	22,597	698400
730	5	199.34	199.34	0.3	0.1	0.1	0.4	0.0	0.4	39	28,269	1051200

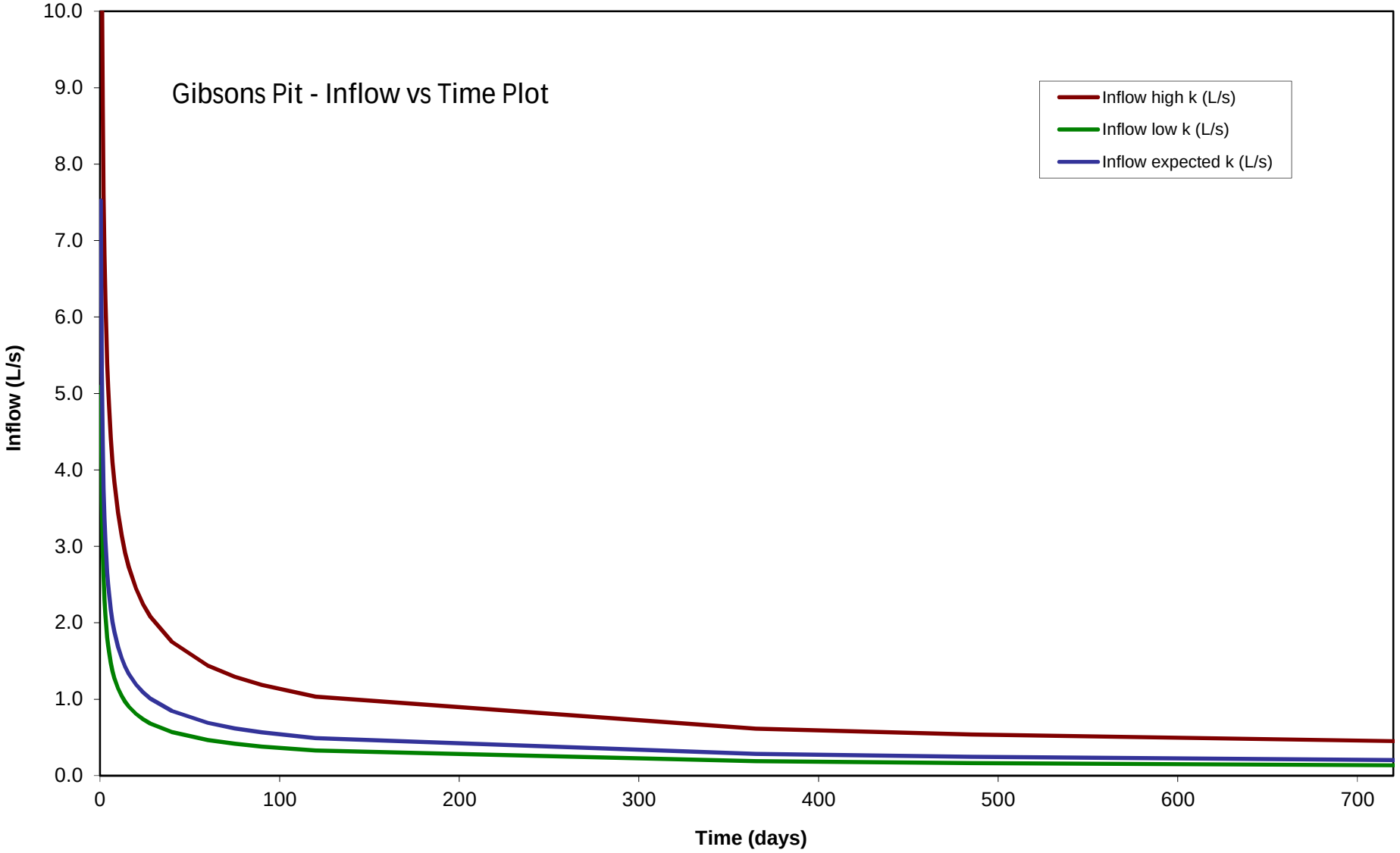
Input Field

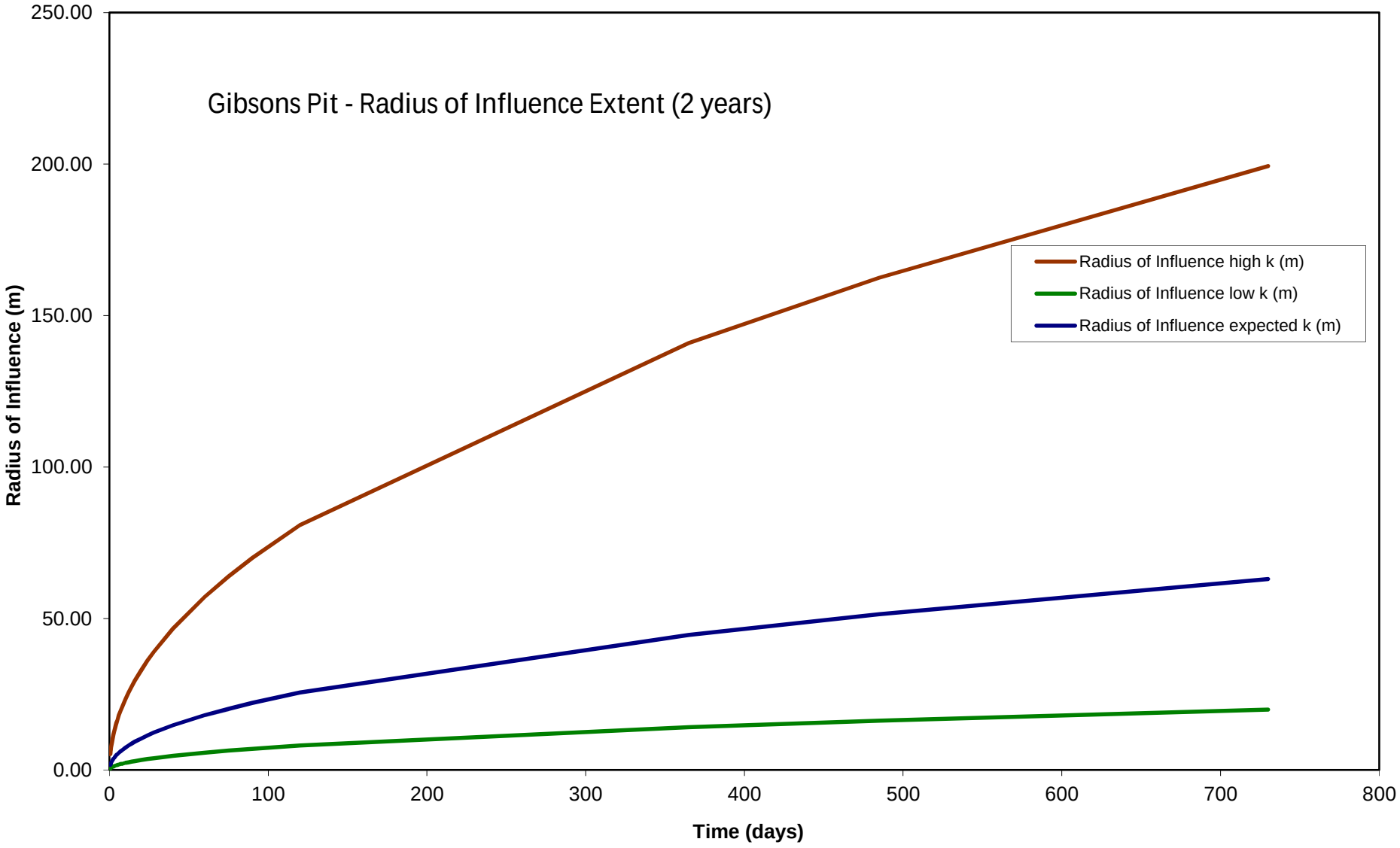
INFLOW ESTIMATES - LOW K SCENARIO

Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	0.52	0.52	1.1	0.0	4.0	5.1	0.0	5.1	440	220	720
0.6	5	0.57	0.57	1.0	0.0	3.7	4.6	0.0	4.6	401	241	864
0.7	5	0.62	0.62	0.9	0.0	3.4	4.3	0.0	4.3	372	260	1008
0.8	5	0.66	0.66	0.9	0.0	3.2	4.0	0.0	4.0	347	278	1152
1	5	0.74	0.74	0.8	0.0	2.8	3.6	0.0	3.6	310	310	1440
1.5	5	0.90	0.90	0.6	0.0	2.3	2.9	0.0	2.9	252	377	2160
2	5	1.04	1.04	0.5	0.1	2.0	2.6	0.0	2.6	226	453	2880
2.5	5	1.17	1.17	0.5	0.0	1.8	2.3	0.0	2.3	199	496	3600
3	5	1.28	1.28	0.4	0.0	1.6	2.1	0.0	2.1	181	542	4320
3.5	5	1.38	1.38	0.4	0.0	1.5	1.9	0.0	1.9	167	585	5040
4	5	1.48	1.48	0.4	0.0	1.4	1.8	0.0	1.8	156	625	5760
4.5	5	1.57	1.57	0.4	0.0	1.3	1.7	0.0	1.7	147	663	6480
5	5	1.65	1.65	0.3	0.0	1.3	1.6	0.0	1.6	140	699	7200
6	5	1.81	1.81	0.3	0.0	1.2	1.5	0.0	1.5	128	765	8640
7	5	1.95	1.95	0.3	0.0	1.1	1.4	0.0	1.4	118	826	10080
8	5	2.09	2.09	0.3	0.0	1.0	1.3	0.0	1.3	110	883	11520
10	5	2.33	2.33	0.2	0.0	0.9	1.1	0.0	1.1	99	988	14400
12	5	2.56	2.56	0.2	0.0	0.8	1.0	0.0	1.0	90	1,082	17280
14	5	2.76	2.76	0.2	0.0	0.8	1.0	0.0	1.0	83	1,168	20160
16	5	2.95	2.95	0.2	0.0	0.7	0.9	0.0	0.9	78	1,249	23040
20	5	3.30	3.30	0.2	0.0	0.6	0.8	0.0	0.8	70	1,397	28800
24	5	3.61	3.61	0.2	0.0	0.6	0.7	0.0	0.7	64	1,530	34560
28	5	3.90	3.90	0.1	0.0	0.5	0.7	0.0	0.7	59	1,653	40320
40	5	4.67	4.67	0.1	0.0	0.4	0.6	0.0	0.6	49	1,976	57600
60	5	5.71	5.71	0.1	0.0	0.4	0.5	0.0	0.5	40	2,420	86400
75	5	6.39	6.39	0.1	0.0	0.3	0.4	0.0	0.4	36	2,707	108000
90	5	7.00	7.00	0.1	0.0	0.3	0.4	0.0	0.4	33	2,965	129600
120	5	8.08	8.08	0.1	0.0	0.3	0.3	0.0	0.3	29	3,425	172800
365	5	14.10	14.10	0.0	0.0	0.1	0.2	0.0	0.2	16	5,983	525600
485	5	16.25	16.25	0.0	0.0	0.1	0.2	0.0	0.2	14	6,901	698400
730	5	19.93	19.93	0.0	0.0	0.1	0.1	0.0	0.1	12	8,475	1051200

Input Field


Gibsons Pit - Inflow Source vs Time Plot (High K)
Parrallel Inflow L/s
Radial Inflow L/s
Base Inflow L/s
Total Inflow L/s
Groundwater Level (m RL)
Inflow (L/s)
Groundwater Level (m)
Time (days)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
6
5
4
3
2
1
0
0
100
200
300
400
500
600
700


Gibsons Pit - Inflow vs Time Plot
Inflow high k (L/s)
Inflow low k (L/s)
Inflow expected k (L/s)
Inflow (L/s)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
100
200
300
400
500
600
700
Time (days)


Gibsons Pit - Radius of Influence Extent (2 years)
Radius of Influence (m)
250.00
200.00
150.00
100.00
50.00
0.00
0
100
200
300
400
500
600
700
800
Time (days)
Radius of Influence high k (m)
Radius of Influence low k (m)
Radius of Influence expected k (m)

Attachment B

Jali Pit – Groundwater Take (2 year of operation)

CALCULATION OF GROUNDWATER INFLOWS INTO APPROXIMATED RECTANGULAR EXCAVATION:
Jali Quarry

Zone A

Unconfined Uniform Formations

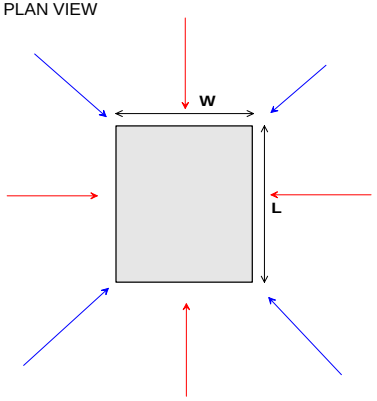
Input Parameters

Length of Excavation	L	150	m
Width of Excavation	W	75	m
Depth of Excavation	D	8	m
Ground Elevation		10	m RL
Groundwater Elevation		8	m RL
Depth to Water (DTW)		2	m bgl
Groundwater Depth	Dgw	2.00	m
Dewatering Depth	H	7.00	m
Perimeter [P = 2x(L+W)]	P	450	m
Area	A	11250	m2

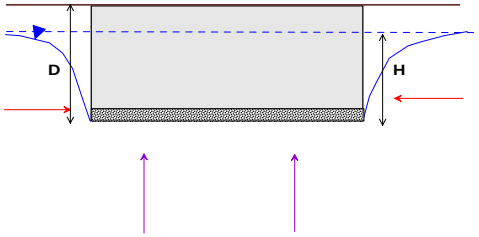
Hydraulic Parameters

High Horizontal Hydraulic Conductivity	K1	4.0E-06	m/s
Most Likely Horizontal Hydraulic Conductivity	K2	4.0E-07	m/s
Low Horizontal Hydraulic Conductivity	K3	4.0E-08	m/s
High Vertical Hydraulic Conductivity	K1	4.0E-07	m/s
Most Likely Vertical Hydraulic Conductivity	K2	4.0E-08	m/s
Low Hydraulic Vertical Conductivity	K3	4.0E-09	m/s
Specific Yield	Sy	10%	

PLAN VIEW



SECTION VIEW



Parallel Flow
Radial Flow
Base Flow

Radius of Influence

$$R = 1.5\sqrt{\frac{KH_r t}{S_y}}$$

- Bear 1979

Parallel Inflow

$$Q_p = \frac{0.5KH^2P}{R}$$

- Dupuit-Forchheimer assumption (disregarding vertical flow and treating flow as horizontal) for the case of a strip).

Radial Inflow

$$Q_r = \frac{\pi KH^2}{\ln(R)}$$

- Dupuit-Forcheimer radial well discharge eqt

Base Inflow

- Darcy eqt

$$Q_b = \frac{KHA}{H+R}$$

- D'Arcy equation

Total Inflow

$$Q_T = Q_r + Q_b + Q_p$$

Assumptions:
1) Aquifer is Unconfined
2) Isotropic Homogeneous Material
3) Laiminar flow (Darcian flow)
4) Kv::Kh = 10
5) Inflow Pumping from in-pit sump
6) Mean Annual Rainfall = 1868.7mm/yr

INFLOW ESTIMATES - EXPECTED K SCENARIO

Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	1.65	1.65	1.3	0.1	0.5	1.9	0.0	1.9	165	83	720
0.6	5	1.81	1.81	1.2	0.1	0.5	1.7	0.0	1.7	151	90	864
0.7	5	1.95	1.95	1.1	0.0	0.5	1.6	0.0	1.6	139	98	1008
0.8	5	2.09	2.09	1.0	0.0	0.4	1.5	0.0	1.5	130	104	1152
1	5	2.33	2.33	0.9	0.0	0.4	1.3	0.0	1.3	116	116	1440
1.5	5	2.86	2.86	0.8	0.0	0.3	1.1	0.0	1.1	95	143	2160
2	5	3.30	3.30	0.7	0.0	0.3	1.0	0.0	1.0	82	165	2880
2.5	5	3.69	3.69	0.6	0.0	0.2	0.9	0.0	0.9	74	184	3600
3	5	4.04	4.04	0.5	0.0	0.2	0.8	0.0	0.8	67	202	4320
3.5	5	4.36	4.36	0.5	0.0	0.2	0.7	0.0	0.7	62	218	5040
4	5	4.67	4.67	0.5	0.0	0.2	0.7	0.0	0.7	58	233	5760
4.5	5	4.95	4.95	0.4	0.0	0.2	0.6	0.0	0.6	55	248	6480
5	5	5.22	5.22	0.4	0.0	0.2	0.6	0.0	0.6	52	261	7200
6	5	5.71	5.71	0.4	0.0	0.2	0.6	0.0	0.6	48	287	8640
7	5	6.17	6.17	0.3	0.0	0.1	0.5	0.0	0.5	44	310	10080
8	5	6.60	6.60	0.3	0.0	0.1	0.5	0.0	0.5	41	332	11520
10	5	7.38	7.38	0.3	0.0	0.1	0.4	0.0	0.4	37	371	14400
12	5	8.08	8.08	0.3	0.0	0.1	0.4	0.0	0.4	34	408	17280
14	5	8.73	8.73	0.2	0.0	0.1	0.4	0.0	0.4	31	441	20160
16	5	9.33	9.33	0.2	0.0	0.1	0.3	0.0	0.3	29	472	23040
20	5	10.43	10.43	0.2	0.0	0.1	0.3	0.0	0.3	26	529	28800
24	5	11.43	11.43	0.2	0.0	0.1	0.3	0.0	0.3	24	581	34560
28	5	12.35	12.35	0.2	0.0	0.1	0.3	0.0	0.3	22	629	40320
40	5	14.76	14.76	0.1	0.0	0.1	0.2	0.0	0.2	19	755	57600
60	5	18.07	18.07	0.1	0.0	0.0	0.2	0.0	0.2	16	932	86400
75	5	20.20	20.20	0.1	0.0	0.0	0.2	0.0	0.2	14	1,046	108000
90	5	22.13	22.13	0.1	0.0	0.0	0.1	0.0	0.1	13	1,151	129600
120	5	25.56	25.56	0.1	0.0	0.0	0.1	0.0	0.1	11	1,338	172800
365	5	44.57	44.57	0.0	0.0	0.0	0.1	0.0	0.1	7	2,415	525600
485	5	51.38	51.38	0.0	0.0	0.0	0.1	0.0	0.1	6	2,816	698400
730	5	63.04	63.04	0.0	0.0	0.0	0.1	0.0	0.1	5	3,521	1051200

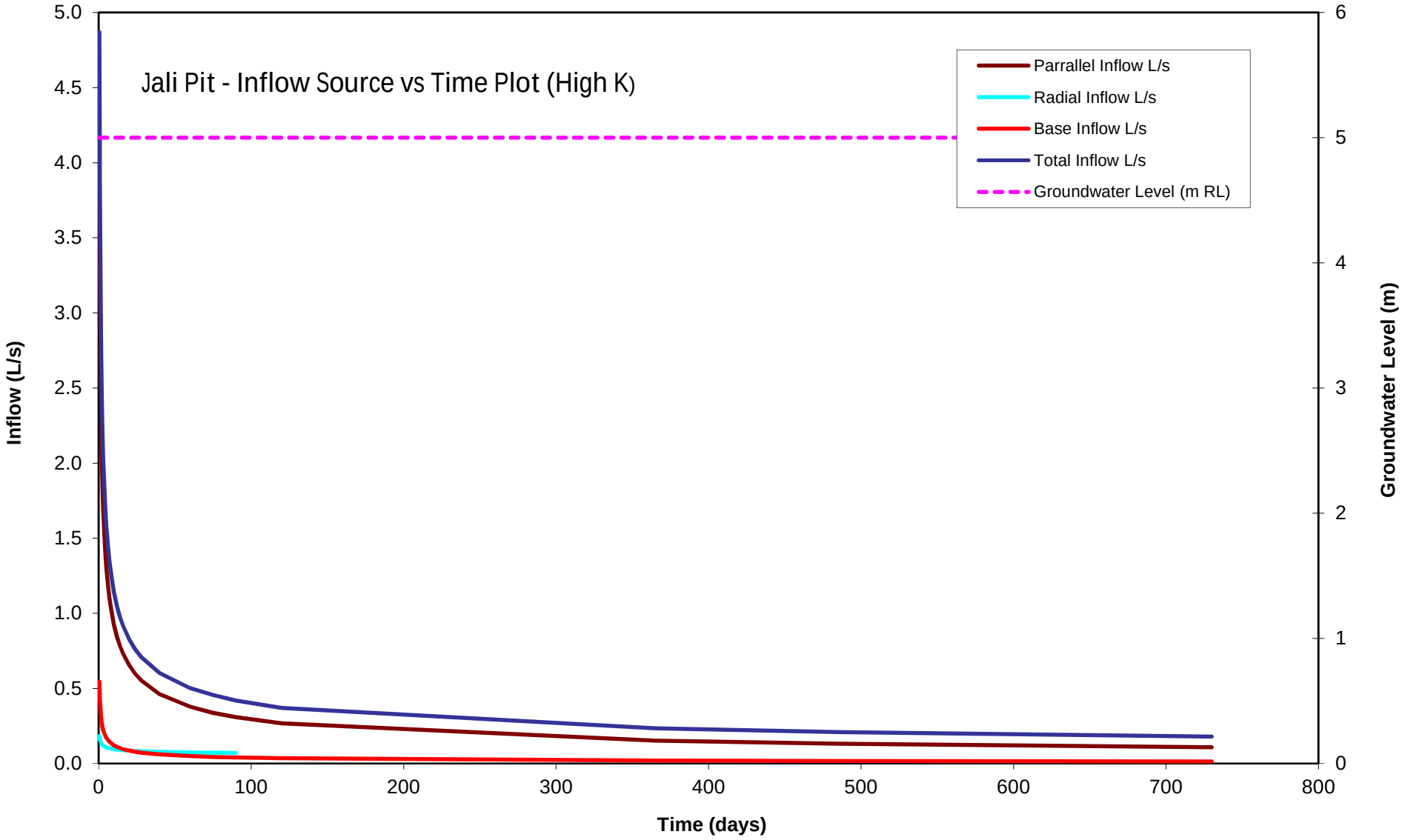
Input Field

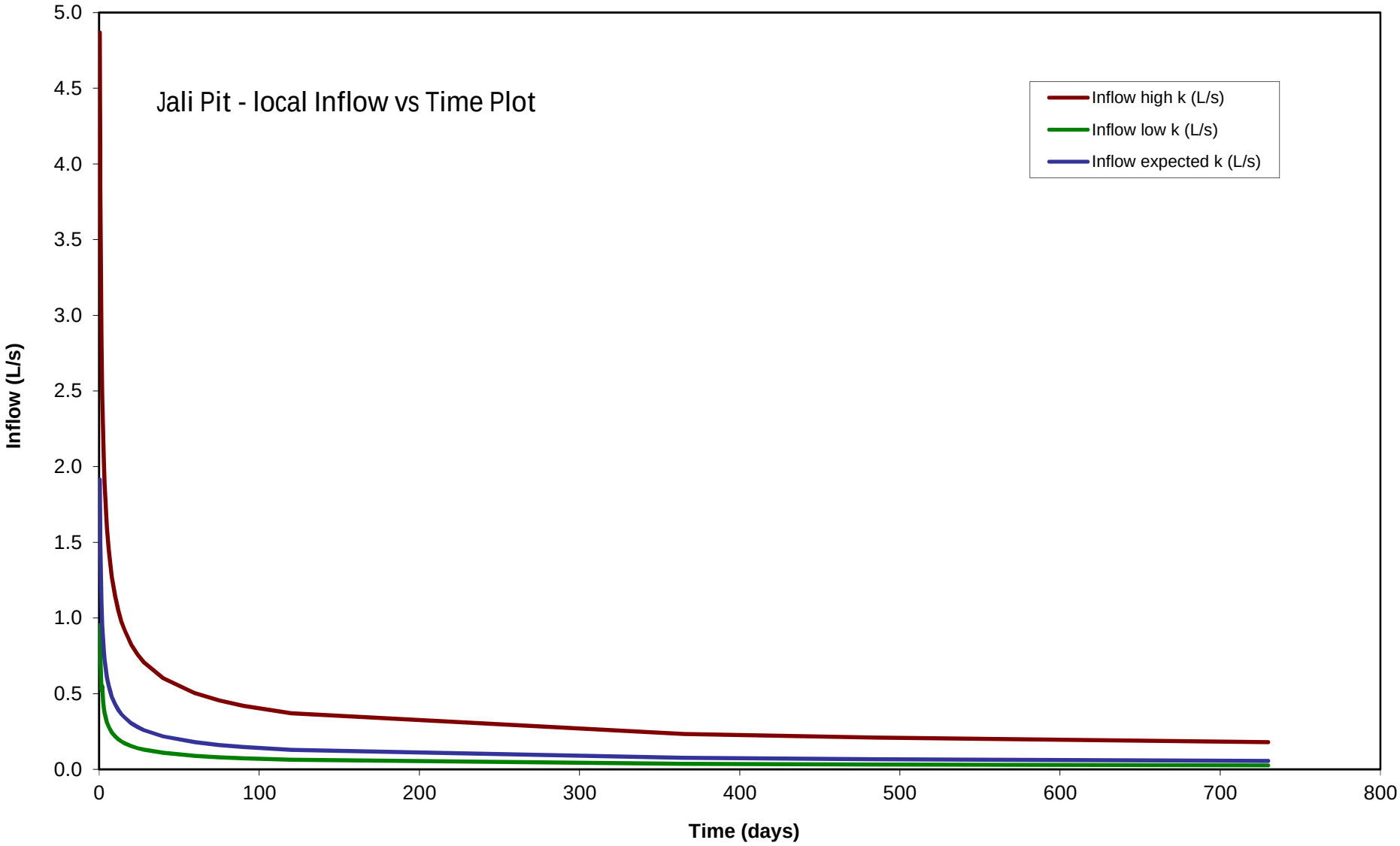
Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	5.22	5.22	4.1	0.2	0.5	4.9	0.0	4.9	421	210	720
0.6	5	5.71	5.71	3.8	0.2	0.5	4.5	0.0	4.5	385	231	864
0.7	5	6.17	6.17	3.5	0.2	0.5	4.1	0.0	4.1	356	250	1008
0.8	5	6.60	6.60	3.3	0.2	0.4	3.9	0.0	3.9	334	267	1152
1	5	7.38	7.38	2.9	0.2	0.4	3.5	0.0	3.5	299	299	1440
1.5	5	9.04	9.04	2.4	0.1	0.3	2.8	0.0	2.8	246	368	2160
2	5	10.43	10.43	2.1	0.1	0.3	2.5	0.0	2.5	214	427	2880
2.5	5	11.67	11.67	1.9	0.1	0.2	2.2	0.0	2.2	192	479	3600
3	5	12.78	12.78	1.7	0.1	0.2	2.0	0.0	2.0	176	527	4320
3.5	5	13.80	13.80	1.6	0.1	0.2	1.9	0.0	1.9	163	570	5040
4	5	14.76	14.76	1.5	0.1	0.2	1.8	0.0	1.8	153	611	5760
4.5	5	15.65	15.65	1.4	0.1	0.2	1.7	0.0	1.7	144	650	6480
5	5	16.50	16.50	1.3	0.1	0.2	1.6	0.0	1.6	137	687	7200
6	5	18.07	18.07	1.2	0.1	0.2	1.5	0.0	1.5	126	755	8640
7	5	19.52	19.52	1.1	0.1	0.1	1.4	0.0	1.4	117	819	10080
8	5	20.87	20.87	1.0	0.1	0.1	1.3	0.0	1.3	110	878	11520
10	5	23.33	23.33	0.9	0.1	0.1	1.1	0.0	1.1	99	988	14400
12	5	25.56	25.56	0.8	0.1	0.1	1.0	0.0	1.0	91	1,088	17280
14	5	27.61	27.61	0.8	0.1	0.1	1.0	0.0	1.0	84	1,181	20160
16	5	29.51	29.51	0.7	0.1	0.1	0.9	0.0	0.9	79	1,268	23040
20	5	32.99	32.99	0.7	0.1	0.1	0.8	0.0	0.8	71	1,429	28800
24	5	36.14	36.14	0.6	0.1	0.1	0.8	0.0	0.8	66	1,577	34560
28	5	39.04	39.04	0.6	0.1	0.1	0.7	0.0	0.7	61	1,714	40320
40	5	46.66	46.66	0.5	0.1	0.1	0.6	0.0	0.6	52	2,082	57600
60	5	57.15	57.15	0.4	0.1	0.0	0.5	0.0	0.5	43	2,604	86400
75	5	63.89	63.89	0.3	0.1	0.0	0.5	0.0	0.5	39	2,949	108000
90	5	69.99	69.99	0.3	0.1	0.0	0.4	0.0	0.4	36	3,268	129600
120	5	80.82	80.82	0.3	0.1	0.0	0.4	0.0	0.4	32	3,848	172800
365	5	140.95	140.95	0.2	0.1	0.0	0.2	0.0	0.2	20	7,391	525600
485	5	162.48	162.48	0.1	0.1	0.0	0.2	0.0	0.2	18	8,787	698400
730	5	199.34	199.34	0.1	0.1	0.0	0.2	0.0	0.2	16	11,327	1051200

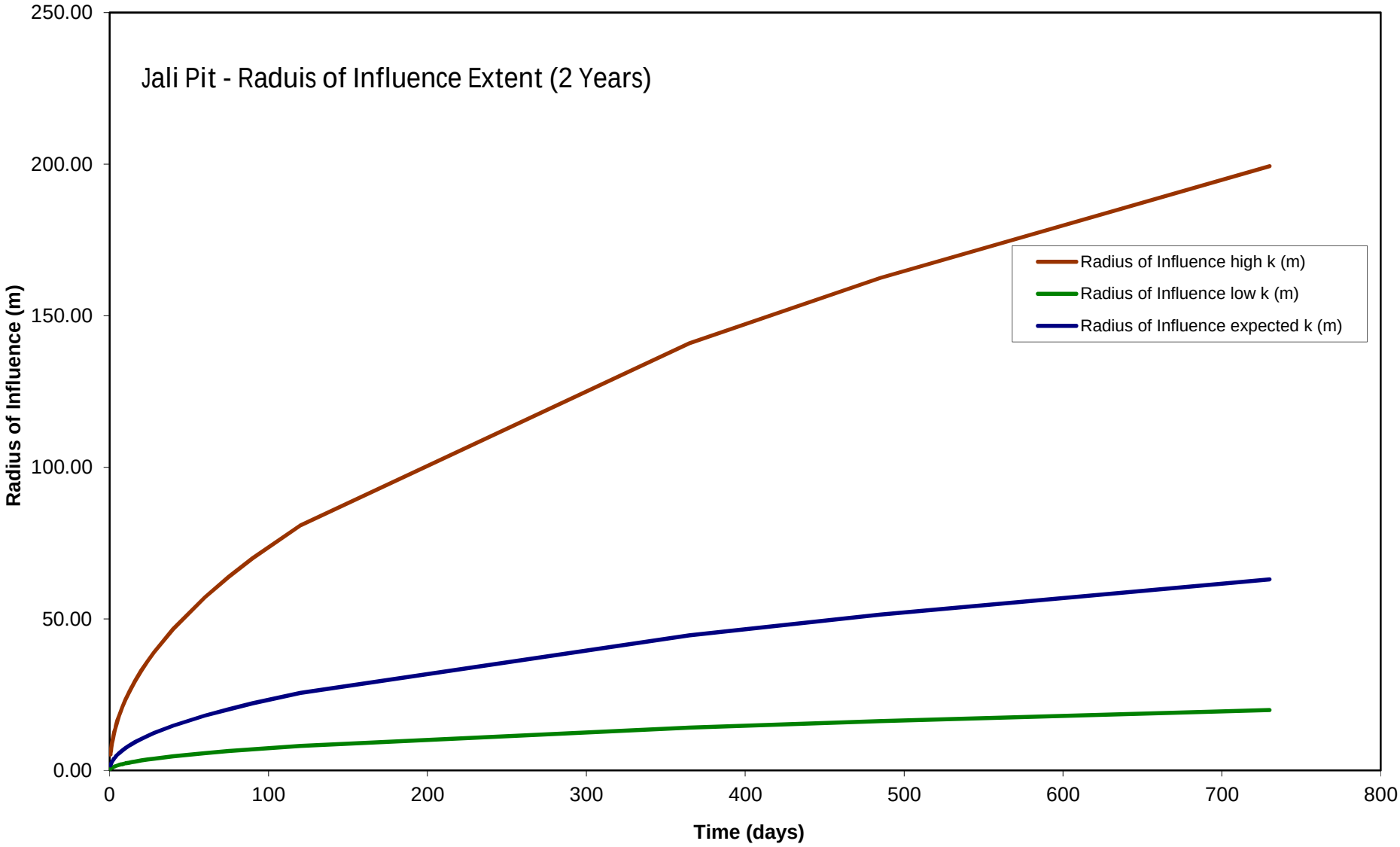
Input Field

Time days	GW Head m RL	Radius of Influence m	Base Radius of Inflow m	Parrallel Inflow L/s	Radial Inflow L/s	Base Inflow L/s	Total Inflow L/s	Evap L/s	Total Inflow L/s	Total Inflow m3/d	Cummulative Inflow m3	Time mins
0.5	5	0.52	0.52	0.4	0.0	0.5	1.0	0.0	1.0	83	41	720
0.6	5	0.57	0.57	0.4	0.0	0.5	0.9	0.0	0.9	75	45	864
0.7	5	0.62	0.62	0.3	0.0	0.5	0.8	0.0	0.8	70	49	1008
0.8	5	0.66	0.66	0.3	0.0	0.4	0.8	0.0	0.8	65	52	1152
1	5	0.74	0.74	0.3	0.0	0.4	0.7	0.0	0.7	58	58	1440
1.5	5	0.90	0.90	0.2	0.0	0.3	0.5	0.0	0.5	45	68	2160
2	5	1.04	1.04	0.2	0.1	0.3	0.6	0.0	0.6	48	95	2880
2.5	5	1.17	1.17	0.2	0.0	0.2	0.4	0.0	0.4	39	97	3600
3	5	1.28	1.28	0.2	0.0	0.2	0.4	0.0	0.4	35	105	4320
3.5	5	1.38	1.38	0.2	0.0	0.2	0.4	0.0	0.4	32	113	5040
4	5	1.48	1.48	0.1	0.0	0.2	0.3	0.0	0.3	30	120	5760
4.5	5	1.57	1.57	0.1	0.0	0.2	0.3	0.0	0.3	28	127	6480
5	5	1.65	1.65	0.1	0.0	0.2	0.3	0.0	0.3	27	134	7200
6	5	1.81	1.81	0.1	0.0	0.2	0.3	0.0	0.3	24	146	8640
7	5	1.95	1.95	0.1	0.0	0.1	0.3	0.0	0.3	23	158	10080
8	5	2.09	2.09	0.1	0.0	0.1	0.2	0.0	0.2	21	169	11520
10	5	2.33	2.33	0.1	0.0	0.1	0.2	0.0	0.2	19	188	14400
12	5	2.56	2.56	0.1	0.0	0.1	0.2	0.0	0.2	17	206	17280
14	5	2.76	2.76	0.1	0.0	0.1	0.2	0.0	0.2	16	223	20160
16	5	2.95	2.95	0.1	0.0	0.1	0.2	0.0	0.2	15	238	23040
20	5	3.30	3.30	0.1	0.0	0.1	0.2	0.0	0.2	13	267	28800
24	5	3.61	3.61	0.1	0.0	0.1	0.1	0.0	0.1	12	292	34560
28	5	3.90	3.90	0.1	0.0	0.1	0.1	0.0	0.1	11	316	40320
40	5	4.67	4.67	0.0	0.0	0.1	0.1	0.0	0.1	9	378	57600
60	5	5.71	5.71	0.0	0.0	0.0	0.1	0.0	0.1	8	463	86400
75	5	6.39	6.39	0.0	0.0	0.0	0.1	0.0	0.1	7	518	108000
90	5	7.00	7.00	0.0	0.0	0.0	0.1	0.0	0.1	6	568	129600
120	5	8.08	8.08	0.0	0.0	0.0	0.1	0.0	0.1	5	657	172800
365	5	14.10	14.10	0.0	0.0	0.0	0.0	0.0	0.0	3	1,156	525600
485	5	16.25	16.25	0.0	0.0	0.0	0.0	0.0	0.0	3	1,336	698400
730	5	19.93	19.93	0.0	0.0	0.0	0.0	0.0	0.0	2	1,648	1051200

Input Field


Jali Pit - Inflow Source vs Time Plot (High K)
Parrallel Inflow L/s
Radial Inflow L/s
Base Inflow L/s
Total Inflow L/s
Groundwater Level (m RL)
Inflow (L/s)
Groundwater Level (m)
Time (days)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6
5
4
3
2
1
0
0
100
200
300
400
500
600
700
800


Jali Pit - local Inflow vs Time Plot
Inflow high k (L/s)
Inflow low k (L/s)
Inflow expected k (L/s)
Inflow (L/s)
Time (days)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
600
700
800


Jali Pit - Raduis of Influence Extent (2 Years)
Radius of Influence (m)
250.00
200.00
150.00
100.00
50.00
0.00
0
100
200
300
400
500
600
700
800
Time (days)
Radius of Influence high k (m)
Radius of Influence low k (m)
Radius of Influence expected k (m)

Appendix B Contamination assessment

Pacific Complete

Woolgoolga to Ballina Pacific Highway Upgrade

Jali and Gibsons Quarry Phase 1 Contamination Investigation

March 2017

Table of contents

Table index

Appendices

1. Introduction

GHD Pty Ltd (GHD) was commissioned by Pacific Complete (PC) to undertake a Phase 1 Contamination Assessment, for two sites that will be potentially impacted by the Woolgoolga to Ballina Pacific Highway Upgrade project. The two sites are Gibsons and Jali Quarry/Borrow Sites, located at Old Bagotville Road, Bagotville, NSW, 2477 (the Sites). A site location plan is provided in Figure 1, Appendix A.

Jali Quarry is located to the west of Old Bagotville Road and occupies a portion of Lot 244 in deposited plan (DP) 755691. The disturbed area (due to quarry operations) of Jali Quarry covers an area of approximately 3 hectares.

Gibsons Quarry is located to the east of Old Bagotville Road, directly opposite Jali Quarry and occupies portions of Lot 2 DP 585377 and Lot 5 DP 843369. The disturbed area (due to quarry operations) of Gibsons quarry covers an area of approximately 10 hectares.

1.1 Objectives

The objective of the Phase 1 contamination assessment is to assess the potential for soil or water contamination at the Sites.

1.2 Scope of work

The scope of works for the Phase 1 contamination assessment included.

- A site history review including review of Council Section 149 Certificates (Part 2 and 5), title searches, previous contamination investigation reports (if any) and historical aerial photographs.
- Review of geology, hydrology and topography information for the Sites.
- Review of SafeWork NSW Dangerous Goods records.
- A review of NSW EPA notices under the *Contaminated Land Management Act 1997* and a search of the *Protection of the Environment and Operations Act* (POEO) Environment Protection License Register.
- Review of groundwater information for the area.
- A site inspection to assess the current site conditions and potential contamination issues.
- Preparation of this report (which includes both sites) including recommendations for further investigations or remediation (if required).

All investigations and assessment were undertaken in accordance with the Pacific Complete Contaminated Land Management assessment procedure and with reference to relevant guidelines made or approved by NSW EPA including:

- *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (OEH 2011)
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition),* (DEC 2006)
- *Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997,* (EPA, 2015)

The Phase 1 contamination assessment did not include intrusive soil or groundwater investigations or a hazardous building materials assessment.

2. Site information

2.1 Site identification

A summary of the Sites identification details are provided in Table 2-1. The Sites locations are shown on Figure 1 in Appendix A.

Table 2-1 Site identification summary

Information	Jali and Gibsons Site Details
Street Address	Old Bagotville Road, Wardell, NSW, 2477
Lot and DP number	Jali Quarry: Portion of Lot 244 in DP 755691 Gibsons Quarry: Portions of Lot 2 DP 585377 and Lot 5 DP 843369
Approximate Site Area (quarry area only)	Jali Quarry: 3 ha Gibsons Quarry: 10 ha
Local Government Area (LGA)	Ballina Shire Council
Land Use Zoning	RU2 Rural Landscape
Current Land Use	Non-operational quarries
Proposed Land Use	Highway

2.2 Surrounding land uses

The land uses surrounding the Sites consisted of:

- North: Vegetated land was located immediately north of the Sites, followed by a quarry. Cleared agricultural land and vegetated land were located further north of the Sites.
- East: Vegetated land was located immediately east of the Sites, followed by what appears to be water filled pits from a former quarry. Further to the east is vegetated land followed by cleared agricultural land and the Richmond River.
- South: Cleared agricultural land used for cropping was located immediately south of Gibsons Quarry. Vegetated land was located immediately south of Jali Quarry, followed by cleared agricultural land. Eatons Quarry was also located to the south east of the Sites. Old Bagotville Road runs between the two quarries in a north south direction.
- West: Vegetated land was located immediately west, followed by cleared agricultural land used for cropping and vegetated land.

2.3 Site inspection

A Senior Environmental Engineer from GHD completed a site inspection on 14 February 2017. The main site features observed and select photographs taken during the walkover are outlined in Table 2-2 and summarised below:

- At the time of the site inspection, the Sites were non-operational and comprised of cleared/disturbed areas as a result of former quarry operations. The two quarries were accessible from Old Bagotville Road and were not fenced.
- The surface of both Sites generally consisted of rock/gravel with some grassed areas. Some areas of the Sites were avoided during the inspection due to long grass posing a snake hazard.

- A number of stockpiles were noted on both Sites generally comprising soil and material from the quarrying operations.
- Rubbish was noted to have been dumped in a number of locations across the Sites and included material such as ceramic, plastic, metal, electrical wire, glass, fibro (potential asbestos containing material (ACM)), timber, tyres, drums, above ground storage tank (AST) old cars, washing machines, cupboards, green waste and general household waste.
- Three buildings were observed at Gibsons Quarry including:
  - A storage shed, suspected to be the former fuel/oil store, with a canopy. The inside of the shed had a concrete floor with a gantry in one corner. The canopied area had a bare earth ground surface. Potential hydrocarbon staining was observed on the concrete and on the ground surface beneath the canopy. Several empty drums were also noted behind the shed.
  - An abandoned brick house (former residence). No visual signs of contamination were noticed, however rubbish was scattered around the building.
  - An unknown shed which may have been used for chemical/fuel storage (as evident by several empty drums noted in the area).
- Surface water was noted in a pit in the eastern portion of Gibsons Quarry. The vegetation growing in and around the pond appeared healthy.

The location of each photograph is presented on Figure 2, Appendix A.

Table 2-2 Summary of Site details

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
Gibsons Quarry		
Entrance to Gibsons Quarry from old Bagotville Road, facing east.	0	
Area of demolition and household waste near the entrance to Gibsons Quarry, including ceramic, plastic, metal, electrical wire, fibro (potential ACM), glass and a small transformer.	1	   
Typical example of stockpiled quarry material observed at Gibsons Quarry along Old Bagotville Road.	2	
The centre of Gibsons Quarry, showing the cut faces and stockpiles in the background.	3a, 3b	

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
		
Dumped waste observed in the central portion of Gibsons Quarry.	4, 5, 6	   
Dumped fibro, potentially ACM located on the southern boundary of Gibsons Quarry.	7	 
Stockpiled quarry material located on the eastern portion of Gibsons Quarry.	8, 9	 

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
Various materials dumped on the eastern portion of Gibsons Quarry, including a washing machine, plastic and glass, two dumped cars, a drum and AST. Both the drum and AST were rusted out but showed no visible signs of staining.	10a, 10b	   
Pit on eastern portion of Gibsons Quarry that has filled with water. Vegetation appeared healthy.	11	 
Grassed area to the north east of Gibsons Quarry. A detailed inspection of this area was not undertaken due to the long grass.	12	
Shed in the north eastern portion of the main quarry area, possibly used for fuel/oil/chemical storage. The shed had a steel and timber frame and was corrugated iron clad. The shed consisted of an enclosed area with concrete floor and a front canopy with bare earth surface. Oil stains and odour were noted within the shed on the concrete floor. Possible hydrocarbon stains were also noted on the ground surface beneath the canopy. Household garbage was also observed in the shed, including a TV, heater,	13	 

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
plastic and general household waste. A water tank was located to the west of the shed.		 
Several rusted, empty drums were located at the back of the shed. No soil staining was evident.	13	 
A derelict residence was located immediately north of the main quarry area. The building was constructed from timber, brick and steel. No obvious signs of contamination were observed.	14	   
A septic system was observed to the north of the derelict residence, which may be a potential source of contamination. No visible signs of contamination were observed. The location of the effluent disposal field was unknown but could be assumed to be to the north (downgradient).	14	 

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
Dumped garbage was scatted around the derelict residence, including plastic and other household waste materials, wood and metal.	15	 
A third building was located on the northern portion of Gibsons Quarry. The old shed was constructed from timber and corrugated iron. The inside of the shed could not be accessed due the long grass.	16	 
The shed was possibly used for storage of fuel/oil/chemicals as a rusted drum was observed near the building. More dumped garbage was located to the north of the main shed.	17a, 17b	 
A number of stockpiles containing various materials associated with the quarry, as well as bricks, tyres and sticks/wood were located throughout the site. No obvious signs of contamination were observed.	18a, 18b, 18c, 19	 

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
		
Jali Quarry		
Entrance to Jali Quarry from Old Bagotville Road, facing west.	0	
Rock stockpiles were located near the entrance of Jali Quarry, along with rusted drums and metal.	20	 
Marshy areas were located in the central and northern portions of Jali Quarry, indicating that the area has not been used for quarrying operations in some time. The vegetation appeared healthy.	21, 22	 
Numerous stockpiles of excavated material were located along the northern and southern portions of Jali Quarry. No evidence of contamination was observed.	23a, 23b, 23c, 23d	 

Comments/observations/ anecdotal evidence	Photo location (Figure 2)	Photo
		 
A stockpile containing metal and fibro (potential ACM) was located in the western portion of Jali Quarry.	24	 
A small waterhole was located on the southern portion of Jali Quarry. No evidence of contamination was observed.	25	
An area of dumped tyres, as well as some metal and household waste was located on the southern portion of Jali Quarry next to Old Bagotville Road.	26	

3. Environmental setting

The following section provides an overview of the environmental setting of the sites obtained from publically available information. Much of the information in Sections 3 and 4 was obtained from a Lotsearch report (2017) for the Sites, which is presented in Appendix B. It should be noted that the Lostsearch report included a separate portion of land to the south of Gibsons Quarry, known as Eatons Quarry. Information regarding Eatons Quarry has not been summarised in this report and has been referred to as surrounding land.

3.1 Soils and geology

The 1:250,000 Geology Sheet for the Ballina area shows the Sites are primarily underlain by the Neranleigh-Fernvale beds, which comprise feldspathic and lithic meta-arnite, meta-siltstone, chert, jasper, basic meta-volcanics and conglomerate. The northern portion of Gibsons Quarry is underlain by Cainozoic prograded barrier beach, foredune and shoreface sands.

The 1:100,000 Lismore and Ballina Soil Landscape Sheet shows the sites are classified as disturbed terrain (DTxx). The soil types surrounding the sites are the 'Billinudgel' (TRbia) Transferral, the 'Wardell' (AEwa) Aeolian and the 'Empire Vale' (ALep) Alluvial soil landscape units. The Sites are not considered to be affected by dryland salinity.

The northern portion of Gibsons Quarry is classified as Class 4 acid sulfate soils, according to NSW Planning and Environment (search undertaken by Lotsearch). This means that works more than 2 m below he natural ground surface and works by which the water table is likely to be lowered more than 2 m below natural ground surface present an environmental risk.

3.2 Hydrology

The Richmond River is located 2.5 km south of the Sites and flows to the north approximately 2.5 km east of the Sites. Tuckean Broadwater is located 1.8 km south west of the Sites and flows into the Richmond River 2.5 km south of the Sites.

3.3 Hydrogeology

A review of existing groundwater borehole records using the Department of Primary Industries NSW Office of Water database was carried out on the 14 February 2017. The search was conducted to identify registered groundwater boreholes within 2 km of site and to record information such as groundwater use and standing water level. Seven registered groundwater bores are located within one kilometre of the site. Details of the groundwater bores are located in Table 3-1.

According to the Hydrogeology Map of Australia (search undertaken by Lotsearch) the aquifers on site are described as fractured or fissured, extensive aquifers of low to moderate productivity.

Table 3-1 Groundwater bore summary

Bore registration number	Purpose	Depth m below ground level (mbgl)	Standing water level (m bgl)	Water bearing zone	Approximate Distance/Direction from site
GW305763	Monitoring	11.90	2.25	2.25 – 15.15	120 m North
GW056965	General Use	30.00		24.00 – 28.00	170 m West
GW305765	Monitoring	9.60			210 m South East
GW305869	Monitoring	10.00			360 m North
GW305767	Monitoring	8.00			430 m South East
GW046127	Stock/Domestic	3.70	1.20	1.80 – 3.60	550 m North
GW305766	Monitoring	4.05	1.50	1.50 – 4.00	610 m South East

Based on the information available, regional groundwater and water within the Sites would be expected to be at depths greater than 2 meters below ground level. Generally, groundwater in the area would primarily be used for stock watering purposes but could also possibly be used for domestic purposes, including drinking water.

3.4 Sensitive Receptors

Based on the desktop review and site inspection, the following potential sensitive human and environmental receptors for contamination were identified for the Sites and surrounding areas:

Human health receptors

- Current and future occupants of the site (e.g. workers and subcontractors).
- Visitors to the site (e.g. workers conducting maintenance, members of the public).
- Current and future occupants of surrounding properties (e.g. workers and visitors).

Environmental receptors

- Flora and fauna within the site and surrounding land.
- Richmond River and Tuckean Broadwater.
- Groundwater beneath the site.

4. Desktop information

4.1 Site history

4.1.1 Title search summary

A title search for the sites was undertaken by Roads and Maritime Services and provided to GHD. A copy of the title searches are provided in Appendix B. The title searches showed that Lot 2 DP 585377 and Lot 5 DP 843369 (Gibsons Quarry) were owned by Roads and Maritime Services and Lot 244 DP 755691 (Jali Quarry) was owned by Jali Local Aboriginal Land Council. Historic land title information was not provided.

4.1.2 Dangerous Goods Search

SafeWork NSW Storage of Hazardous Chemicals records searches were only undertaken for the two lots comprising Gibsons Quarry, which were the only two lots that Roads and Maritime Services own and could provide permission to conduct the searches for. The search did not locate any records pertaining those lots. Documentation of the search is provided in Appendix B.

4.1.3 Historical aerial photographs

A selection of historical aerial photographs (at least one per decade) were examined to assess past activities and land uses at the site. Photographs (as provided by Lot Search) were examined from the years 1958, 1967, 1971, 1979, 1987, 1997 and 2009. The most recent aerial photograph (2015) as shown in Six Maps (http://maps.six.nsw.gov.au/) was also reviewed. Copies of the photographs are provided in Appendix B.

A summary of the information gained from the review of historical aerial photographs for the Sites and the surrounding area are provided in Table 4-1.

In summary, the Sites appeared to be vegetated blocks that were developed into quarries between 1958 and 1967, with continued expansion until approximately 2009. The surrounding land comprised agricultural land that was cleared and farmed from 1967. Additional quarries were developed to the north (prior to 1967) to the north east (prior to 1987) and to the south (1979-1987) of the sites.

Table 4-1 Review of historical aerial photographs

Photograph Information	Jali and Gibsons Quarries	Surrounds
1958 Black and White	The Sites appeared to be vegetated, with cleared land observable on the northern portion of Gibsons Quarry. No buildings or infrastructure were observed to be present on the sites. Tracks and/or cut lines were observable throughout both Sites.	The surrounding land uses appeared to comprise mostly vegetated land, with patches of cleared land. A road was present in the location of the current Old Bagotville Road. A building appeared to be present on cleared land to the south west of the sites.
1967 Black and White	Clearing and quarrying works had taken place on the eastern portion of Jali Quarry. A building was observed on the cleared northern portion of Gibsons Quarry (the small shed shown in the photos in Section 2.2).	Clearing and possibly quarrying works had taken place to the north west of the sites. Further clearing had occurred to the north of the building located south west of the sites. Vegetation was present immediately surrounding both quarries.
1971 Black and White	No significant, observable changes.	Further clearing and quarrying had taken place to the north west of the sites. Further clearing had occurred to the north of the building located south west of the sites.
1979 Black and White	Significant clearing and quarrying works had occurred at both Jali and Gibsons Quarries. Additional buildings were observed on the northern portion of Gibsons Quarry including the large shed and residence shown in the photos in Section 2.2.	Significant clearing had occurred to the south and south west of the sites, with paddocks (including cropping) clearly identifiable. Expansion of the quarry to the north appeared to have occurred and potential quarrying to the south (in the location of Eatons Quarry) appeared to have begun.
1987 Black and White	Further expansion had occurred at both quarries, with quarrying beginning in the eastern portion of Gibsons Quarry. Additional access roads were constructed on the northern portion of Gibsons Quarry.	Clearing had occurred to the east of the sites, with the formation of another quarry to the north east of the sites, which appeared to have a lot of surface water present. Expansion of the quarrying operation to the south of the sites had occurred. Further development appeared to have occurred at the property to the south west of the site, with additional private roads and buildings constructed. A building was constructed to the south east of Gibsons Quarry.
1997 Colour	The pit on the eastern portion of Gibsons Quarry appears to be full of water. Gibsons Quarry appears deeper but the footprint has not significantly increased. No other significant, observable changes.	The quarry to the north east of the sites appeared to be full of water. The two properties, one to the south east and one to the south west, appeared to have expanded, with additional buildings observed. Vegetation was still present immediately surrounding Jali Quarry.

Photograph Information	Jali and Gibsons Quarries	Surrounds
2009 Colour	The pit on the eastern portion of Gibsons Quarry appears to be still full of water. Gibsons Quarry appears deeper but the footprint has not significantly increased. Some areas of both quarries are revegetating.	Expansion of the quarry to the north of the sites appeared to have occurred. An additional house was constructed to the south east of the sites. Further expansion of the quarry south of Gibsons Quarry (Eatons Quarry) had occurred to the east.
2015 Colour	Trees and regrowth appeared on both quarries. Vegetation growth in the pond on the eastern portion of Gibsons Quarry appeared to have occurred.	Trees and regrowth appeared to be growing on the quarry to the north east of the sites, however groundwater was still present. Vegetation was still present immediately surrounding Jali Quarry.

4.2 Regulatory information

4.2.1 Overview

As part of the desk based review, information was obtained from a number of sources to enable a greater understanding of the potential for contamination at the site. The desk based regulatory information review included a review of the following sources of information:

- Council information including land zoning and permissible use.
- NSW Environmental Protection Authority (EPA), Contaminated Sites Register (notifications or incidents).
- NSW EPA, Protection of the Environment Operations (POEO) Licence register.

The findings of the information review are provided in Appendix C and are summarised below.

4.2.2 Council information

Local environment plan (LEP)

The sites are located in the local government area of Ballina Shire Council. In accordance with the *Ballina LEP* 2012, the sites are zoned as RU2 Rural Landscape. The objective of this zone is:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within the zone and land uses within adjoining zones.
- To enable small-scale tourist-orientated development that is compatible with the rural nature of the land.
- To encourage development that involves restoration or enhancement (or both) of the natural environment if consistent with the production and landscape character of the land.
- To enable development that does not adversely impact on the natural environment, including habitat and waterways.
- To ensure that there is not unreasonable or uneconomic demands (or both) for the provision of public infrastructure.

Permissible land uses include environmental protection works, extensive agriculture, home-based child care, home occupations and intensive plant agriculture.

4.2.3 NSW Environment Protection Authority

A search of the datasets maintained by NSW EPA including notices under the CLM Act and POEO Environment Protection License Register were carried out. The search results are presented in Appendix C and are summarised below.

Contaminated sites register

A site will be on the Contaminated Land: Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the CLM Act.

No contaminated land records were listed for the sites or for any sites within a one kilometre radius of the Sites (as reported by Lotsearch).

List of NSW contaminated sites notified to EPA

A site appearing on the EPA "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review information before it can make a determination as to whether the site warrants regulation.

The search did not identify any listings for the Sites (as reported by Lotsearch).

POEO licence register

The POEO register identifies premises that are licensed for certain activities under the POEO Act. Information of particular relevance to this assessment, which are listed on the Register, includes site location, activity type, relevant clean up notice and non-compliance information. Each licence provides information on potential point and non-point sources of soil and groundwater contamination that may be generated on-site through standard operations, accidental spills and leaks.

Lotsearch undertook a search of the register and identified two premises with a POEO licence within a one kilometre radius of the sites. These are summarised in Table 4-2.

Table 4-2 Licensed activities under the POEO Act 1997

Organisation	Name	Address	Suburb	Activity	Distance	Direction
Quarry Solutions Pty Ltd	Eatons Quarry	Old Bagotville Road	Bagotville	Land-based extractive activity	70 m	South
Quarry Solutions Pty Ltd	Montis Quarry	Old Bagotville Road	Bagotville	Land-based extractive activity	30 m	North West

There were no delicensed activities still regulated by the EPA recorded within one kilometre of the Sites.

The former licensed activities under the POEO Act 1997, now revoked or surrendered recorded within one kilometre of the site are summarised in Table 4-3.

Table 4-3 Delicensed activities still regulated by the EPA

Organisation	Location	Status	Activity	Distance	Direction
See Civil Pty Ltd	Old Bagotville Road	Surrendered	Land-based extractive industry	70 m	South
Far North Coast County Council	Lismore County District	Surrendered	Application of herbicides	adjacent	-
Luhrmann Environment Management Pty Ltd	Waterways throughout NSW	Surrendered	Application of herbicides	adjacent	-
Robert Orchard	Waterways throughout NSW	Surrendered	Application of herbicides	adjacent	-
Sydney Weed & Pest Management Pty Ltd	Waterways throughout NSW	Surrendered	Application of herbicides	adjacent	-
See Civil Pty Ltd	Old Bagotville Road	Surrendered	Land-based extractive industry	30 m	North west

4.3 Other information

The following is a summary of other information derived from desktop search completed by Lotsearch:

- The majority of both sites are located within a vegetation buffer, with a small portion of the western corner of Jali Quarry located on Category 1 bushfire prone land.
- No record of former Gasworks are located within a one kilometre radius of the sites.
- No sites on the National Waste Management Site database are listed within a one kilometre radius of the sites.
- The sites are located within an underground petroleum storage system (UPSS) sensitive zone according to the *UPSS Regulation 2014*.
- One point of interest, a homestead at Pinehaven, is located approximately 400 m south west of the sites.
- No tank areas or tank points are located within a one kilometre radius of the sites.
- There are no Mining Subsidence Districts within a one kilometre radius of the sites.
- There are two State Environmental Planning Policy (SEPP) Protected Areas within a one kilometre radius of the sites. SEPP14 – Coastal wetlands are located approximately 1 km south of the sites and a SEPP 71 – Coastal Protection Zone is located approximately 300 m to the south and west of the sites.

5. Preliminary conceptual site model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. A CSM provides the framework for identifying contamination sources and how potential receptors may be exposed to contamination.

Based on the information collected as part of this investigation, the following preliminary CSM has been developed for the site.

5.1 Potential contaminant sources

Potential sources of contamination identified during the site inspection include:

- Spillage or leakage of oils, fuel, herbicides, pesticides and other chemicals previously stored or used on the Sites.
- Potential spills or leaks of oils or fuels from machinery or vehicle previously used on the Sites.
- Historical use of herbicides and pesticides both on and on the adjoining agricultural land.
- Waste materials including potential ACM, contents from discarded drums/AST/derelict cars, plastic, wood, tyres, glass, metal and general household waste.
- Potential use of fill from unknown sources.
- Potential hazardous building materials present within buildings on the Sites.
- Potential leaks from on-site septic tank.

5.2 Potential contaminant pathways

The primary pathways by which current and future receptors could be exposed to the potential sources of contamination are considered to be:

- Direct contact (including ingestion) with potentially contaminated soil or water.
- Inhalation of potential contaminants in soil or groundwater (disturbance or volatilisation of hydrocarbons).
- Inhalation of fibres from ACM and other hazardous building materials (synthetic fibres)
- Vertical and horizontal migration of potential contaminants within the groundwater.
- Mobilisation of soil contamination through windborne dust or via surface water flow
- Migration of surface water contamination through surface water runoff into adjoining water bodies.

5.3 Potential contaminant receptors

When evaluating potential adverse health/environmental effects from exposure to a contaminated site, all potentially exposed populations should be considered. For the site, the key populations or receptors of interest are considered to include:

Human health receptors

- Visitors to the Sites
- Future construction and maintenance workers
- Current and future occupants of surrounding properties

Environmental receptors

- Flora and fauna within the Sites and surrounding land
- Richmond River and Tuckean Broadwater
- Local drainage channels and surface water
- Groundwater beneath the Sites

5.4 Potential source-pathway-receptor linkages

A summary of the potential contaminant source – pathway – receptor linkages is provided below.

Soil

- *Soil >> Inhalation Exposure Pathway >> Human Health Receptors*
- *Soil >> Ingestion Exposure Pathway >> Human Health Receptors and Environmental Receptors.*
- *Soil >> Dermal Exposure Pathway >> Human Health Receptors and Environmental Receptors.*

Waste

- *Waste >> Inhalation Exposure Pathway >> Human Health Receptors*
- *Waste >> Ingestion Exposure Pathway >> Human Health Receptors and Environmental Receptors*
- *Waste >> Dermal Exposure Pathway >> Human Health Receptors and Environmental Receptors*

Surface Water

- *Surface Water >> Ingestion Exposure Pathway >> Human Health Receptors and Environmental Receptors*
- *Surface Water >> Dermal Exposure Pathway >> Human Health Receptors and Environmental Receptors*

Groundwater

- *Groundwater >> Ingestion Exposure Pathway >> Human Health Receptors and Environmental Receptors*
- *Groundwater >> Dermal Exposure Pathway >> Human Health Receptors and Environmental Receptors*

6. Conclusions and recommendations

6.1 Conclusion

GHD was commissioned by PC to undertake a Phase 1 Contamination Assessment, for two sites that will be potentially impacted by the Woolgoolga to Ballina Pacific Highway Upgrade project. The two sites are Gibsons and Jali Quarry/Borrow Sites, located at Old Bagotville Road, Bagotville, NSW, 2477 (the Sites).

The objective of the Phase 1 contamination assessment is to assess the potential for soil or water contamination at the two sites.

GHD completed a desktop study and site walkover to assess the potential for soil or water contamination at the Sites and assess potential risks posed by these contaminants to future users of the sites.

In accordance with the objectives detailed in Section 1.1, and based on the information contained within this assessment and limitations outlined in Section 7, the following conclusions were made:

- The Sites appeared to be developed into quarries sometime between 1958 and 1967, with continued expansion noted to approximately 2009. Prior to their development, the Sites consisted of undisturbed vegetated land. At the time of this assessment, the quarries were non-operational and contained three buildings, two storage sheds and a derelict residence.
- Based on the desktop review and site inspection, the potential sources of contamination were identified to include:
  - Spillage or leakage of oils, fuel, herbicides, pesticides and other chemicals previously stored or used on the Sites.
  - Potential spills or leaks of oils or fuels from machinery or vehicle previously used on the Sites.
  - Historical use of herbicides and pesticides both on and on the adjoining agricultural land.
  - Waste materials including potential ACM, contents from discarded drums/AST/derelict cars, plastic, wood, tyres, glass, metal and general household waste.
  - Potential use of fill from unknown sources.
  - Potential hazardous building materials present within buildings on the Sites.
  - Potential leaks from on-site septic tank.

Based on the desktop review and site inspection, the potential for significant contamination to be present at the Sites is likely to be low.

6.2 Recommendations

Based on the above assessment, GHD recommends the following measures be undertaken to address the identified issues:

- Removal of general building wastes and rubbish with detailed inspection for ACM also undertaken within these areas.
- Undertake a hazardous buildings and material survey of structures on the site which may be demolished as part of the redevelopment.

- Undertake soil sampling in the areas of the Sites where potential contamination has been identified Including (with reference to photo locations shown on Figure 2, Appendix A:
  - The storage shed (Photo location 13).
  - The small corrugated iron shed (Photo location 16)
  - The drum and AST located in the eastern portion of the site (Photo location 10).
- The septic tank (Photo location 14) is decommissioned in accordance with Ballina Shire Council '*Onsite Sewage Management Fact Sheet 7 'Septic Tank Decommissioning Procedure and Pumpout Contractors*'.

7. Limitations

This report has been prepared by GHD Pty Ltd for Pacific Complete and may only be used and relied on by Pacific Complete for the purpose as set out in Section 1.1 of this report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect except where GHD has been negligent in the adoption of those Assumptions. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

GHD has prepared this report on the basis of information provided by Pacific Complete and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Inspections undertaken in respect of this Report are limited to visual inspections only and are constrained by access limitations and the particular site conditions, such as locations of buildings or vegetation (including long grass).

Except as otherwise expressly stated in this Report GHD makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials (“ACM”) on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to the prohibition date of asbestos in Australia, 31 December 2003, have been demolished on the site or material from such buildings disposed of on the site, the site may contain asbestos or ACM.

Except as otherwise expressly stated in this Report, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

8. References

Department of Environment and Conservation (DEC) 2006. *Guidelines for the NSW Site Auditor Scheme (2nd edition)*

Department of Primary Industries Office of Water (DPI OoW) 2017. *Groundwater database*. http://allwaterdata.water.nsw.gov.au/water.stm

Lotsearch 2017. *Environmental Risk and Planning Report Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477*

NSW Environmental Protection Authority (NSW EPA). *Contaminated Land Record of Notices*. http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx

NSW Environmental Protection Authority (NSW EPA) 2015. *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*

NSW Land and Property Information. *Spatial Information Exchange*. https://maps.six.nsw.gov.au/

Office of Environment and Heritage (OEH) 2011. *Guidelines for Consultants Reporting on Contaminated Sites*

Appendices

Appendix A – Figures

Paper Size A3

0 115 230 460 690 920

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Location
- Cadastre
- Railway
- Rivers

Pacific Complete
W2B - Jali and Gibsons Quarries
Phase 1 Contaminated Site Investigation

Job Number	22-18659
Revision	B
Date	20 Feb 2017

Site Locations

Figure 1

G:\22\18659\GIS\Maps\Deliverables\22_18659_JG01_SiteLocations_RevB.mxd

Data source: LPI: DCDB 2012; LPI: SixMaps Aerial Imagery 2015. Created by:slmartin

230 Harbour Drive Coffs Harbour NSW 2450 Australia T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

Paper Size A3

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Site Location

Photo Locations

Cadastre

Pacific Complete
W2B - Jali and Gibsons Quarries
Phase 1 Contaminated Site Investigation

Job Number	22-18659
Revision	B
Date	20 Feb 2017

Site Features

Figure 2

N:\AU\Coffs Harbour\Projects\22\18659\GIS\Maps\Deliverables\22_18659_JG02_SiteFeatures_RevB.mxd

Data source: LPI: DCDB 2012; LPI: SixMaps Aerial Imagery 2015. Created by:slmartin

230 Harbour Drive Coffs Harbour NSW 2450 Australia T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

Appendix B – Desktop Review Information

Lotsearch

Environmental Risk and Planning Report

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Report Buffer: 1000m

Report Date: 10 Feb 2017 16:28:13

Table of Contents

Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
1	Georeferenced to the site location / premise or part of site
2	Georeferenced with the confidence of the general/approximate area
3	Georeferenced to the road or rail
4	Georeferenced to the road intersection
5	Feature is a buffered point
6	Land adjacent to Georeferenced Site
7	Georeferenced to a network of features

Dataset Listing

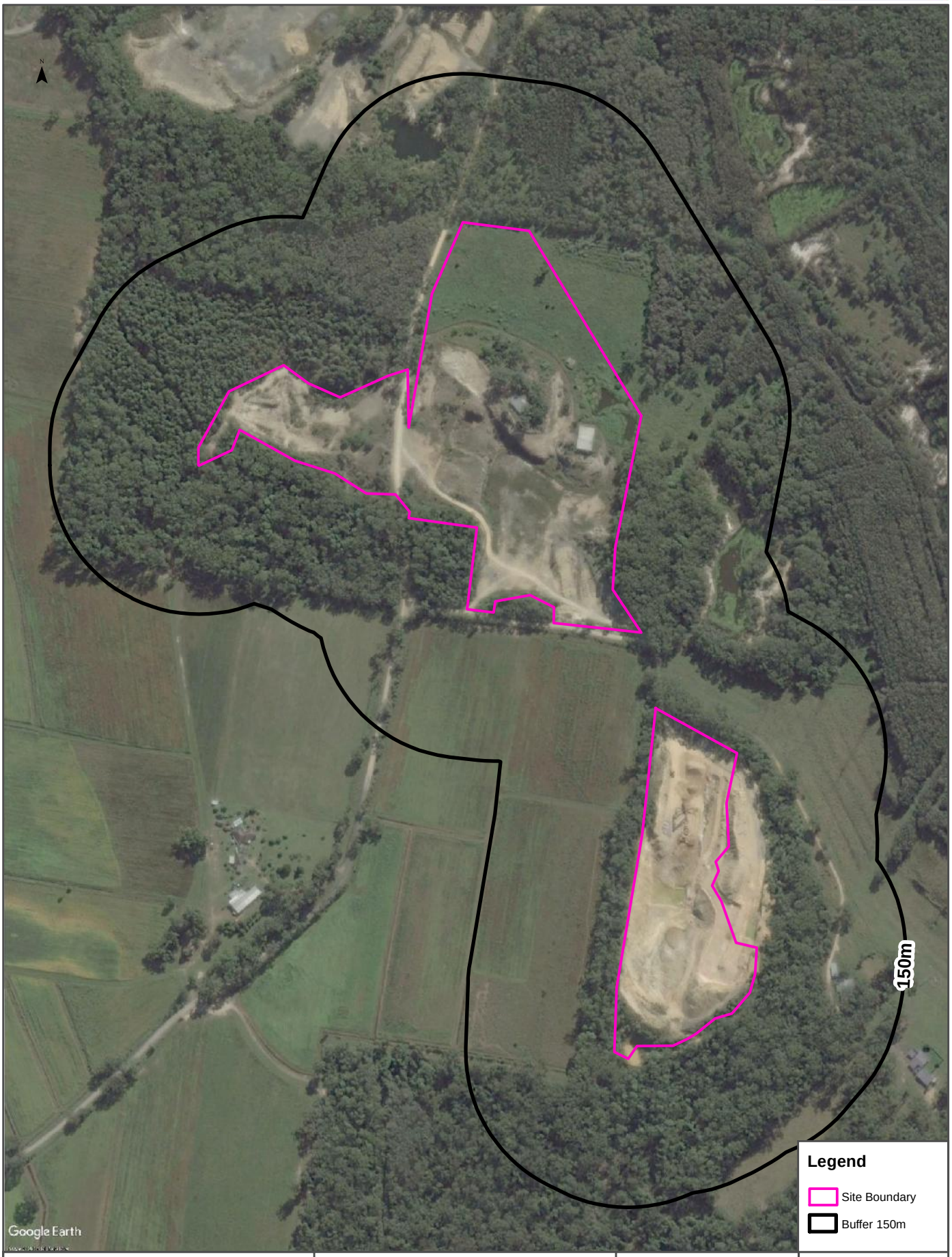
Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Cadastre Boundaries	Land and Property Information	10/02/2017	10/02/2017	Daily	-	-	-
Topographic Data	Land and Property Information	10/04/2015	01/04/2015	As required	-	-	-
List of NSW contaminated sites notified to EPA	Environment Protection Authority	07/02/2017	09/01/2017	Monthly	0	0	0
Contaminated Land: Records of Notice	Environment Protection Authority	07/02/2017	07/02/2017	Monthly	0	0	0
Former Gasworks	Environment Protection Authority	07/02/2017	16/01/2017	Monthly	0	0	0
National Waste Management Site Database	Geoscience Australia	06/02/2017	15/11/2012	Quarterly	0	0	0
Licensed Activities under the POEO Act 1997	Environment Protection Authority	07/02/2017	06/02/2017	Monthly	1	2	2
Delicensed POEO Activities still Regulated by the EPA	Environment Protection Authority	07/02/2017	06/02/2017	Monthly	0	0	0
Former POEO Licensed Activities now revoked or surrendered	Environment Protection Authority	07/02/2017	06/02/2017	Monthly	1	6	6
UPSS Environmentally Sensitive Zones	Department of Environment, Climate Change and Water (NSW)	14/04/2015	12/01/2010	As required	1	1	1
Points of Interest	Land and Property Information	10/04/2015	01/04/2015	Annually	0	0	1
Tanks (Areas)	Land and Property Information	10/04/2015	01/04/2015	Annually	0	0	0
Tanks (Points)	Land and Property Information	10/04/2015	01/04/2015	Annually	0	0	0
State Forest	Land and Property Information	01/02/2017	29/06/2016	As required	0	0	0
NSW National Parks and Wildlife Service Reserves	NSW Office of Environment and Heritage	01/02/2017	31/12/2016	Annually	0	0	0
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1	1	1
Groundwater Boreholes	NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corporation; Commonwealth of Australia (Bureau of Meteorology) 2015	21/03/2016	01/12/2015	Annually	0	0	14
Geological Units 1:250,000	NSW Department of Industry, Resources & Energy	20/08/2014		None planned	2	-	5
Geological Structures 1:250,000	NSW Department of Industry, Resources & Energy	20/08/2014		None planned	0	-	0
Naturally Occurring Asbestos Potential	NSW Department of Industry, Resources & Energy	04/12/2015	24/09/2015	Unknown	0	0	0
Soil Landscapes	NSW Office of Environment and Heritage	12/08/2014		None planned	2	-	6
Standard Local Environmental Plan Acid Sulfate Soils	NSW Planning and Environment	07/10/2016	07/10/2016	As required	2	-	-
Dryland Salinity Assessment	National Land and Water Resources Audit	18/07/2014	12/05/2013	None planned	0	0	0
Mining Subsidence Districts	Land and Property Information	31/08/2016	31/08/2016	As required	0	0	0
SEPP 14 - Coastal Wetlands	NSW Planning and Environment	17/12/2015	24/10/2008	Annually	0	0	1
SEPP 26 - Littoral Rainforest	NSW Planning and Environment	17/12/2015	05/02/1988	Annually	0	0	0
SEPP 71 - Coastal Protection	NSW Planning and Environment	17/12/2015	01/08/2003	Annually	0	0	1
SEPP Major Developments 2005	NSW Planning and Environment	09/03/2013	25/05/2005	Under Review	0	0	0
SEPP Strategic Land Use Areas	NSW Planning and Environment	06/07/2016	28/01/2014	Annually	0	0	0
Local Environmental Plan - Land Zoning	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	2	3	7
Local Environmental Plan - Minimum Subdivision Lot Size	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	1	-	-
Local Environmental Plan - Height of Building	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	1	-	-
Local Environmental Plan - Floor Space Ratio	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	0	-	-

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Local Environmental Plan - Land Application	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	2	-	-
Local Environmental Plan - Land Reservation Acquisition	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	0	-	-
State Heritage Items	NSW Planning and Environment	03/01/2017	30/10/2015	Quarterly	0	0	0
Local Heritage Items	NSW Planning and Environment	03/01/2017	04/09/2016	Quarterly	0	0	0
Bushfire Prone Land	NSW Rural Fire Service	11/11/2016	12/08/2016	Quarterly	2	2	2
Eastern Bushland Database (North Region)	NSW Office of Environment and Heritage	24/07/2016	01/01/1991	None planned	1	1	2
RAMSAR Wetlands	Commonwealth of Australia Department of the Environment	08/10/2014	24/06/2011	As required	0	0	0
ATLAS of NSW Wildlife	NSW Office of Environment and Heritage	10/02/2017	10/02/2017	Daily	-	-	-

Aerial Imagery 2015

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Aerial Imagery © 2016 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.

Coordinate System: GDA 1994 MGA Zone 56

Date: 13 February 2017

Contaminated Land & Waste Management Facilities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the report buffer:

Map Id	Site	Address	Suburb	Activity	EPA site management class	Status	Dist	Direction	LC
N/A	No records in buffer								

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

EPA site management class	Explanation
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised.
Regulation under the CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required.
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order.

Contaminated Land & Waste Management Facilities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Contaminated Land: Records of Notice

Record of Notices within the report buffer:

Map Id	Area No	Name	Address	Suburb	Notices	Distance	Direction	LC
N/A	No records in buffer							

Contaminated Land Records of Notice Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority
Terms of use and disclaimer for Contaminated Land: Record of Notices, please visit
http://www.epa.nsw.gov.au/clm/clmdisclaimer.htm

Former Gasworks

Former Gasworks within the report buffer:

Map Id	Location	Council	Further Info	Distance	Direction	LC
N/A	No records in buffer					

Former Gasworks Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

National Waste Management Site Database

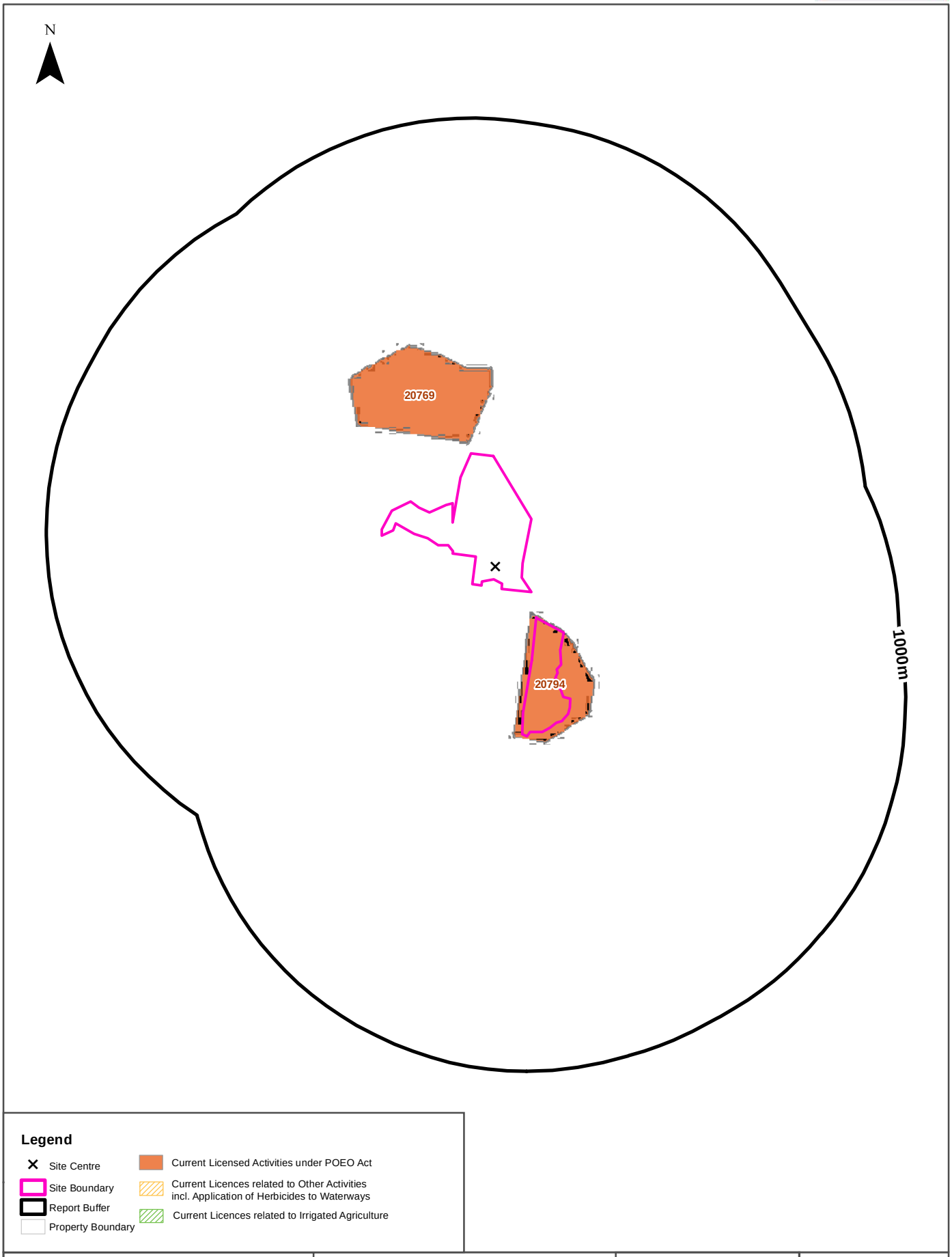
Sites on the National Waste Management Site Database within the report buffer:

Site Id	Owner	Name	Address	Suburb	Postcode	Landfill	Reprocess	Transfer	Distance	Direction	LC
N/A	No records in buffer										

Wate Management Facilities Data Source: Australian Governement Geoscience Australia
Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Current EPA Licensed Activities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



EPA Activities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Licensed Activities under the POEO Act 1997

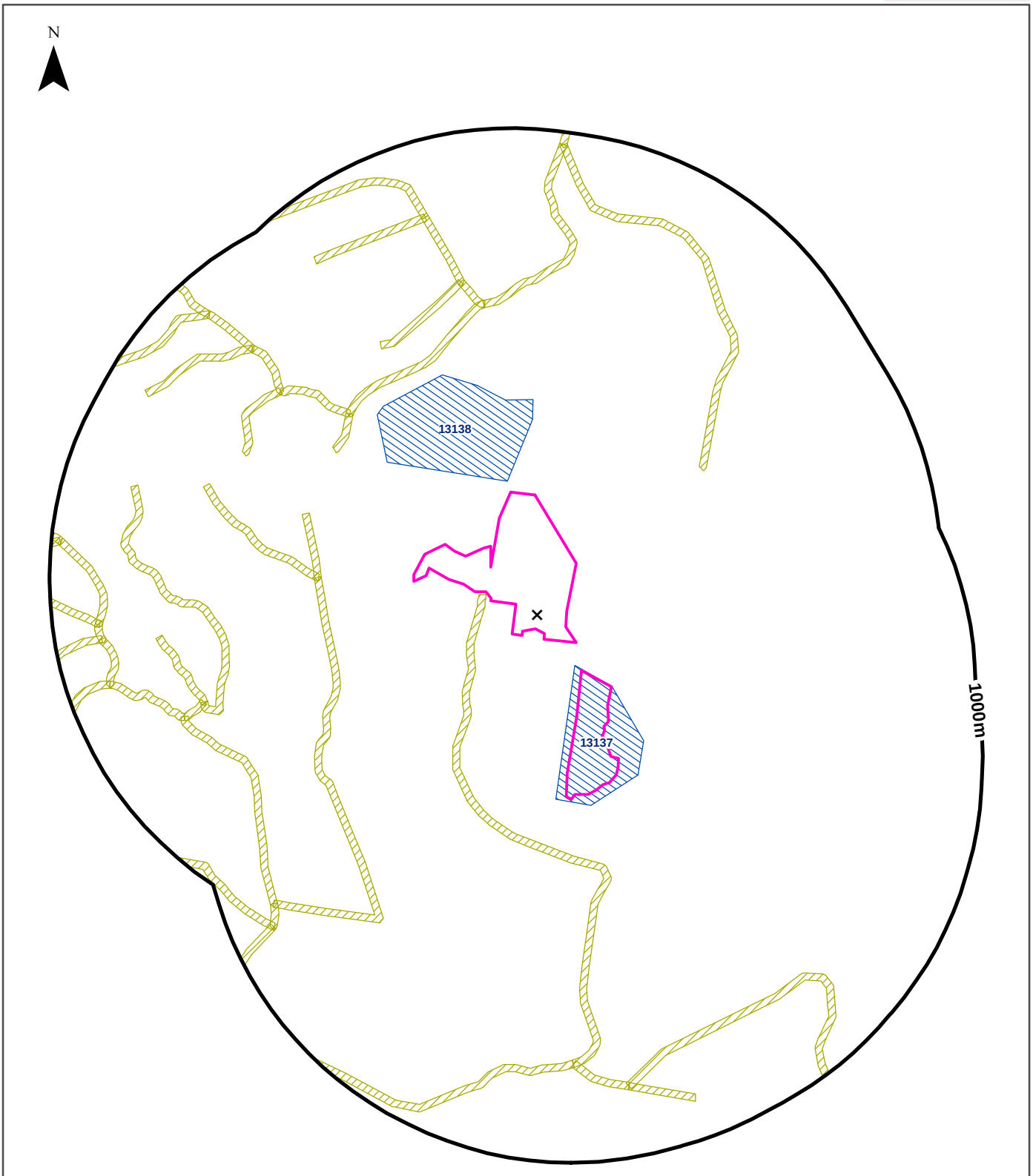
Licensed activities under the Protection of the Environment Operations Act 1997, within the report buffer:

EPL	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
20794	QUARRY SOLUTIONS PTY LTD	Eatons Quarry	Old Bagotville Road, BAGOTVILLE, NSW 2477		Land-based extractive activity	1	0m	Onsite
20769	QUARRY SOLUTIONS PTY LTD	Montis Pit	Old Bagotville Road, BAGOTVILLE, NSW 2477		Land-based extractive activity	1	31m	North West

POEO Licence Data Source: Environment Protection Authority

Delicensed & Former Licensed EPA Activities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Legend

- Site Centre
- Site Boundary
- Report Buffer
- Property Boundary
- Delicensed Activities still Regulated by EPA
- Former Licensed/Regulated Activities (revoked or surrendered)
- Surrendered Licences related to Other Activities on Waterways incl. Application of Herbicides

Scale:	Data Sources:	Coordinate System:	Date:
0 100 200 400 Meters	Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017	GDA 1994 MGA Zone 56	10February 2017

EPA Activities

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the report buffer:

Licence No	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
N/A	No records in buffer							

Delicensed Activities Data Source: Environment Protection Authority

Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the report buffer:

Licence No	Organisation	Location	Status	Issued Date	Activity	Loc Conf	Distance	Direction
13137	SEE CIVIL PTY LTD	Old Bagotville Road, BAGOTVILLE, NSW 2477	Surrendered	19/10/2009	Land-based extractive activity	1	0m	Onsite
4292	FAR NORTH COAST COUNTY COUNCIL	COUNTY DISTRICT - LISMORE NSW 2480	Surrendered		Other Activities / Non Scheduled Activity - Application of Herbicides	7	4m	-
4653	LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW	Surrendered		Other Activities / Non Scheduled Activity - Application of Herbicides	7	4m	-
4838	Robert Orchard	Various Waterways throughout New South Wales - SYDNEY NSW 2000	Surrendered		Other Activities / Non Scheduled Activity - Application of Herbicides	7	4m	-
6630	SYDNEY WEED & PEST MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148	Surrendered		Other Activities / Non Scheduled Activity - Application of Herbicides	7	4m	-
13138	SEE CIVIL PTY LTD	Old Bagotville Road, BAGOTVILLE, NSW 2477	Surrendered	19/10/2009	Land-based extractive activity	1	31m	North West

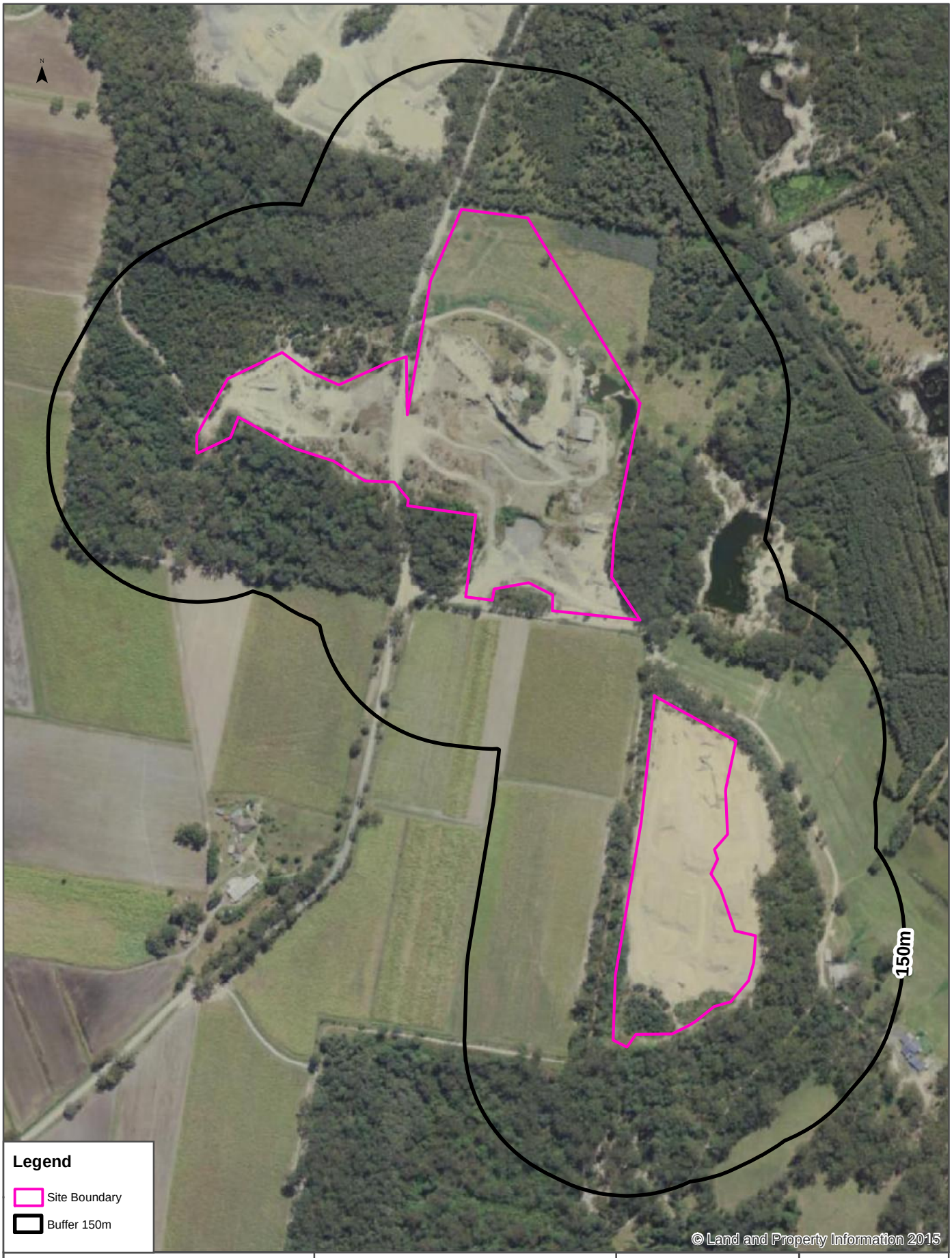
Former Licensed Activities Data Source: Environment Protection Authority

UPSS Sensitive Zones

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Aerial Imagery 2009

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Scale: 0 50 100 200 Meters

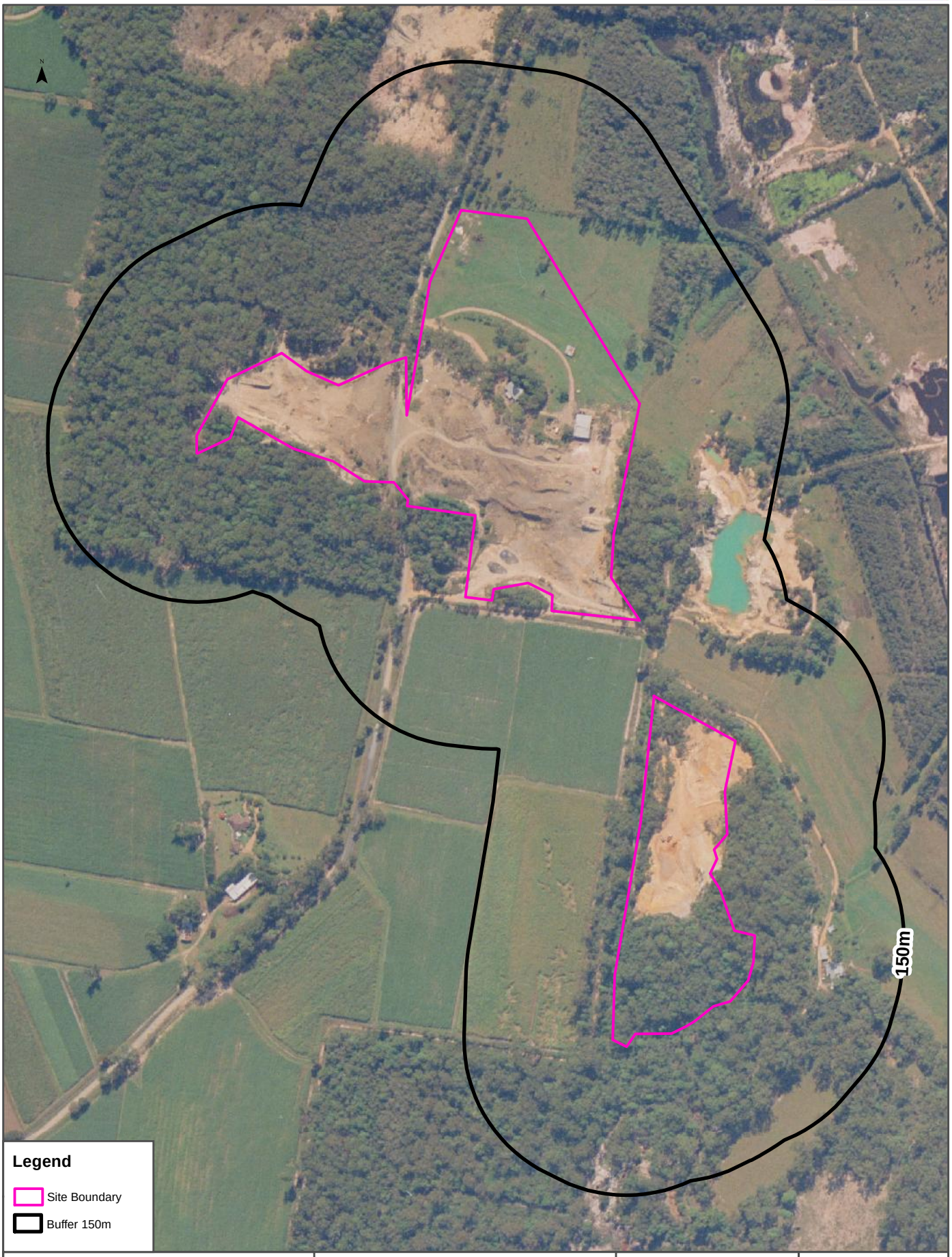
Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)

Coordinate System: GDA 1994 MGA Zone 56

Date: 08 February 2017

Aerial Imagery 1997

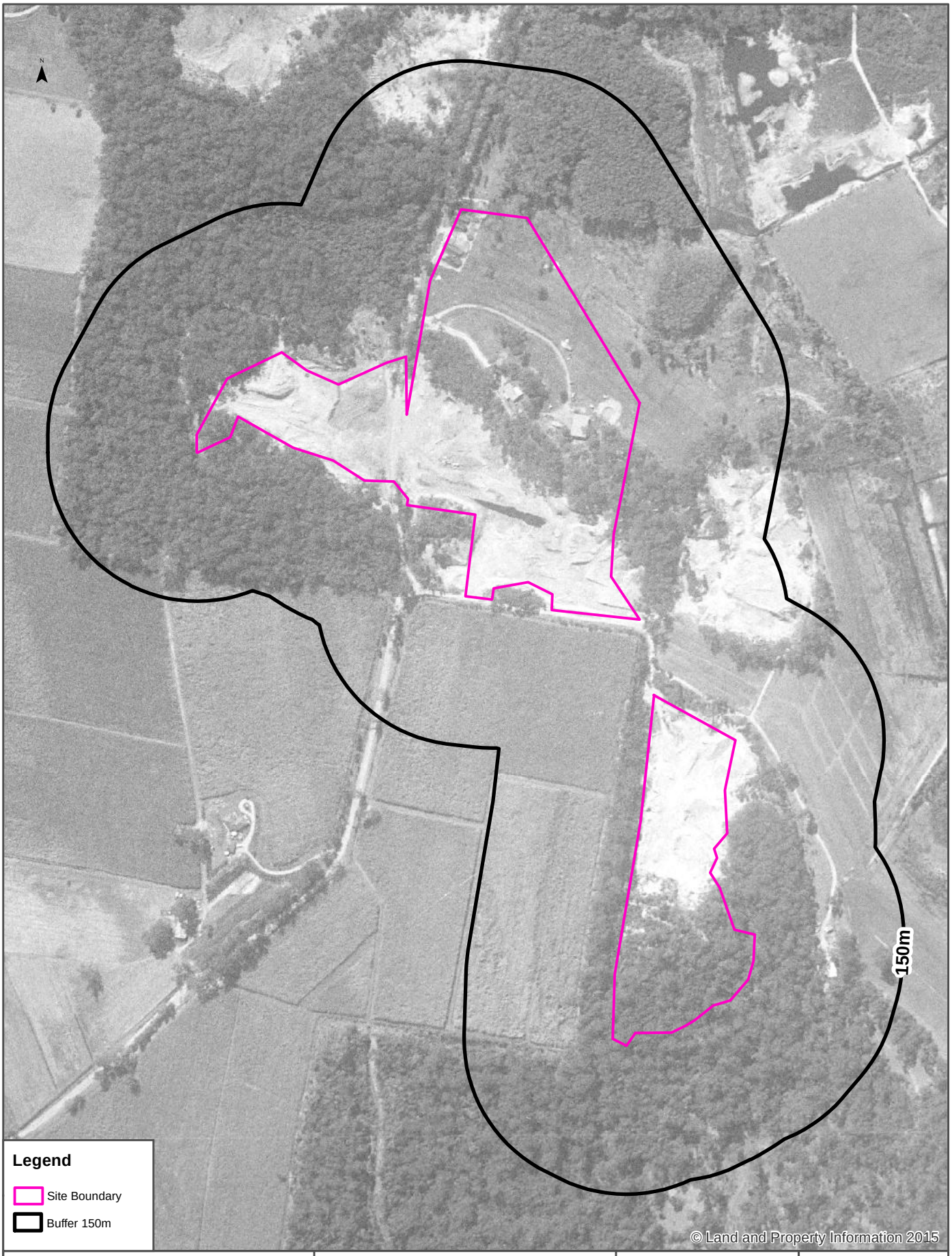
Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Scale: 0 50 100 200 Meters	Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)	Coordinate System: GDA 1994 MGA Zone 56	Date: 13 February 2017

Aerial Imagery 1987

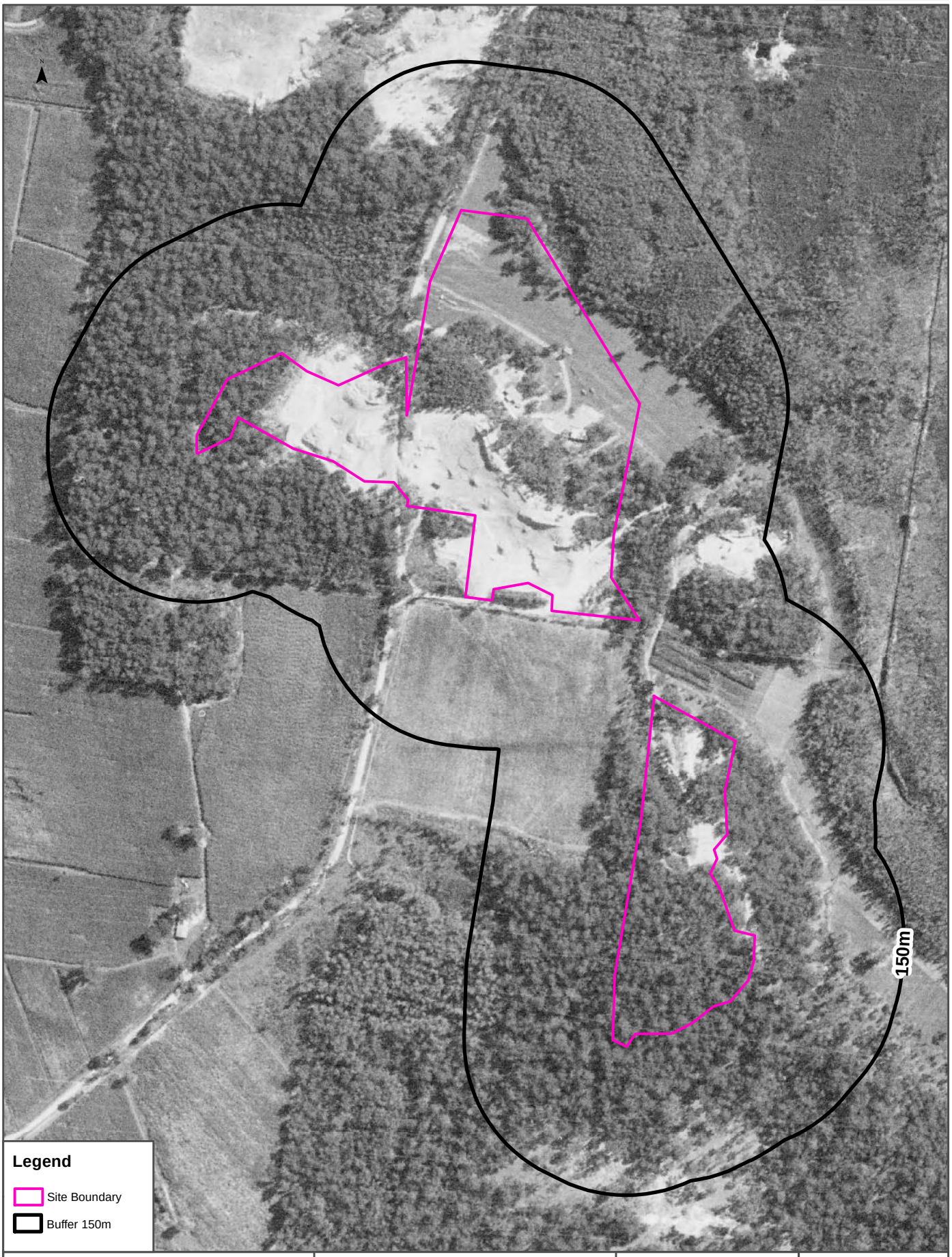
Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Scale: 0 50 100 200 Meters	Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)	Coordinate System: GDA 1994 MGA Zone 56	Date: 13 February 2017

Aerial Imagery 1979

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



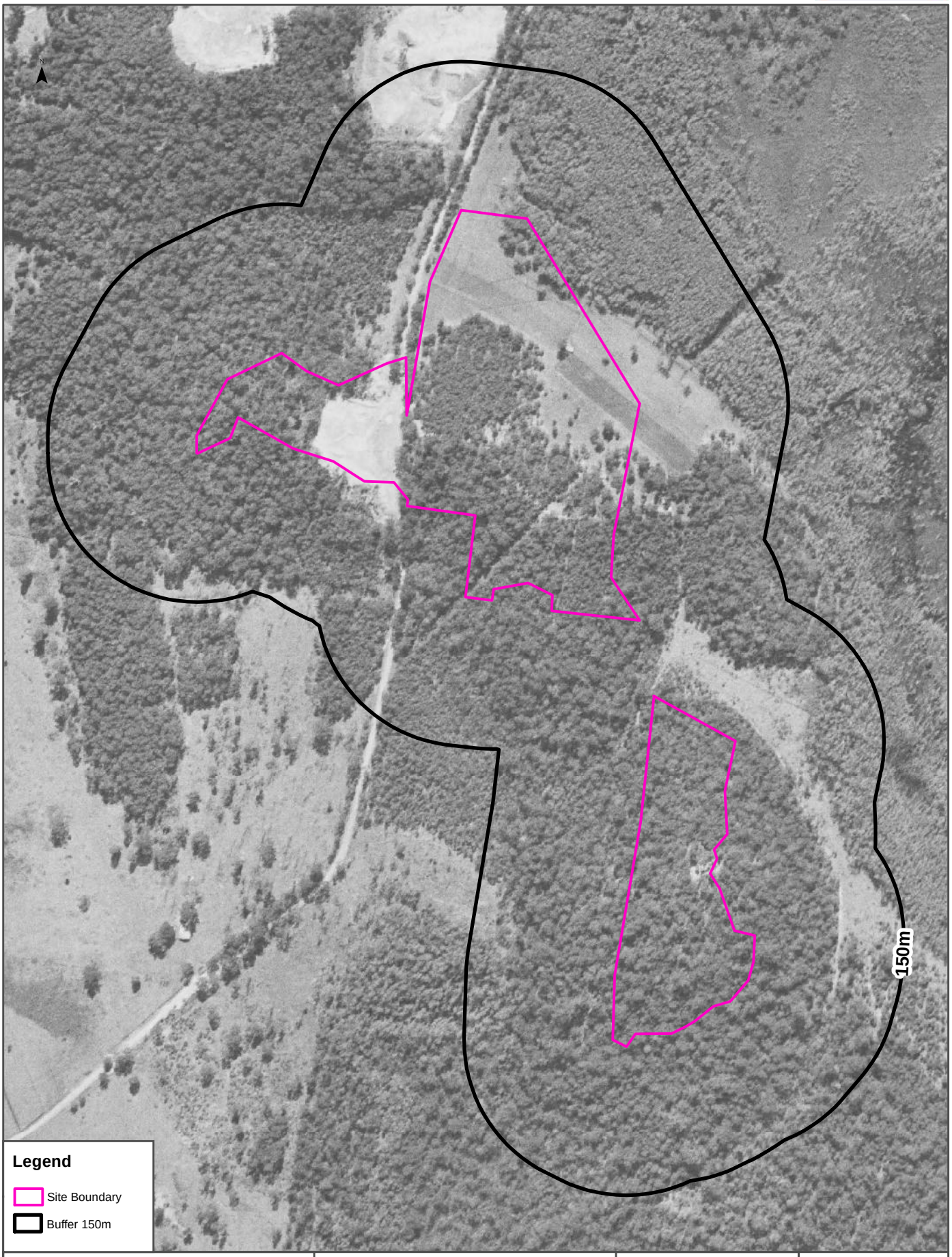
Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)

Coordinate System: GDA 1994 MGA Zone 56

Date: 13 February 2017

Aerial Imagery 1971

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



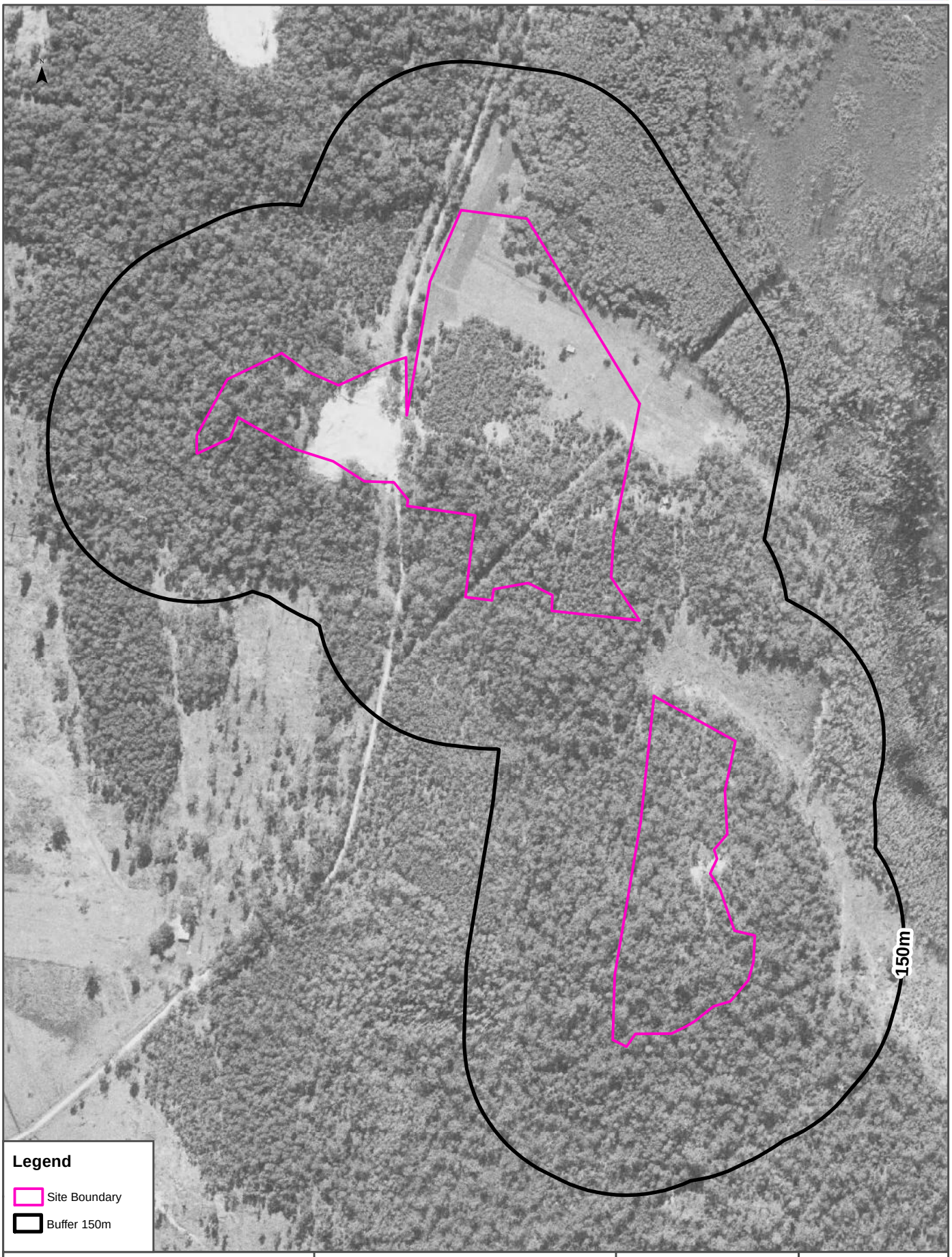
Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)

Coordinate System: GDA 1994 MGA Zone 56

Date: 13 February 2017

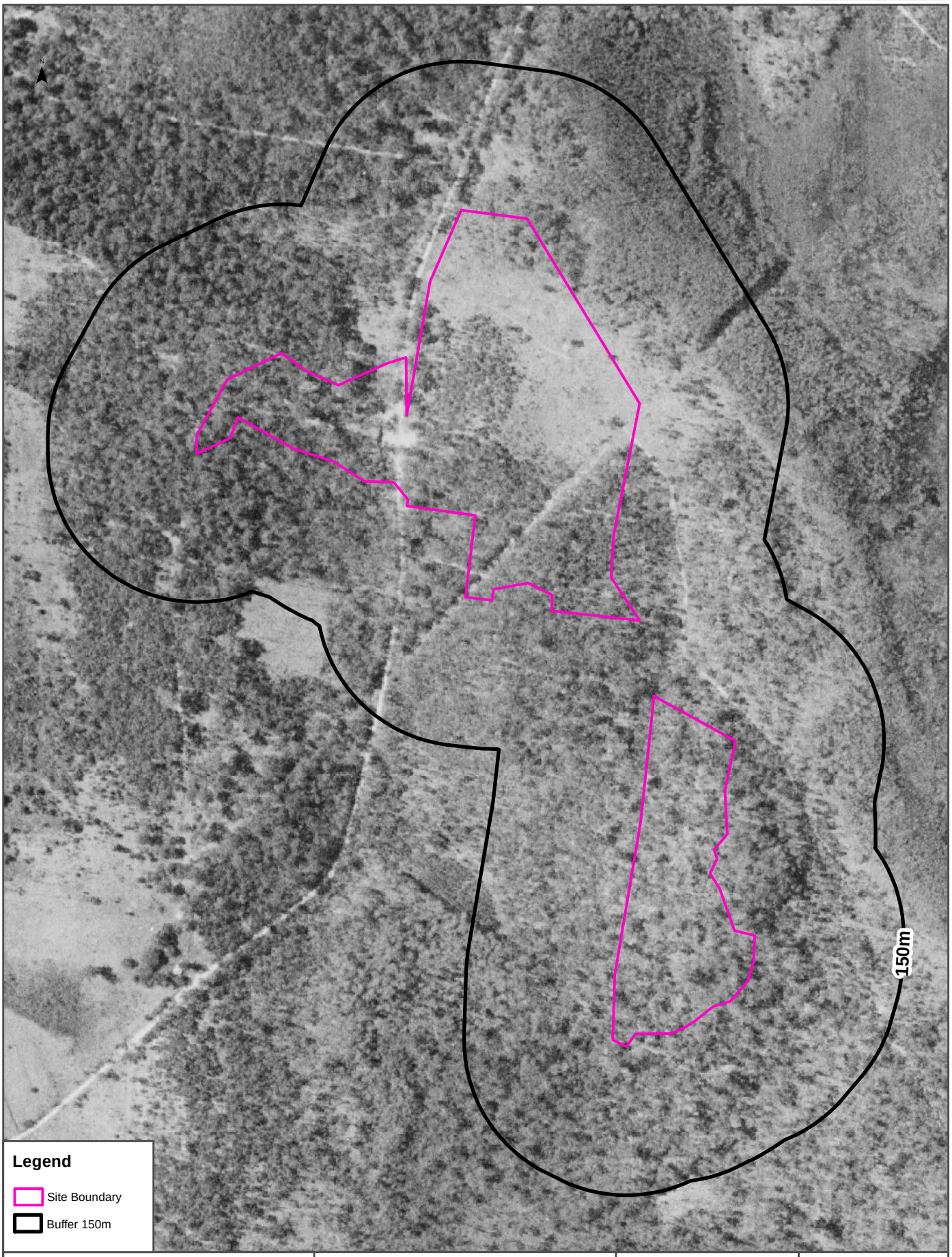
Aerial Imagery 1967

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Aerial Imagery 1958

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



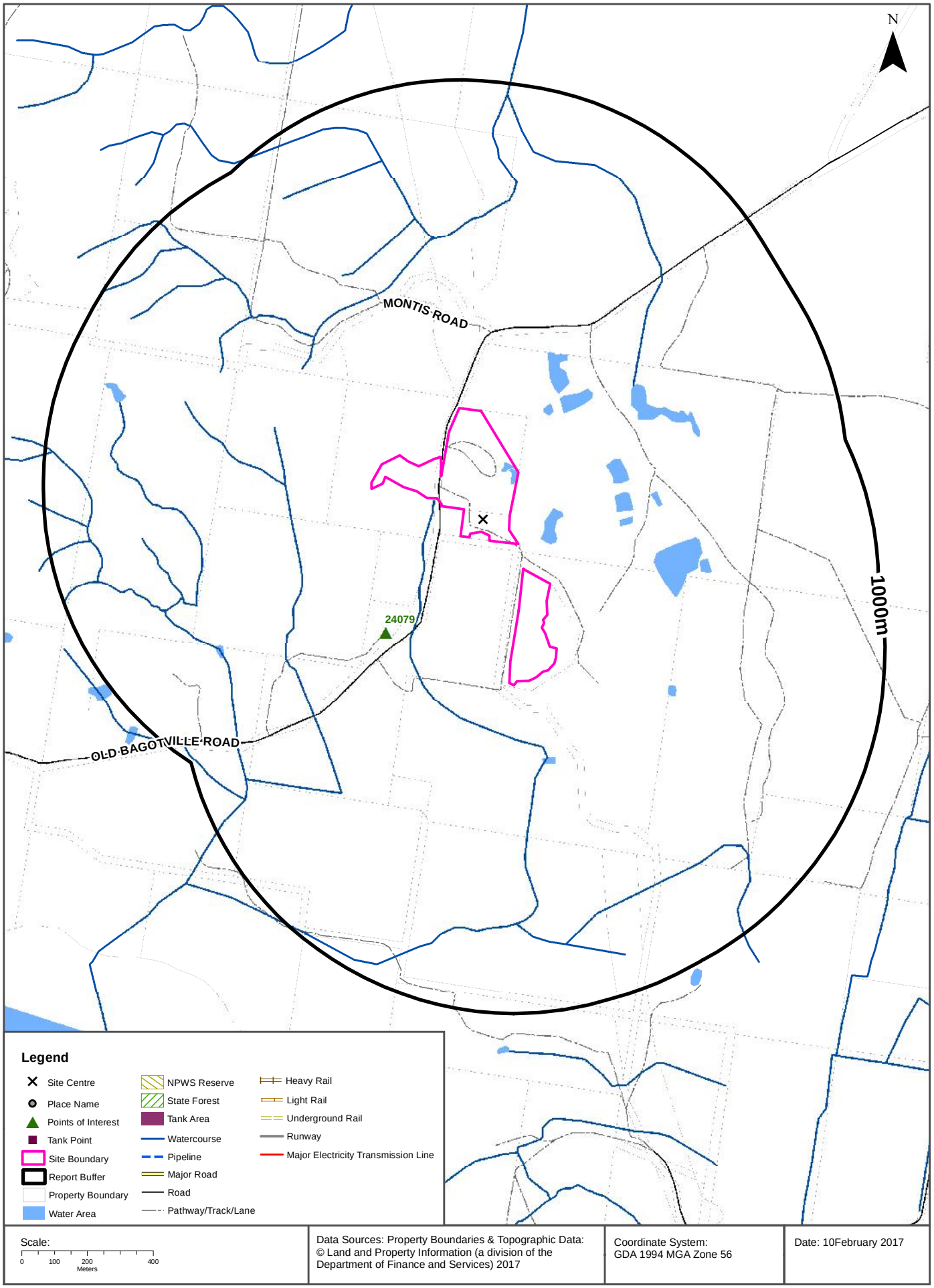
Data Sources: Historical Aerials: © Land and Property Information (a division of the Department of Finance and Services)

Coordinate System: GDA 1994 MGA Zone 56

Date: 13 February 2017

Topographic Features

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Topographic Features

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Points of Interest

What Points of Interest exist within the report buffer?

Map Id	Feature Type	Label	Distance	Direction
24079	Homestead	PINEHAVEN	374m	South West

Tanks (Areas)

What are the Tank Areas located within the report buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Capture Method	Feature Currency	Distance	Direction
N/A	No records in buffer						

Tanks (Points)

What are the Tank Points located within the report buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Capture Method	Feature Currency	Distance	Direction
N/A	No records in buffer						

Topographic Features

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

State Forest

What State Forest exist within the report buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

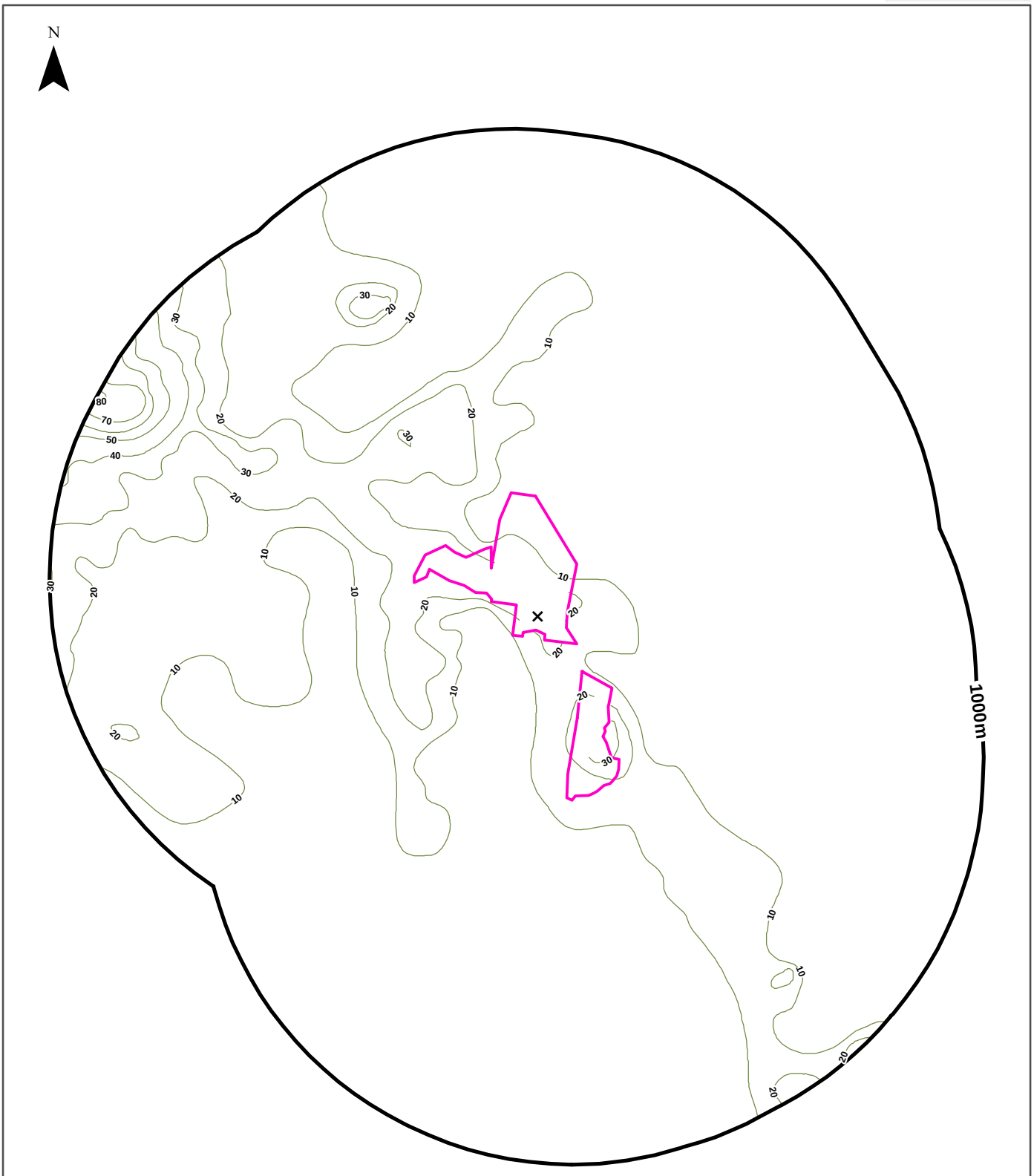
National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the report buffer?

Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N/A	No records in buffer				

Elevation Contours (m AHD)

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Legend

- Site Centre
- Elevation Contour (m AHD)
- Site Boundary
- Report Buffer
- Property Boundary

Accuracy & Currency: This contour data can be up to 0.4 of the contour interval out in height and must therefore not be used for any design or engineering works, but only as a general guide to topography. Gaps may occur along contour lines due to vertical topography, obscured topography in the source photography such as buildings, dense vegetation or dead ground, or the fact that original buildings have been replaced in the intervening thirty years since the original contour capture.

Scale: 0 100 200 400 Meters

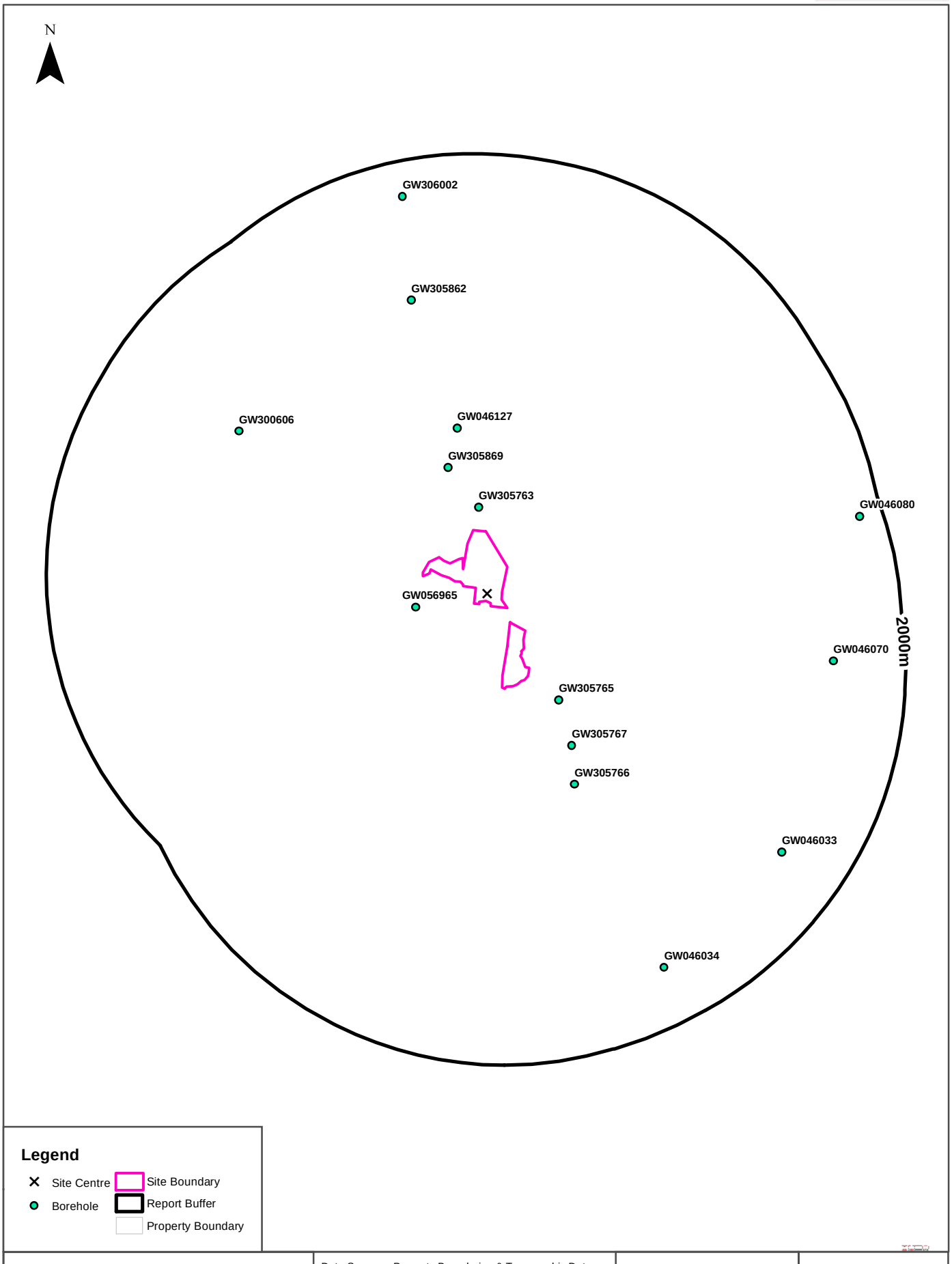
Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Groundwater Boreholes

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Hydrogeology & Groundwater

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Hydrogeology

Description of aquifers on-site:

Description
Fractured or fissured, extensive aquifers of low to moderate productivity

Description of aquifers within the report buffer:

Description
Fractured or fissured, extensive aquifers of low to moderate productivity

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)
Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Groundwater Boreholes

Boreholes within 2km of the site:

GW No.	Licence No	Work Type	Owner Type	Purpose	Contractor	Complete Date	Final Depth	Drilled Depth	Salinity	SWL	Yield	Elev	Dist	Dir
GW305763	30BL184054	Bore	D.M.R. & N.S.W. G.R.	Monitoring		29/05/2006	11.90	11.90		2.25			122m	North
GW056965	30BL124363	Bore	Private	General Use		01/12/1982	30.00	30.00					171m	West
GW305765	30BL184041	Bore	D.M.R. & N.S.W. G.R.	Monitoring		17/02/2006	9.60	9.60					208m	South East
GW305869	30BL184096	Bore	Private	Monitoring		24/03/2006	10.00	10.00					357m	North
GW305767	30BL184041	Bore	D.M.R. & N.S.W. G.R.	Monitoring		31/01/2006	8.00	8.00					429m	South East
GW046127	30BL103571	Well	Private	Stock		01/01/1900	3.70	3.70	V.Brackish				548m	North
GW305766	30BL184041	Bore	D.M.R. & N.S.W. G.R.	Monitoring		31/01/2006	4.05	4.05		1.50			614m	South East
GW300606	30BL177599	Bore		Domestic	Maxwell Thomas Ritter	30/01/1997	33.00	33.00	Good	10.00	2.125		1223m	North West
GW305862	30BL184192	Bore	Private	Monitoring		01/06/2006	8.25	8.25		0.50			1264m	North
GW046070	30BL104926	Spear	Private	General Use		01/01/1971	12.20	12.20	Poor				1618m	East
GW046033	30BL104910	Spear	Private	Domestic			10.70	10.70	Poor				1642m	South East
GW046034	30BL104911	Well	Private	Domestic			2.40	2.40	Good				1696m	South East
GW306002	30BL184330	Bore	Private	Monitoring	North Coast Drilling	15/09/2006	8.95	8.95		0.80			1810m	North
GW046080	30BL104937	Spear	Private	General Use		01/10/1975	5.50	6.10	Hard				1877m	East

Borehole Data Source : NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corporation for all bores prefixed with GW. All other bores © Commonwealth of Australia (Bureau of Meteorology) 2015. Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Hydrogeology & Groundwater

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

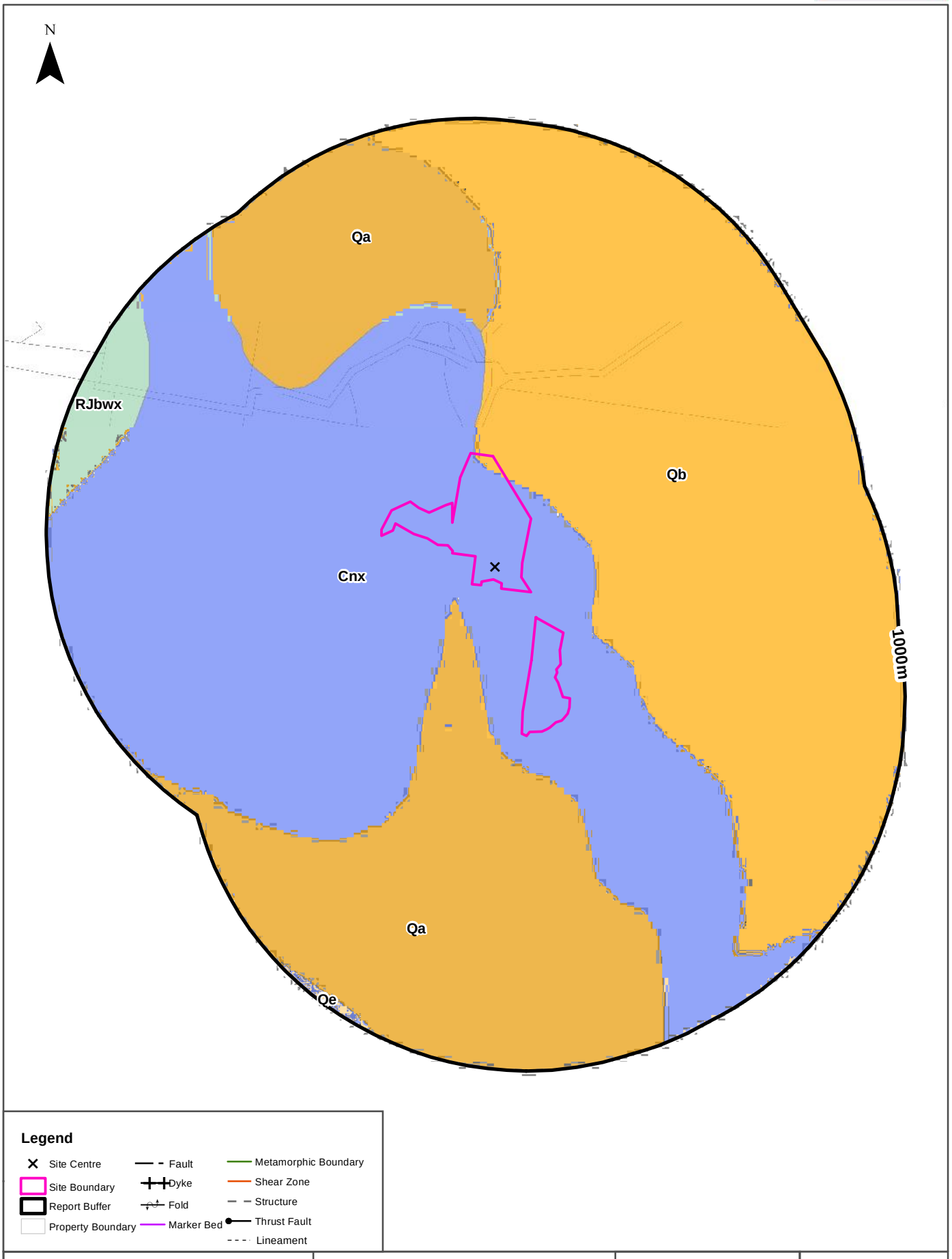
Driller's Logs

Drill log data relevant to the boreholes within 2km of the site:

Groundwater No	Drillers Log	Distance	Direction
GW305763	0.00m-2.25m silty clay, high plasticity, pale grey 2.25m-6.20m sand,fg, grey 6.20m-11.90m sandy clay, m-h plasticity, pale grey	122m	North
GW056965	0.00m-2.00m Clay 2.00m-24.00m Shale 24.00m-28.00m Quartz Shale Water Supply 28.00m-30.00m Blue Metal	171m	West
GW305765	0.00m-0.40m silty clay, fill brown 0.40m-2.45m sandy clay, low plasticity, red brown 2.45m-4.30m sandstone, pale grey & brown 4.30m-9.60m siltstone, pale brown & grey indistinct laminators	208m	South East
GW305869	0.00m-0.50m fill, gravely clay, brown, cg, fg, dense 0.50m-2.60m sandy clay, pale grey, fg, hrd 2.60m-10.00m siltstone, grey, fg, med to hrd	357m	North
GW305767	0.00m-1.50m silty clay, low plasticity, mottled red and brown 1.50m-6.70m sandstone, fg, pale brown 6.70m-8.00m siltstone, pale grey	429m	South East
GW046127	0.00m-1.83m Sand 1.83m-3.66m Sand Indurated Water Supply	548m	North
GW305766	0.00m-1.50m silty clay, med - high plasticity grey 1.50m-3.75m clayey silty sand, fg, pale grey 3.75m-4.05m silty clay, high plasticity, pale grey mottled red	614m	South East
GW300606	0.00m-1.00m Top soil 1.00m-3.00m Clay 3.00m-10.00m Decomposed shale 10.00m-15.00m Shale 15.00m-28.00m Sandstone 28.00m-29.00m Shale 29.00m-33.00m Basalt	1223m	North West
GW305862	0.00m-2.00m silty sand, grey fg dense 2.00m-3.50m clayey sand, grey fg very dense 3.50m-7.25m sand, pale grey, fg, very dense 7.25m-8.25m sandy clay, grey fg, stiff	1264m	North
GW046070	0.00m-0.30m Soil 0.30m-10.67m Sand Clay 10.67m-12.19m Sand White Water Supply	1618m	East
GW046033	0.00m-0.61m Clay Topsoil 0.61m-1.83m Clay 1.83m-6.10m Sand Water Supply 6.10m-9.75m Clay Sandy 9.75m-10.67m Sand Coarse Water Supply	1642m	South East
GW046034	0.00m-2.13m Driller 2.13m-2.44m Sand Water Supply	1696m	South East
GW306002	0.00m-0.80m silty sand, fg, drk grey 0.80m-3.20m sand, fg, pale brwn, with some silt 3.20m-5.75m silty sand, fg, drk brn 5.75m-8.95m clay, high plasticity, pale grey & red	1810m	North
GW046080	0.00m-0.46m Peat Alluvial 0.46m-1.83m Clay 1.83m-6.10m Sand Water Supply	1877m	East

Geology 1:250,000

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Geology

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Geological Units

What are the Geological Units onsite?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Cnx	Feldspathic & lithic meta-arenite, metaSiltstone, chert, jasper, basic meta-volcanics, conglomerate. They are a thick sequence of proximal to distal turbidites with structurally intercalated or stratigraphically underlying chert, jasper & metabasalt	Neranleigh-Fernvale beds						1:250,000
Qb	Prograded barrier beach, foredune & shoreface sands, barrier dune sand & terrestrial dunes & dune deflation areas & backbarrier - washover sand sheets & transgressive barrier deposits				Cainozoic			1:250,000

What are the Geological Units within the report buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Cnx	Feldspathic & lithic meta-arenite, metaSiltstone, chert, jasper, basic meta-volcanics, conglomerate. They are a thick sequence of proximal to distal turbidites with structurally intercalated or stratigraphically underlying chert, jasper & metabasalt	Neranleigh-Fernvale beds						1:250,000
Qa	Undifferentiated alluvial deposits; sand, silt, clay and gravel; some residual and colluvial deposits. Includes some channel, levee, lacustrine, flooplain and swamp deposits. May include some higher level Tertiary terraces				Cainozoic			1:250,000
Qb	Prograded barrier beach, foredune & shoreface sands, barrier dune sand & terrestrial dunes & dune deflation areas & backbarrier - washover sand sheets & transgressive barrier deposits				Cainozoic			1:250,000
Qe	Transgressive tidal delta & channel sands & muddy sands, central basin muds, & fluvial bay-head deltas & shoreline deposits of silty sands with rare shells				Cainozoic			1:250,000

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
RJbwx	Comprises Ripley Road sandstone, thick-bedded, coarse-grained, crossbedded, quartz arenite & conglomerate; & Raceview Formation, thinly interbedded, fine-grained. lithic to quartz arenite, siltstone & claystone, minor pebble conglomerate; minor coal		Bundamba Group	Woogaroo Subgroup	Mesozoic			1:250,000

Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Map Sheet	Dataset
No features				1:250,000

What are the Geological Structures within the report buffer?

Feature	Name	Description	Map Sheet	Dataset
No features				1:250,000

Geological Data Source : NSW Department of Industry, Resources & Energy

Naturally Occurring Asbestos Potential

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Naturally Occurring Asbestos Potential

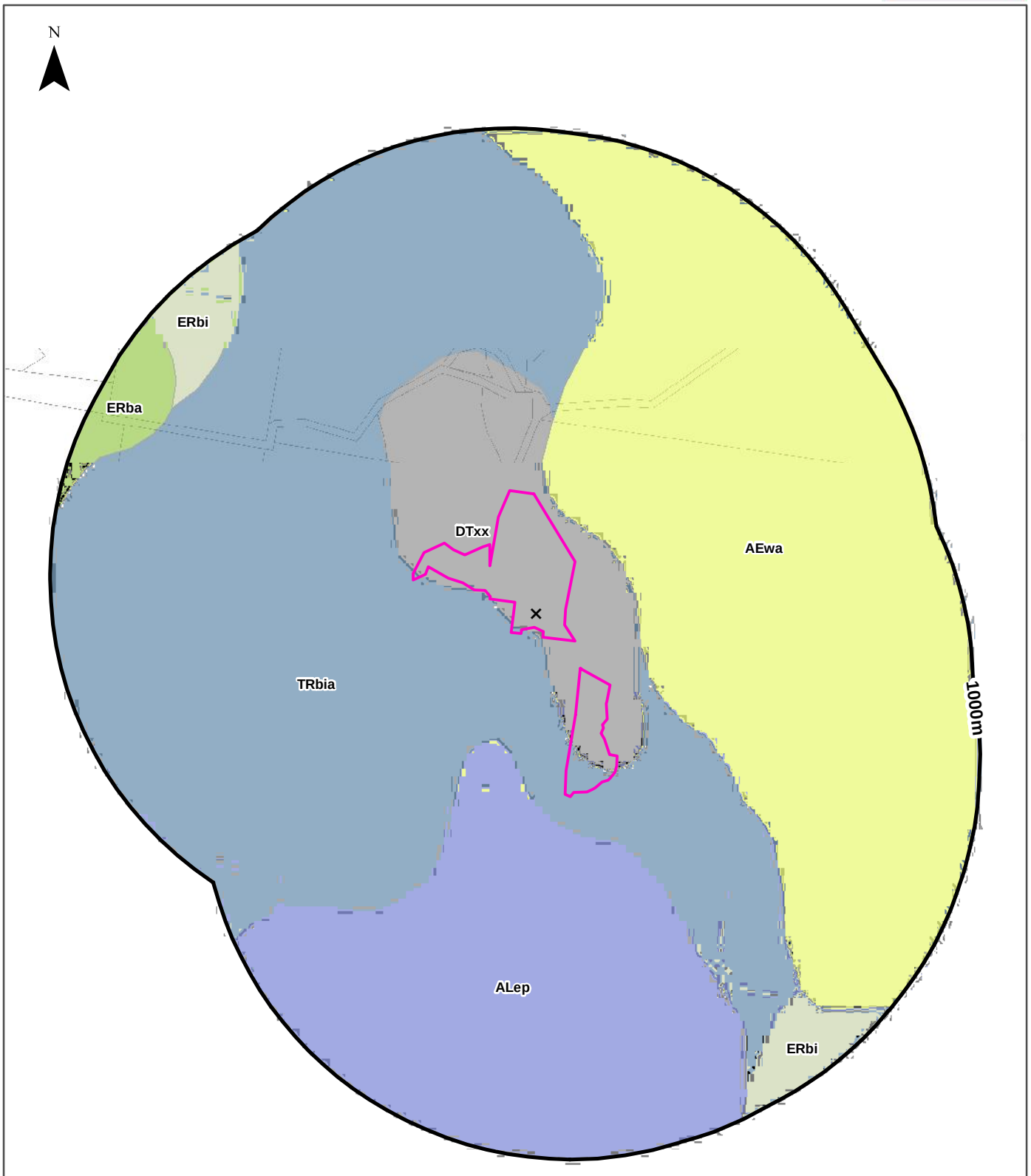
Naturally Occurring Asbestos Potential within the report buffer?

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Mining Subsidence District Data Source: © State of New South Wales through NSW Department of Industry, Resources & Energy

Soil Landscapes

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Soils

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Soil Landscapes

What are the onsite Soil Landscapes?

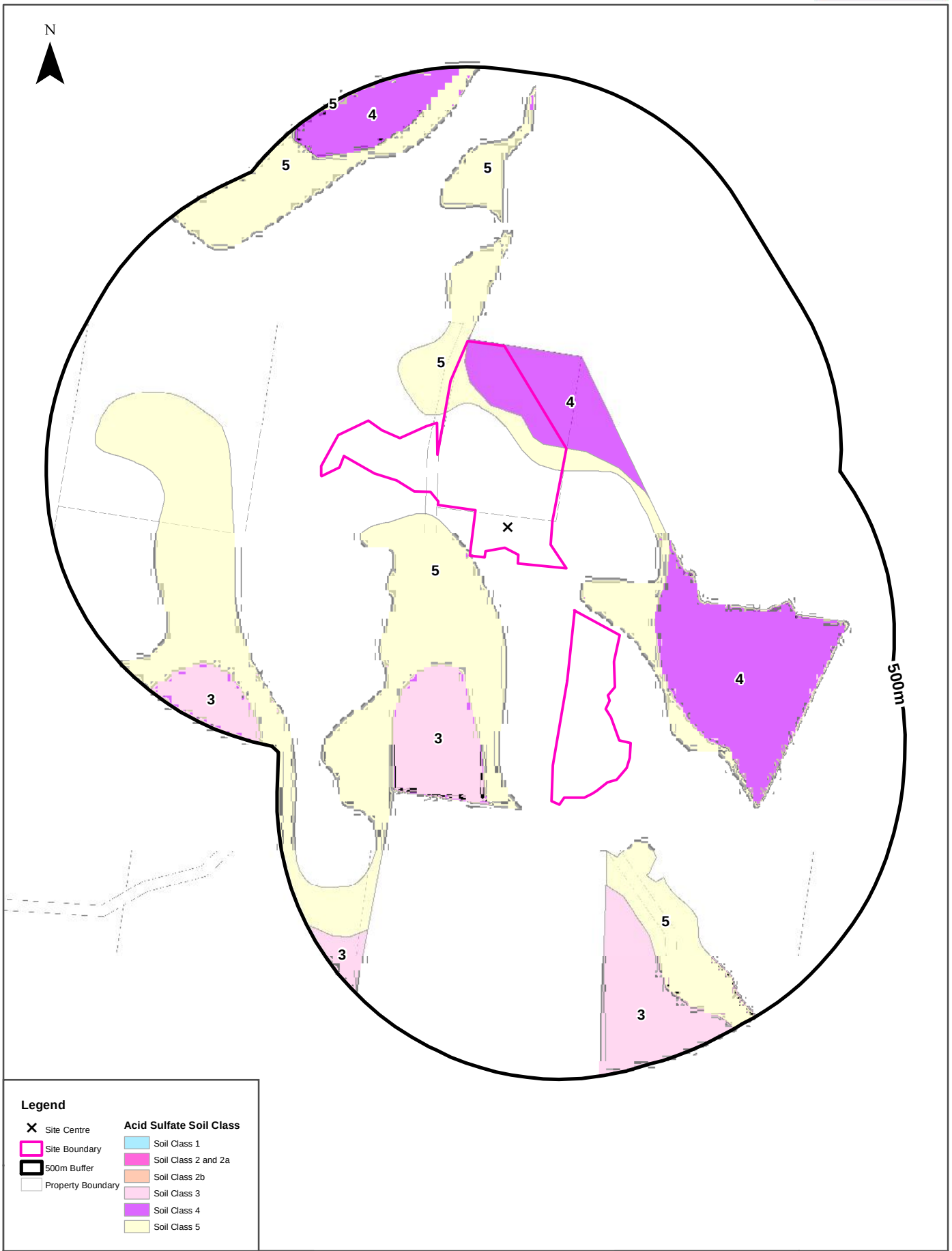
Soil Code	Name	Group	Process	Map Sheet	Scale
DTxx	DISTURBED TERRAIN		DISTURBED TERRAIN	Lismore & Ballina	1:100,000
TRbia	BILLINUDGEL variant a		TRANSFERRAL	Lismore & Ballina	1:100,000

What are the Soil Landscapes within the report buffer?

Soil Code	Name	Group	Process	Map Sheet	Scale
AEwa	WARDELL		AEOLIAN	Lismore & Ballina	1:100,000
ALep	EMPIRE VALE		ALLUVIAL	Lismore & Ballina	1:100,000
DTxx	DISTURBED TERRAIN		DISTURBED TERRAIN	Lismore & Ballina	1:100,000
ERba	BAGOTVILLE		EROSIONAL	Lismore & Ballina	1:100,000
ERbi	BILLINUDGEL		EROSIONAL	Lismore & Ballina	1:100,000
TRbia	BILLINUDGEL variant a		TRANSFERRAL	Lismore & Ballina	1:100,000

Acid Sulfate Soils

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Standard Local Environmental Plan Acid Sulfate Soils

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Standard Local Environmental Plan Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

Soil Class	Description	LEP
4	Works more than 2 metres below natural ground surface present an environmental risk; Works by which the watertable is likely to be lowered more than 2 metres below natural ground surface, present an environmental risk	Ballina Local Environmental Plan 2012

If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	LEP	Distance	Direction
N/A				

Dryland Salinity

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Dryland Salinity

Is there Dryland Salinity data onsite?

No

Is there Dryland Salinity data within the report buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A	N/A	N/A

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Mining Subsidence Districts

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

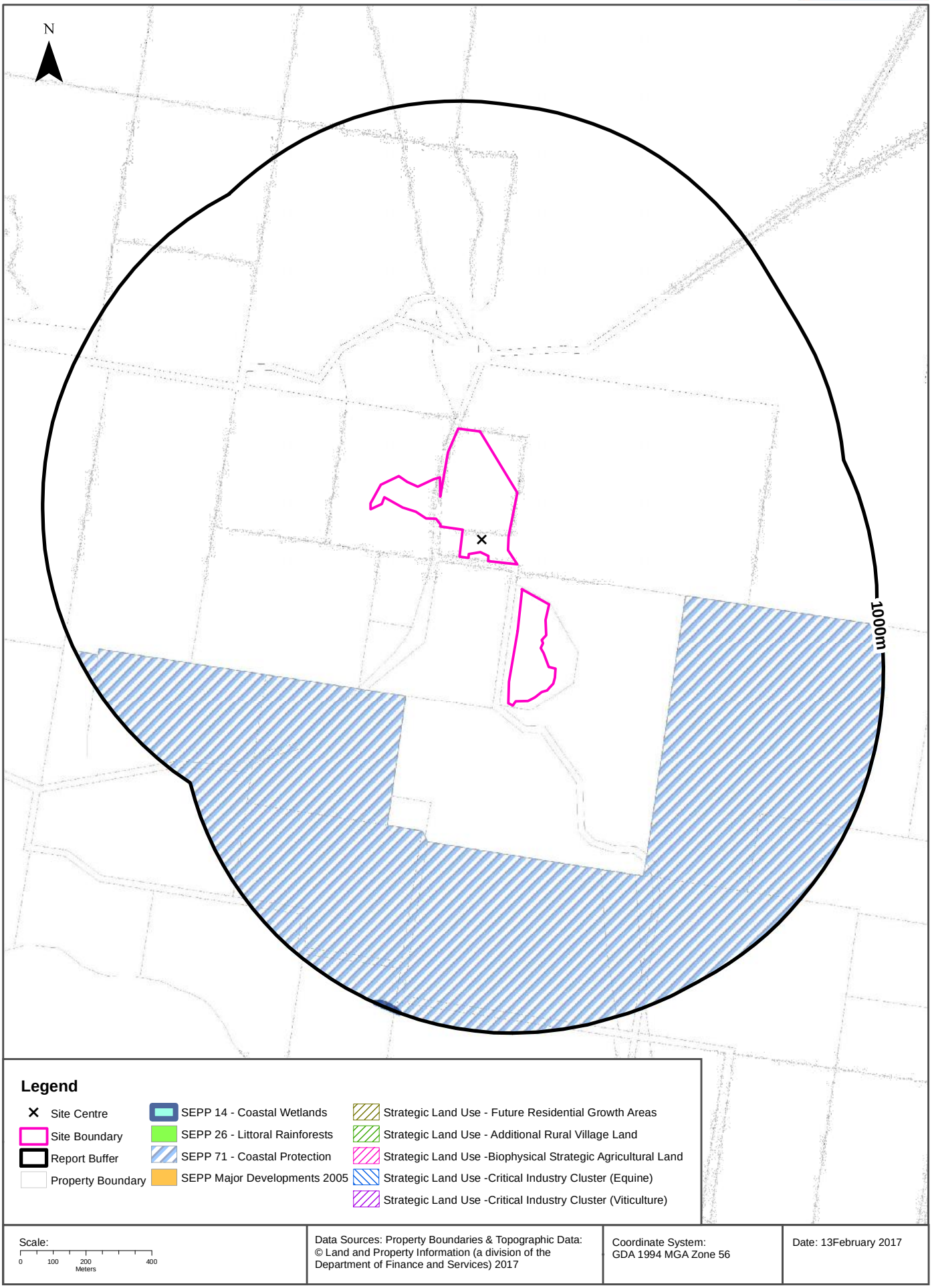
Mining Subsidence Districts

Mining Subsidence Districts within the report buffer?

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

State Environmental Planning Policy

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Environmental Zoning

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

State Environmental Planning Policy Protected Areas

Are there any State Environmental Planning Policy Protected Areas onsite or within the report buffer?

Dataset	Onsite	Within Site Buffer	Distance
SEPP14 - Coastal Wetlands	No	Yes	991m
SEPP26 - Littoral Rainforests	No	No	N/A
SEPP71 - Coastal Protection Zone	No	Yes	314m

SEPP Protected Areas Data Source: NSW Department of Planning & Environment

State Environmental Planning Policy Major Developments (2005)

State Environmental Planning Policy Major Developments within the report buffer?

Map Id	Feature	Effective Date	Distance	Direction
N/A	No records within buffer			

SEPP Major Development Data Source: NSW Department of Planning & Environment

State Environmental Planning Policy Strategic Land Use Areas

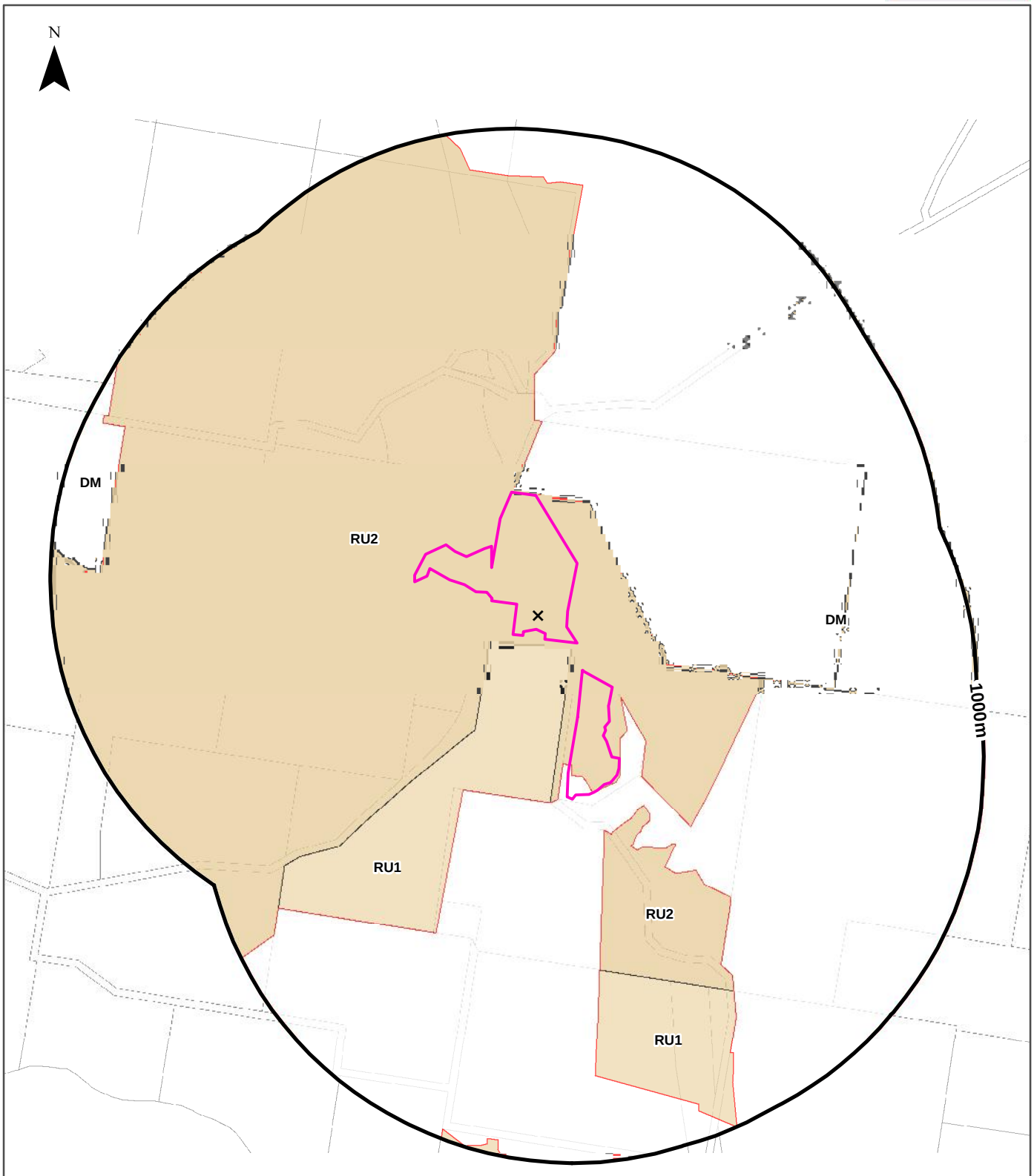
State Environmental Planning Policy Strategic Land Use Areas onsite or within the report buffer?

Strategic Land Use	SEPPNo	Effective Date	Amendment	Amendment Year	Distance	Direction
No records within buffer						

SEPP Strategic Land Use Data Source: NSW Department of Planning & Environment

LEP Planning Zones

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017
Planning: NSW Crown Copyright - Planning & Environment

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Local Environmental Plan

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Land Zoning

What Local Environmental Plan Land Zones exist within the report buffer?

Zone	Description	Purpose	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
RU2	Rural Landscape		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		0m	Onsite
DM	Deferred Matter		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		0m	Onsite
RU1	Primary Production		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		21m	South West
RU2	Rural Landscape		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		103m	South
RU1	Primary Production		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		476m	South
DM	Deferred Matter		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		852m	North West
RU1	Primary Production		Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		958m	South

Local Environmental Plan

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Minimum Subdivision Lot Size

What are the onsite Local Environmental Plan Minimum Subdivision Lot Sizes?

Symbol	Minimum Lot Size	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
AB	40 ha	Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		97.39

Maximum Height of Building

What are the onsite Local Environmental Plan Maximum Height of Buildings?

Symbol	Maximum Height of Building	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
I	8.50 m	Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		97.4

Floor Space Ratio

What are the onsite Local Environmental Plan Floor Space Ratios?

Symbol	Floor Space Ratio	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
No Data							

Land Application

What are the onsite Local Environmental Plan Land Applications?

Application Type	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
Included	Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		97.39
Deferred	Ballina Local Environmental Plan 2012	25/01/2013	04/02/2013	28/08/2015		2.61

Land Reservation Acquisition

What are the onsite Local Environmental Plan Land Reservation Acquisitions?

Reservation	LEP	Published Date	Commenced Date	Currency Date	Amendment	Comments	Percentage of Site Area
No Data							

Heritage

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

State Heritage Items

What are the State Heritage Items located within the report buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
N/A	No records in buffer							

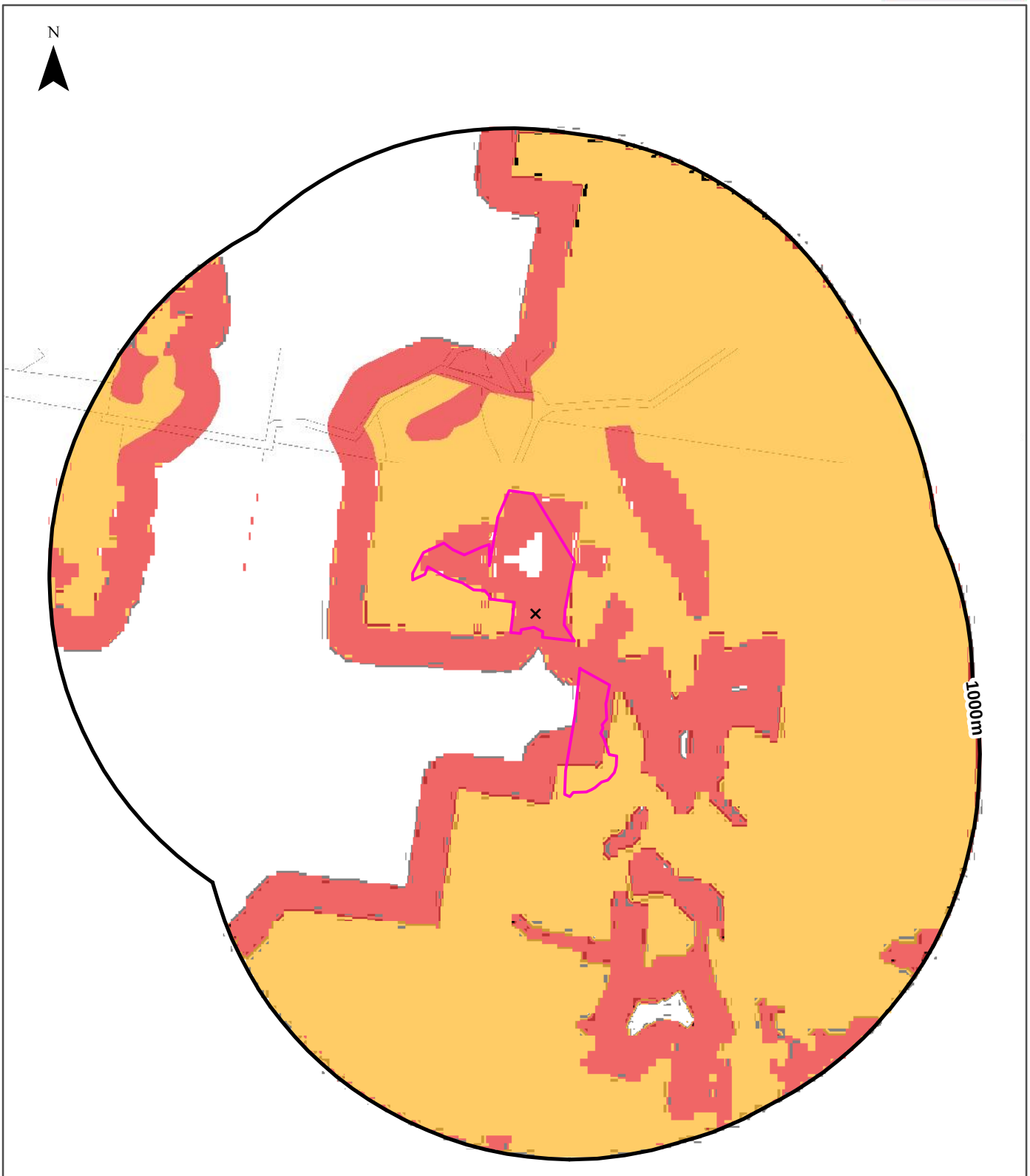
Local Heritage Items

What are the Local Heritage Items located within the report buffer?

Map Id	Name	Classification	Significance	LEP or Act	Published Date	Commenced Date	Currency Date	Distance	Direction
N/A	No records in buffer								

Natural Hazards - Bushfire Prone Land

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Legend

- Site Centre
- Site Boundary
- Report Buffer
- Property Boundary

Bushfire Prone Land Category

- Vegetation Category 1
- Vegetation Category 2
- Vegetation Buffer

Scale: 0 100 200 400 Meters

Data Sources: Property Boundaries: © Land and Property Information (a division of the Department of Finance and Services) 2017

Coordinate System: GDA 1994 MGA Zone 56

Date: 10February 2017

Natural Hazards

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Bushfire Prone Land

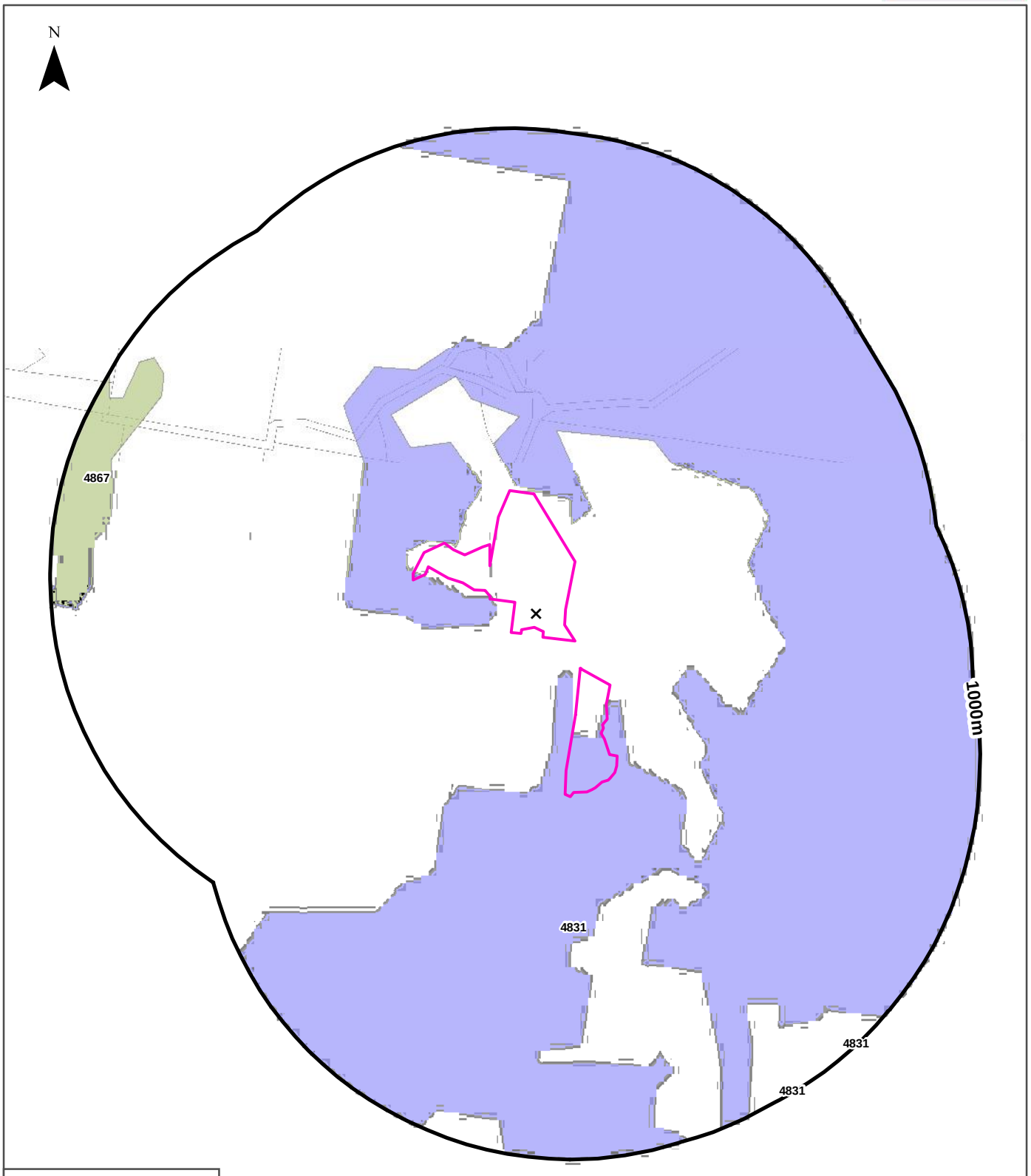
What are the nearest Bushfire Prone Land Categories that exist within the report buffer?

Bushfire Prone Land Category	Distance	Direction
Vegetation Buffer	0m	Onsite
Vegetation Category 1	0m	Onsite

Bushfire Prone Land Data Reference - NSW RFS GIS Data Set

Ecological Constraints - Vegetation & RAMSAR Wetlands

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477



Legend

- Site Centre
- Site Boundary
- Report Buffer
- Property Boundary
- RAMSAR Wetlands

Scale: 0 100 200 400 Meters	Data Sources: Property Boundaries & Topographic Data: © Land and Property Information (a division of the Department of Finance and Services) 2017	Coordinate System: GDA 1994 MGA Zone 56	Date: 10February 2017

Ecological Constraints

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

Vegetation - Eastern Bushland Database (North Region)

What Vegetation exists within the report buffer?

MapId	Veg Code	Veg Desc	NVISCode	NVISDesc	Distance	Direction
4831	4	coastal complex	2	Coastal complex	0m	Onsite
4867	2	moist eucalypt forest	8	Moist forest system	843m	North West

RAMSAR Wetlands

What RAMSAR Wetland areas exist within the report buffer?

Map Id	RAMSAR Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

Ecological Constraints

Jali and Gibsons Borrow Pits, Old Bagotville Road, Wardell, NSW 2477

ATLAS of NSW Wildlife

Endangered &Vulnerable Species on the ATLAS of NSW Wildlife database, within 10km of the site?

Class	Family	Scientific	Common	Exotic	NSW Status	Commonwealth Status
Amphibia	Hylidae	Litoria olongburensis	Olongburra Frog	No	Vulnerable, Protected	Vulnerable
Amphibia	Myobatrachidae	Assa darlingtoni	Pouched Frog	No	Vulnerable, Protected	
Amphibia	Myobatrachidae	Crinia tinnula	Wallum Froglet	No	Vulnerable, Protected	
Aves	Accipitridae	Circus assimilis	Spotted Harrier	No	Vulnerable, Protected	
Aves	Accipitridae	Haliaeetus leucogaster	White-bellied Sea-Eagle	No	Vulnerable, Protected	CAMBA
Aves	Accipitridae	Hieraaetus morphnoides	Little Eagle	No	Vulnerable, Protected	
Aves	Accipitridae	Pandion cristatus	Eastern Osprey	No	Vulnerable, Protected, Category 3 Sensitive Species	
Aves	Anseranatidae	Anseranas semipalmata	Magpie Goose	No	Vulnerable, Protected	
Aves	Ardeidae	Botaurus poiciloptilus	Australasian Bittern	No	Endangered, Protected	Endangered
Aves	Ardeidae	Ixobrychus flavicollis	Black Bittern	No	Vulnerable, Protected	
Aves	Artamidae	Artamus cyanopterus cyanopterus	Dusky Woodswallow	No	Vulnerable, Protected	
Aves	Burhinidae	Burhinus grallarius	Bush Stone-curlew	No	Endangered, Protected	
Aves	Cacatuidae	Calyptorhynchus lathami	Glossy Black-Cockatoo	No	Vulnerable, Protected, Category 2 Sensitive Species	
Aves	Campephagidae	Coracina lineata	Barred Cuckoo-shrike	No	Vulnerable, Protected	
Aves	Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork	No	Endangered, Protected	
Aves	Columbidae	Ptilinopus magnificus	Wompoo Fruit-Dove	No	Vulnerable, Protected	
Aves	Columbidae	Ptilinopus regina	Rose-crowned Fruit-Dove	No	Vulnerable, Protected	
Aves	Columbidae	Ptilinopus superbus	Superb Fruit-Dove	No	Vulnerable, Protected	
Aves	Diomedeidae	Thalassarche melanophris	Black-browed Albatross	No	Vulnerable, Protected	Vulnerable
Aves	Gruidae	Grus rubicunda	Brolga	No	Vulnerable, Protected	
Aves	Haematopodidae	Haematopus longirostris	Pied Oystercatcher	No	Endangered, Protected	
Aves	Jacanidae	Irediparra gallinacea	Comb-crested Jacana	No	Vulnerable, Protected	
Aves	Laridae	Sternula albifrons	Little Tern	No	Endangered, Protected	CAMBA, JAMBA, ROKAMBA
Aves	Menuridae	Menura alberti	Albert's Lyrebird	No	Vulnerable, Protected	
Aves	Monarchidae	Carterornis leucotis	White-eared Monarch	No	Vulnerable, Protected	
Aves	Neosittidae	Daphoenositta chrysoptera	Varied Sittella	No	Vulnerable, Protected	
Aves	Pomatostomidae	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	No	Vulnerable, Protected	
Aves	Procellariidae	Ardenna carneipes	Flesh-footed Shearwater	No	Vulnerable, Protected	J,K
Aves	Procellariidae	Pterodroma solandri	Providence Petrel	No	Vulnerable, Protected	JAMBA
Aves	Psittacidae	Glossopsitta pusilla	Little Lorikeet	No	Vulnerable, Protected	
Aves	Psittacidae	Pezoporus wallicus wallicus	Eastern Ground Parrot	No	Vulnerable, Protected, Category 3 Sensitive Species	

Class	Family	Scientific	Common	Exotic	NSW Status	Commonwealth Status
Aves	Rallidae	Amaurornis moluccana	Pale-vented Bush-hen	No	Vulnerable, Protected	
Aves	Scolopacidae	Calidris ferruginea	Curlew Sandpiper	No	Endangered, Protected	CE,C,J,K
Aves	Scolopacidae	Xenus cinereus	Terek Sandpiper	No	Vulnerable, Protected	CAMBA, JAMBA, ROKAMBA
Aves	Strigidae	Ninox strenua	Powerful Owl	No	Vulnerable, Protected, Category 3 Sensitive Species	
Aves	Turnicidae	Turnix maculosus	Red-backed Button-quail	No	Vulnerable, Protected	
Aves	Tytonidae	Tyto longimembris	Eastern Grass Owl	No	Vulnerable, Protected, Category 3 Sensitive Species	
Aves	Tytonidae	Tyto novaehollandiae	Masked Owl	No	Vulnerable, Protected, Category 3 Sensitive Species	
Aves	Tytonidae	Tyto tenebricosa	Sooty Owl	No	Vulnerable, Protected, Category 3 Sensitive Species	
Insecta	Noctuidae	Phyllodes imperialis southern subspecies	Southern Pink Underwing Moth	No	Endangered	Endangered
Mammalia	Balaenopteridae	Megaptera novaeangliae	Humpback Whale	No	Vulnerable, Protected	Vulnerable
Mammalia	Dasyuridae	Dasyurus maculatus	Spotted-tailed Quoll	No	Vulnerable, Protected	Endangered
Mammalia	Dasyuridae	Phascogale tapoatafa	Brush-tailed Phascogale	No	Vulnerable, Protected	
Mammalia	Dasyuridae	Planigale maculata	Common Planigale	No	Vulnerable, Protected	
Mammalia	Dugongidae	Dugong dugon	Dugong	No	Endangered, Protected	
Mammalia	Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	No	Vulnerable, Protected	
Mammalia	Macropodidae	Thylogale stigmatica	Red-legged Pademelon	No	Vulnerable, Protected	
Mammalia	Muridae	Pseudomys oralis	Hastings River Mouse	No	Endangered, Protected	Endangered
Mammalia	Petauridae	Petaurus norfolcensis	Squirrel Glider	No	Vulnerable, Protected	
Mammalia	Phascolarctidae	Phascolarctos cinereus	Koala	No	Vulnerable, Protected	Vulnerable
Mammalia	Physeteridae	Physeter macrocephalus	Sperm Whale	No	Vulnerable, Protected	
Mammalia	Potoroidae	Potorous tridactylus	Long-nosed Potoroo	No	Vulnerable, Protected	Vulnerable
Mammalia	Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	No	Vulnerable, Protected	Vulnerable
Mammalia	Pteropodidae	Syconycteris australis	Common Blossom-bat	No	Vulnerable, Protected	
Mammalia	Vespertilionidae	Miniopterus australis	Little Bentwing-bat	No	Vulnerable, Protected	
Mammalia	Vespertilionidae	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	No	Vulnerable, Protected	
Mammalia	Vespertilionidae	Myotis macropus	Southern Myotis	No	Vulnerable, Protected	
Mammalia	Vespertilionidae	Nyctophilus bifax	Eastern Long-eared Bat	No	Vulnerable, Protected	
Mammalia	Vespertilionidae	Scoteanax rueppellii	Greater Broad-nosed Bat	No	Vulnerable, Protected	
Reptilia	Cheloniidae	Caretta caretta	Loggerhead Turtle	No	Endangered, Protected	Endangered
Reptilia	Elapidae	Cacophis harriettae	White-crowned Snake	No	Vulnerable, Protected	
Reptilia	Scincidae	Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	No	Vulnerable, Protected	Vulnerable
Flora	Apocynaceae	Marsdenia longiloba	Slender Marsdenia	No	Endangered, Protected	Vulnerable
Flora	Apocynaceae	Ochrosia moorei	Southern Ochrosia	No	Endangered, Protected	Endangered
Flora	Corynocarpaceae	Corynocarpus rupestris subsp. rupestris	Glenugie Karaka	No	Vulnerable, Protected	Vulnerable
Flora	Cunoniaceae	Davidsonia jerseyana	Davidson's Plum	No	Endangered, Protected, Category 2 Sensitive Species	Endangered
Flora	Cunoniaceae	Davidsonia johnsonii	Smooth Davidson's Plum	No	Endangered, Protected	Endangered
Flora	Euphorbiaceae	Acalypha eremorum	Acalypha	No	Endangered, Protected	

Class	Family	Scientific	Common	Exotic	NSW Status	Commonwealth Status
Flora	Euphorbiaceae	Baloghia marmorata	Jointed Baloghia	No	Vulnerable, Protected	Vulnerable
Flora	Fabaceae (Mimosoideae)	Archidendron hendersonii	White Lace Flower	No	Vulnerable, Protected	
Flora	Lauraceae	Cryptocarya foetida	Stinking Cryptocarya	No	Vulnerable, Protected	Vulnerable
Flora	Lauraceae	Endiandra hayesii	Rusty Rose Walnut	No	Vulnerable, Protected	Vulnerable
Flora	Lauraceae	Endiandra muelleri subsp. bracteata	Green-leaved Rose Walnut	No	Endangered, Protected	
Flora	Lindsaeaceae	Lindsaea brachypoda	Short-footed Screw Fern	No	Endangered, Protected, Category 3 Sensitive Species	
Flora	Menispermaceae	Tinospora tinosporoides	Arrow-head Vine	No	Vulnerable, Protected	
Flora	Myrtaceae	Gossia fragrantissima	Sweet Myrtle	No	Endangered, Protected	Endangered
Flora	Myrtaceae	Syzygium hodgkinsoniae	Red Lilly Pilly	No	Vulnerable, Protected	Vulnerable
Flora	Orchidaceae	Diuris sp. aff. chrysantha	Byron Bay Diuris	No	Endangered, Protected, Category 2 Sensitive Species	
Flora	Orchidaceae	Oberonia titania	Red-flowered King of the Fairies	No	Vulnerable, Protected, Category 2 Sensitive Species	
Flora	Orchidaceae	Peristeranthus hillii	Brown Fairy-chain Orchid	No	Vulnerable, Protected, Category 2 Sensitive Species	
Flora	Orchidaceae	Phaius australis	Southern Swamp Orchid	No	Endangered, Protected, Category 2 Sensitive Species	Endangered
Flora	Poaceae	Arthraxon hispidus	Hairy Jointgrass	No	Vulnerable, Protected	Vulnerable
Flora	Polygonaceae	Persicaria elatior	Tall Knotweed	No	Vulnerable, Protected	Vulnerable
Flora	Polypodiaceae	Belvisia mucronata	Needle-leaf Fern	No	Endangered, Protected	
Flora	Proteaceae	Floydia praealta	Ball Nut	No	Vulnerable, Protected	Vulnerable
Flora	Proteaceae	Macadamia tetraphylla	Rough-shelled Bush Nut	No	Vulnerable, Protected	Vulnerable
Flora	Rutaceae	Acronychia littoralis	Scented Acronychia	No	Endangered, Protected	Endangered
Flora	Rutaceae	Coatesia paniculata	Axe-Breaker	No	Endangered, Protected	

Data does not include records not defined as either endangered or vulnerable, and category 1 sensitive species are also excluded. NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 10/02/2017

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 2/585377

SEARCH DATE	TIME	EDITION NO	DATE
14/2/2017	12:03 PM	2	30/12/2011

LAND

LOT 2 IN DEPOSITED PLAN 585377
AT BAGOTVILLE
LOCAL GOVERNMENT AREA BALLINA
PARISH OF BROADWATER COUNTY OF ROUS
TITLE DIAGRAM DP585377

FIRST SCHEDULE

ROADS AND TRAFFIC AUTHORITY OF NSW (T AG646076)

SECOND SCHEDULE (1 NOTIFICATION)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Roads and Maritime Services PRINTED ON 14/2/2017

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 244/755691

SEARCH DATE	TIME	EDITION NO	DATE
14/2/2017	12:03 PM	2	10/4/1990

LAND

LOT 244 IN DEPOSITED PLAN 755691
LOCAL GOVERNMENT AREA BALLINA
PARISH OF BROADWATER COUNTY OF ROUS
(FORMERLY KNOWN AS PORTION 244)
TITLE DIAGRAM CROWN PLAN 7983.1759

FIRST SCHEDULE

JALI LOCAL ABORIGINAL LAND COUNCIL (TN Y927335)

SECOND SCHEDULE (1 NOTIFICATION)

1 Y927335 SUBJECT TO CONDITIONS IN MEMORANDUM AI55778. RESTRICTIONS ON DEALINGS AND PLANS - SEE PART 2, DIVISION 4 ABORIGINAL LAND RIGHTS ACT 1983 (THIS IS NOT AFFECTED BY SECTION 42). ANY DEALING OR PLAN MUST BE ACCOMPANIED BY A REGISTRATION APPROVAL CERTIFICATE OR A STATEMENT OF NON REQUIREMENT.

NOTATIONS

NOTE: THE CERTIFICATE OF TITLE FOR THIS FOLIO OF THE REGISTER DOES NOT INCLUDE SECURITY FEATURES INCLUDED ON COMPUTERISED CERTIFICATES OF TITLE ISSUED FROM 4TH JANUARY, 2004. IT IS RECOMMENDED THAT STRINGENT PROCESSES ARE ADOPTED IN VERIFYING THE IDENTITY OF THE PERSON(S) CLAIMING A RIGHT TO DEAL WITH THE LAND COMPRISED IN THIS FOLIO.
REFER ALL DEALINGS AND PLANS TO SD31 AND THE LEGAL DIVISION

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Roads and Maritime Services PRINTED ON 14/2/2017

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 5/843369

SEARCH DATE	TIME	EDITION NO	DATE
14/2/2017	12:03 PM	4	15/4/2016

LAND

LOT 5 IN DEPOSITED PLAN 843369
AT BAGOTVILLE
LOCAL GOVERNMENT AREA BALLINA
PARISH OF BROADWATER COUNTY OF ROUS
TITLE DIAGRAM DP843369

FIRST SCHEDULE

ROADS AND MARITIME SERVICES (T AK300766)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)
2 AK300766 LAND IS REQUIRED FOR ROAD PURPOSES

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Roads and Maritime Services PRINTED ON 14/2/2017

NSW GOVERNMENT | SafeWork NSW

Locked Bag 2906, Lisarow NSW 2252
Customer Experience 13 10 50
ABN 81 913 830 179 | www.safework.nsw.gov.au

Our Ref: D17/076845
Your Ref: Brian Cork

24 February 2017

Attention: Brian Cork
GHD Pty Ltd
230 Harbour Dr
Coffs harbour NSW 2450

Dear Mr Cork,

RE SITE: Lot 2 DP 585377 & Lot 5 DP 843369 Old Bagotville Rd Wardell NSW

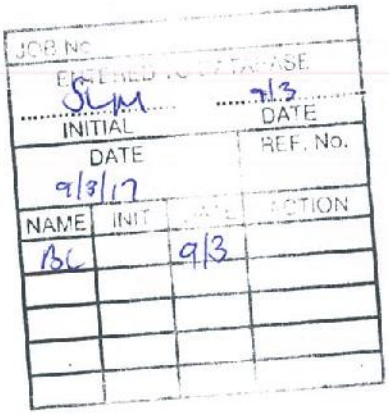
I refer to your site search request received by SafeWork NSW on 17 February 2017 requesting information on Storage of Hazardous Chemicals for the above site.

A search of the records held by SafeWork NSW has not located any records pertaining to the above mentioned premises.

For further information or if you have any questions, please call us on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely,

Customer Service Officer
Customer Experience - Operations
SafeWork NSW



GHD

230 Harbour Drive
Coffs Harbour
T: 61 2 6650 5600 F: 61 2 6650 5601 E: cfsmail@ghd.com

2218659-59491/https://projects.ghd.com/OC/Newcastle/rmsw2bcontam/Delivery/Documents/2218659_REP_GHD_W2B Jali and Gibsons Preliminary Site Investigation.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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Appendix C Ecology Assessment

Melaleuca Group Pty Ltd

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Date: 10 October 2016

To: Mr John Bruin
Environmental Advisor
Pacific Complete
21 Prince St
GRAFTON NSW 2460

Dear John,

Re: Ecological Assessment Jali Quarry, Section 10 Woolgoolga to Ballina Pacific Highway Upgrade (16.0000302544.1502)

1. Introduction and Background

1.1 Introduction

Melaleuca Group Pty Ltd in conjunction with Dave Fell Environmental Pty Ltd and WildSearch Environmental Services have been commissioned by Pacific Complete to undertake an ecological assessment of the Jali Quarry site and a 10m buffer around that site.

The objective of this investigation was to determine if the proposal would adversely impact on the surrounding ecological values at the study site and in the locality. If any such adverse impacts are determined, this investigation also aimed to provide mitigation measures and/or remediation options to the proponent.

1.2 Site Identification

The Study Area (Attachment 1, Figures A1, A2) is located in the Wardell area and consist of:

1. part of Lot 244 DP755691 (37 Old Bagotville Rd).

1.3 The Proposal

It is proposed to extract gravel and/or fill from within the existing quarry footprint (area within the existing walls of the quarry pit, refer to Figure A2 in Attachment 1). The proposal does not extend into the surrounding vegetated areas.

1.4 Scope of Works

As instructed, the Ecological Assessment Report is to include the pit area along with a 5 to 10m surrounding buffer (i.e. within adjacent vegetation):

- Threatened species (Flora and Fauna)
- Habitat assessment (Hollows, refuge etc.)
- Weed Survey and identification
- Field visit to identified locations
- Biometric Vegetation Community identification (EEC etc.)
- Habitat quality scores

GPS locations of all biodiversity features (e.g. threatened flora and hollow bearing trees) will need to be recorded and delivered in accordance with the attached *Tender Criteria for the Delivery of GIS datasets*.

The Ecological Assessment Report is also to cover the relevant conditions from the EIS, SPIR and MCoA for the project. The report is for a major consistency review.

2. Methodology

The methods used to conduct this assessment are:

- A review of relevant documents and past studies pertaining to the subject land;
- A review of available recent aerial photographs;
- A search of Schedules 1, 2 and 3 of the NSW Threatened Species Conservation Act 1995 (TSC Act), the Atlas of Living Australia (ALA) and of the National Parks and Wildlife Service (NPWS) Bionet Atlas of NSW Wildlife (Atlas) to identify threatened species, populations and ecological communities, or their habitats recorded on and within a five kilometre radius of the subject land;
- Search of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) database to identify threatened species, ecological communities, Ramsar Sites and migratory species recorded within a five kilometre radius of the subject land;
- A site visit including a flora assessment of the subject land with particular attention given to mapping of vegetation communities and Endangered Ecological Communities and identification of threatened flora identified in the NPWS Atlas search;
- A number of meandering transect fauna assessments of the subject land with particular attention given to identification of threatened fauna identified in the NPWS Atlas search; and
- An evaluation of the habitat and wildlife corridor value of the subject land.

This concise methodology is considered a consistent approach for all ecological assessments and follows relevant guidelines. Further details are provided in Attachment B.

3. Findings

3.1 Likelihood of threatened Species, populations and ecological communities potentially occurring at the subject site

A review of (actual) records of threatened flora species and populations known to occur within a 100km^2 area in the locality. This included the study area along with a number of additional sites under assessment in September 2016. The OEH, NPWS Wildlife Atlas showed 1,182 records of 25 threatened flora species, 512 records of 54 threatened fauna species, 10 EECs and 36 Threats as listed under Schedules 1, 1a and 2 of the Threatened Species Conservation (TSC) Act 1995, within this area (refer Attachment C). Many of these are records are a result of studies undertaken for the W2B Highway Upgrade (e.g. Australian Museum 2015). It is important to note that the search area also encompassed the nearby Uralba Nature Reserve which comprises extensive eucalypt forests and therefore encompassed habitats not found at the study site.

A search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Search Tool listed 23 threatened flora species and 44 threatened fauna species or their habitat is likely to occur in the locality (refer Attachment C). In addition, this search identified two (2) Threatened Ecological Communities considered likely to occur in the area (refer Attachment C).

Given the proposed works would occur within the quarry floor, in areas highly disturbed and cleared during previous quarrying operations, it is unlikely any of the threatened flora species would be found at the Site.

Consideration of all the listed threatened fauna species in Schedules 1 and 2 of the TSC Act (1995), with a known or possible occurrence within the local area was undertaken. The desktop assessment concludes a majority of these species do not and will not occur on the site due to the absence of suitable habitat e.g. well-developed subtropical or temperate rainforest or wet sclerophyll forest; or marine systems or wetlands within the proposed quarry footprint area (refer Figure A2). The possible exceptions would be the Koala (*Phascolarctos cinereus*) and Grey-headed Flying-Fox (*Pteropus poliocephalus*) which have been recorded in the immediate local area.

Similarly, while nearby treed vegetation adjacent to the site has been identified as constituting a floodplain EEC (Refer Attachment 1, Figure A3) analysis of the 100-year event flood map and the soils at the site (Refer Attachment 1, Figure A4) indicate that these cannot be floodplain Endangered Ecological Communities. Therefore, on the basis of the desktop assessment, the vegetation at the site is considered to be unlikely to represent any of the locally known EECs.

3.2 Vegetation at the Subject land

The site has been formerly used for sand and gravel extraction. The quarry floor is highly disturbed and has been previously cleared. It comprised extensive areas of bare earth, grassed areas and a two of small and shallow artificial waterbodies that hold water after rain. Areas of recolonising shrubs and small trees occur across the quarry floor (refer Attachment 1 Figure A5 and Photographs A1 - A4). Eucalypt forests surround the quarry. Much of this surrounding forest, particularly on the western and northern sides of the quarry, is regrowth forest. These forests are dominated by Blackbutt grassy open forest however there is a small stand of Narrow-leaved Red Gum (*Eucalyptus seeana*) in the north eastern corner of the site. A summary of the site findings are included in Table 1 below.

A single hollow-beared tree was located outside of the survey area. All other trees within the search area were too young and small to develop hollows.

Table 1. Vegetation Summary – Jali Quarry site and 10m buffer

Vegetation Description	EEC	Threatened Flora	Fauna Habitat
Jali Quarry and 10m buffer surrounding the site			
Quarry Floor: "Cleared". Previously cleared highly disturbed vegetation. Small number of scattered small trees and shrubs including: White Mahogany, Brush Box, Coastal Blackbutt, Black Oak, Blackwood (*Acacia melanoxylon*), Swamp Mahogany, Broad-leaved Paperbark, Persoonia. Nearby forested vegetation dominated by "Blackbutt grassy open forest of the lower Clarence Valley of the North Coast". Dominant species include: Coastal Blackbutt, White Mahogany, Northern Grey Ironbark, Tallowwood, Pink Bloodwood (*Corymbia intermedia*), Swamp Box (Lophostemon suaveolens). An open under-storey and ground cover is typical. At the north eastern edge of the quarry a small stand of Narrow-leaved Red Gum (*Eucalyptus seeana*) occurs. This best fits the "Narrow-leaved Red Gum woodlands of the lowlands of the North Coast" Vegetation type.	Vegetation at the site is not indicative of an EEC. The Narrow-leaved Red Gum woodlands and the adjacent paperbark forest, both previously identified as EEC's are not on a floodplain, not on alluvial soils and are not subjected to flooding and therefore do not fit the characteristics of a floodplain EEC. No EEC's present at the site.	None found within the study area and none known within 50m of site.	Mostly cleared and Highly degraded. Mostly relatively young regrowth forest. Limited fauna habitat within Study Area. Signs (scats) of Koalas having recently used the site were recorded under a number of Tallowwood at the southern margins of the site. No other records. No suitable habitat or vines, for the Pink Underwing Moth and Richmond Birdwing Butterfly was found. No adult moths, butterflies or caterpillars were found. No suitable *Nurus* habitat occurs at the site.

3.3 Threatened species, populations and ecological communities

No threatened flora were found at the quarry or within the 10m buffer search area around the quarry. One Threatened fauna species, the Koala, was recorded. This species was recorded using the Tallowwoods (*Eucalyptus microcorys*) at the southern edge of the quarry (Refer Table 2 and Attachment 1, Figures A6). An old fox den was located in the forests along the southern margins of the site.

Table 2. Threatened fauna – Jali Quarry site and 10m buffer. Map Datum – GDA94

Species	Date	Easting	Northing	No.	Notes
Koala	22-Sep-16	541857	6794643	1	Scats under Tallowwood
Koala	22-Sep-16	541841	6794657	1	Scats under Tallowwood
Koala	22-Sep-16	541824	6794657	1	fresh scats under Tallowwood
Koala	22-Sep-16	541795	6794673	1	Scats under Tallowwood
Koala	22-Sep-16	541775	6794670	1	Scats under Tallowwood

To fully assess the presence of EECs within the Study area, consideration of the soils, geology, vegetation and topography is required.

The quarry is located on a low-lying coastal ridge with an elevation ≤10m. The area is generally considered low-lying and is bounded to the west by coastal plains and then hillslopes leading up to the Blackwall Range.

The following soil landscapes are mapped by Morand (2009) over the site (Refer Attachment 1, Figure A4):

- Erosional Landscape *Billinudgel variant a* (**TRbia**), and
- Disturbed terrain (**DTxx**).

The *Billinudgel* (***bi***) *soil* landscape is described as consisting of clay loams or silty or sandy clay loams in the A1 (topsoil horizon with blocky clay subsoils). The topography of this soil landscape is low rolling hills that abut the higher and steeper *Burringbar* (**bu**) soil landscape. In this instance, the hillslope soils were dominated by the *Bangalow* (**ba**) and *Rosebank* (**ro**) soil landscapes. These are not alluvial soils.

The *Disturbed Terrain* (**DTxx**) soil landscape indicates that the soil profiles have been highly disturbed by past activities, in this case quarry operations. The soils no-longer exhibit natural soil profiles.

The Study Area is not mapped as flood liable by Ballina Shire Council (BMT WBM 2008) nor by Pacific Complete (Attachment 1, Figure A4).

Therefore, none of the vegetation at or immediately surrounding the Study Area is considered to be an EECs. As such, no further assessment is required under section 5A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

3.4 Weed identification and distribution

Searches for weeds were completed during traverses and site surveys associated with the vegetation mapping, habitat condition and threatened species surveys. A list of the weed species detected is presented in Table 3. The majority of the weeds were found in the quarry floor, along the road verge and along the highly disturbed forest margins. Weeds species across the quarry site were considered to be scattered with small areas of dense infestations and included occasional Slash Pine, Groundsel Bush, Molasses Grass, Fireweed, Ragweed, Cobblers Pegs and Lantana and a range of typical weed species found on the North Coast. Lantana was more common in the surrounding forested areas.

Table 3. Weeds detected at the Jali Quarry site

Scientific Name	Common Name	Noxious Class	Enviro Weed	WONS	Comments
Ageratina adenophora	Crofton Weed	4	N/A	No	Uncommon along the forest edges of the site and as patches in the quarry floor
Ageratum conyzoides	Billy Goat Weed	N/A	Yes	No	Common across the site
Ambrosia artemisiifolia	Annual Ragweed	5	N/A	No	Uncommon in cleared and disturbed areas
Bidens pilosa	Cobblers Pegs	N/A	N/A	No	Mostly in cleared and disturbed parts
Brachiaria decumbens	Para Grass	N/A	N/A	Yes	Mostly in cleared parts
Cinnamomum camphora	Camphor Laurel	4	N/A	No	Occasional small shrubs.
Pinus elliottii	Slash Pine	N/A	No	No	scattered trees
Conyza sumatrensis	Tall Fleabane	N/A	Yes	No	Mostly in cleared parts
Lantana camara	Lantana	4	N/A	Yes	Mostly along the forest margins and in SE corner of quarry.
Paspalum mandiocanum	Broad leaf Paspalum	N/A	Yes	No	Throughout the disturbed areas.
Solanum mauritianum	Wild Tobacco	N/A	Yes	No	Rare on margins and in southern forested parts
Sporobolus fertilis	Giant Parramatta Grass	4	Yes	No	along eastern road verge mostly.

Key: WONS = Weeds of National Significance

3.5 Fauna Habitat and Corridor Values of Subject land

3.5.1 Key Habitats and Corridors in NSW database

Key habitats are defined as "*areas of predicted high-conservation value for priority forest fauna assemblages, endemic forest vertebrates or endemic invertebrates* (Scotts 2003).

Regional corridors connect important areas of habitat (generally >500m wide) and are generally of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (Scotts 2003).

The 'Key Habitats and Corridors in NSW' database (NPWS undated) was consulted to determine whether the subject land occurred within a mapped regional or sub-regional corridor.

The site lies within the Wardell-Uralba Regional Corridor and is within the extensive "Uralba-Tuckean Swamp Coastal Connector" and "Alstonville Plateau Link" Climate Change Corridors as mapped by NSW OEH.

Key Habitat is mapped to the east of the sites. This is consistent with the relatively good condition of the forest habitats near the sites.

The quarry site supported few fauna species and none would be dependent upon the quarry site. The surrounding forests support a diverse avifauna, mammals such as the Koala, Echidna and Swamp Wallaby. The proximity of the site to the extensive forests and heathlands that extend north to Wardell and eventually the Blackwall Range has resulted in a diverse assemblage of bird species including; White-throated Treecreeper, Wonga Pigeon, Eastern Yellow Robin, Lewin's Honeyeater, Yellow-faced Honeyeater, Spotted and Striated pardalote, Grey Fantail, Leaden Flycatcher, Silvereye, Fantailed Cuckoo and White-throated Gerygone, amongst others. Two frog species, the Red-backed Toadlet (*Pseudophryne coriacea*) and Striped Marsh Frog (*Limnodynastes peronii*) were recorded using the wetland areas. Other common amphibians would be expected to use the site. The site suits highly mobile species (Swamp Wallabies, birds and bats), which are able to move between vegetated environments using small areas of remnant or regrowth vegetation as 'stepping stone' habitat.

3.5.2 Fauna Conservation Significance of the Subject land

With regard to the seven EPBC listed threatened fauna, fauna habitats and their associated environmental constraints, this assessment found the following:

- The areas of nearby forested vegetation have relatively high fauna values and are of some significance;
- The cleared areas generally have very low fauna values and are unconstrained by fauna considerations;
- The forests of the southern adjacent to the southern edge of the quarry are known Koala habitat;
- The forests adjacent to the quarry are valuable as a corridor and "stepping-stone" for migratory species and had significant value as a seasonal food resource for the Koala, Grey-headed Flying-Fox, microchiropteran bat species and numerous birds including the Golden

Whistler, Grey Fantail, Lewin's Honeyeater, Yellow-faced Honeyeater, Australian Figbird, Spangled Drongo, and Eastern Yellow Robin, amongst others.

The habitat scores determined by BAAM (2013b) and Australian Museum Consulting for the vegetation at the site or for the adjacent vegetation were assessed and compared with our determinations. Where the mapping overlapped the vegetation polygons mapped as part of this study direct comparisons could be made. For these areas our determinations supported those of Australian Museum Consulting. For those areas not assessed by AM Consulting the relative habitat scores for each of the vegetation polygons and for each of the EPBC listed Threatened flora and fauna species has been assessed. Habitat value scores for all potential EPBC listed species is considered very low, other than for the Koala and Grey-headed Flying Fox. A majority of the species are dependent upon rainforest and this forest types is absence from the site. As such, reproduction of mapping has not been completed within this report as it would result in 7 maps presenting little or no information. Habitat score are provided within the accompanying GIS layers.

No threatened flora or EECs were detected during field surveys and only one threatened fauna species, the Koala, was detected. The quarry floor is highly degraded and offers limited habitat values due to its highly disturbed state. As such, the quarry floor does not represent habitat for locally occurring threatened flora or fauna species.

It is understood, that the activity will be within the walls of the existing quarry area and that no removal of treed vegetation immediately adjacent to the quarry will occur. Vegetation being disturbed consists generally of exotic grasses, herbaceous weeds and a limited number of common native shrub and tree species. As such no adverse impacts will occur.

Mitigation measures outlined within the W2B Construction Environment Management Plan (CEMP) and associated Flora and Fauna Management Sub-plan (FFMP) are considered adequate to manage these impacts. In particular, weed and pathogen control measures are to be implemented during the works in accordance with the W2B CEMP and FFMP.

Should you require any additional information or wish to clarify any matter raised in this correspondence please feel free to contact the writer at any time.

Yours faithfully,
Melaleuca Group

.....
Dr. Melissa Van Zwieten
Senior Environmental Scientist
Attachments:
Attachment A: Figures and Site Photographs
Attachment B: Methodology
Attachment C: Bionet Atlas of NSW Wildlife and Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) search results

Attachment A. Figures

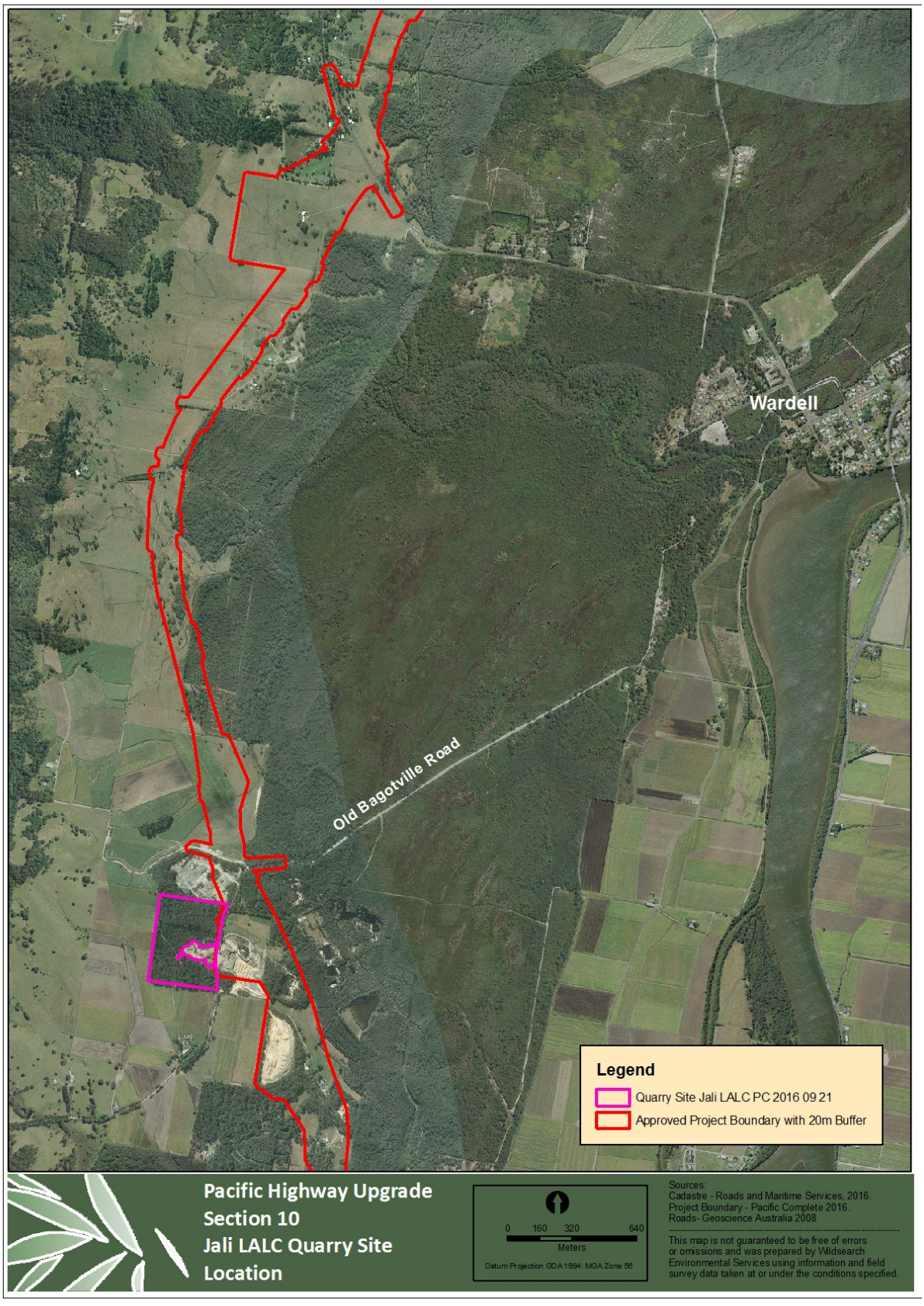

Figure A1. Jali Quarry Site - location

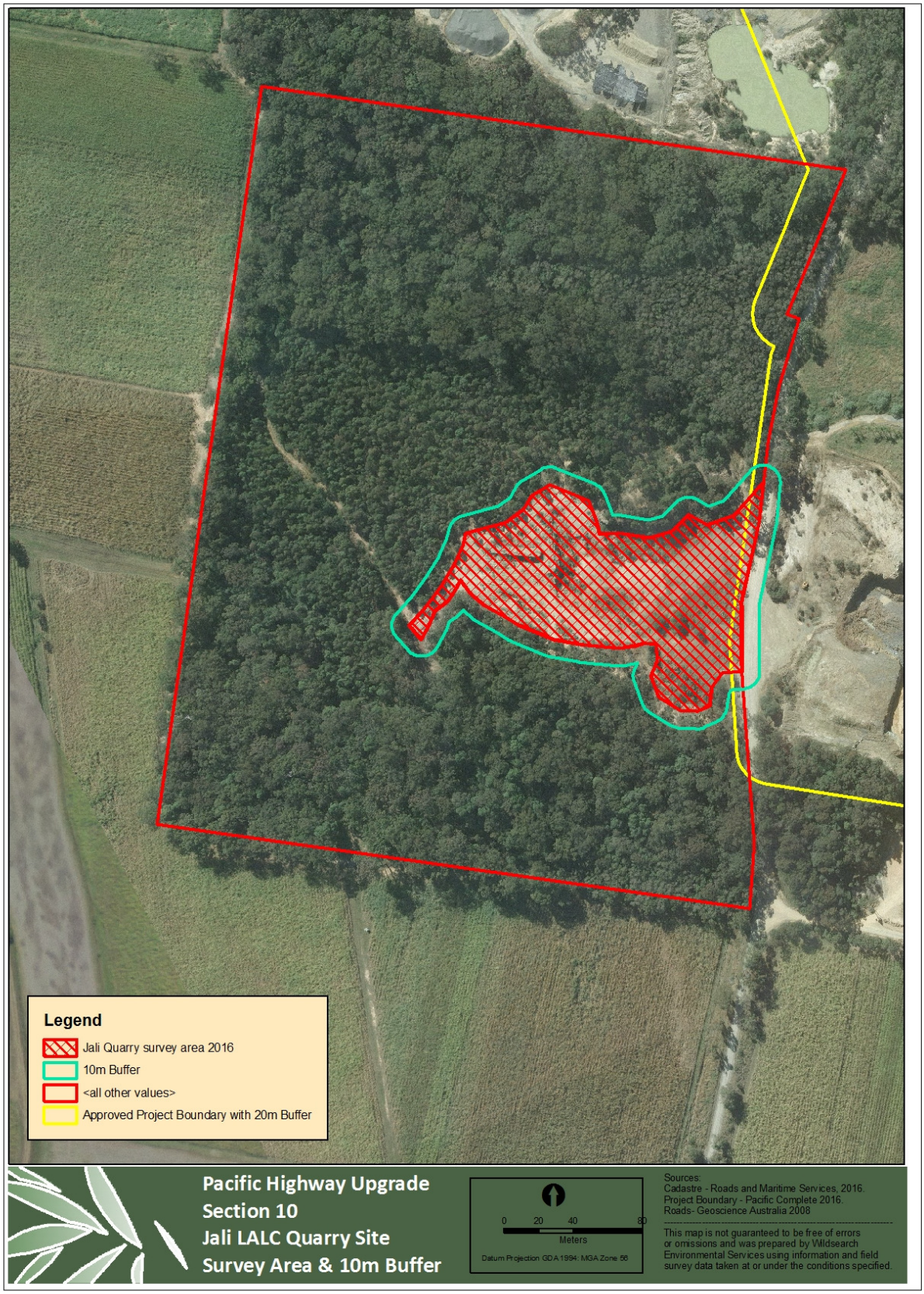

Figure A2. Jali Quarry Site (Note: Study area is red hatches area along with a surrounding 10m buffer; approximate bounds shown by blue line).

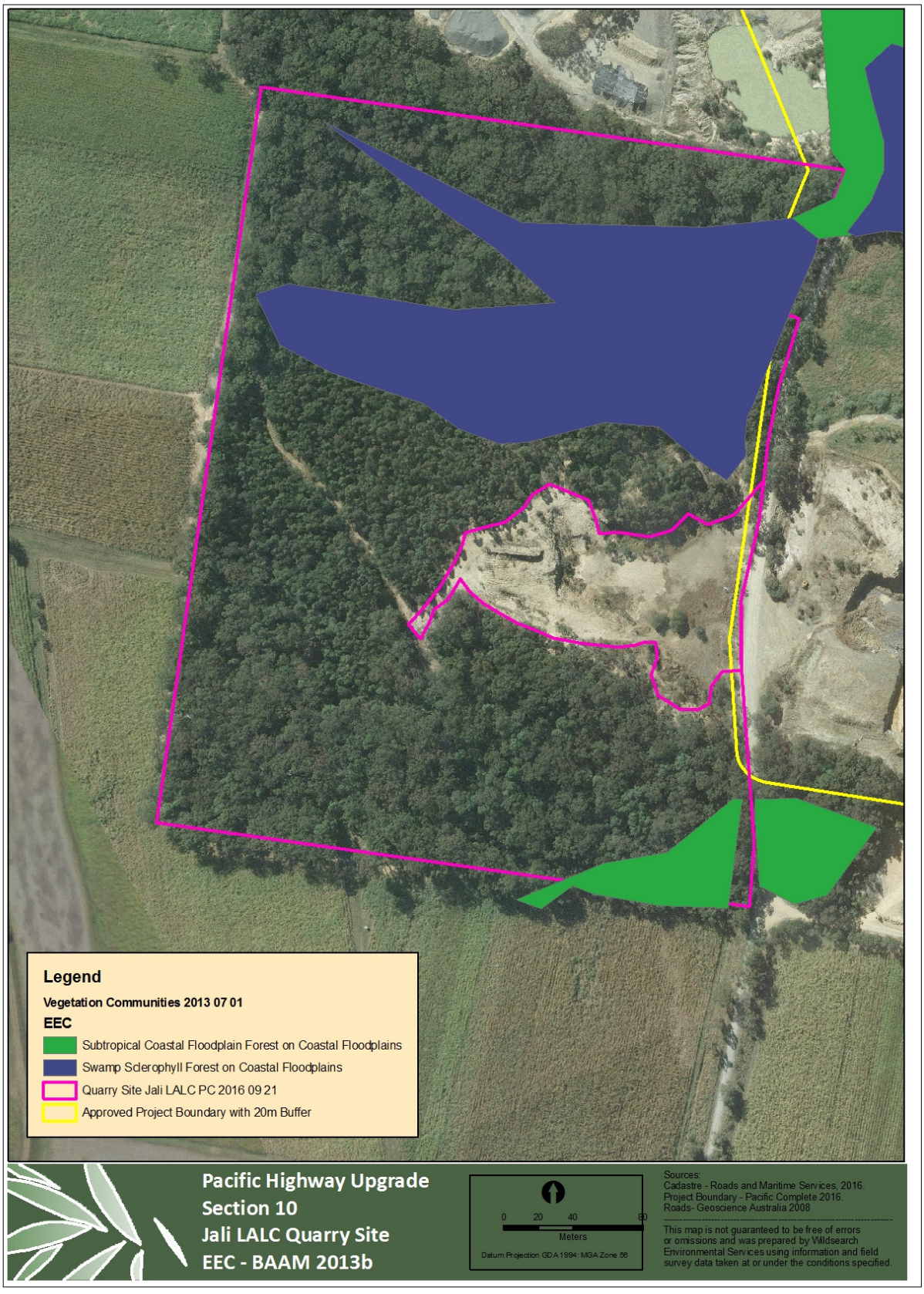

Figure A3. Endangered Ecological Communities (BAAM mapping).

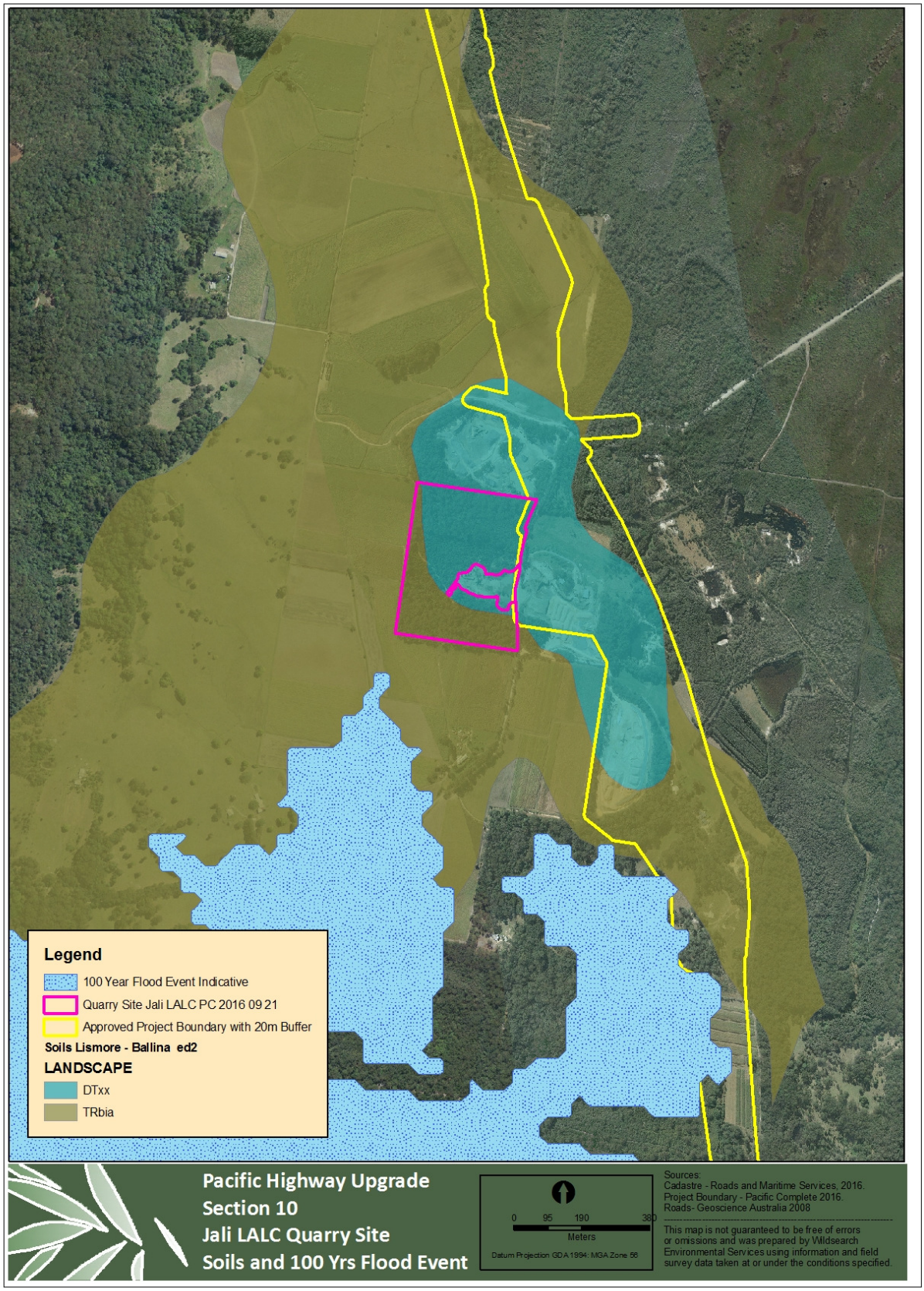

Figure A4. Soil Landscapes (after Morand 2009) and 100-year flood event mapping.

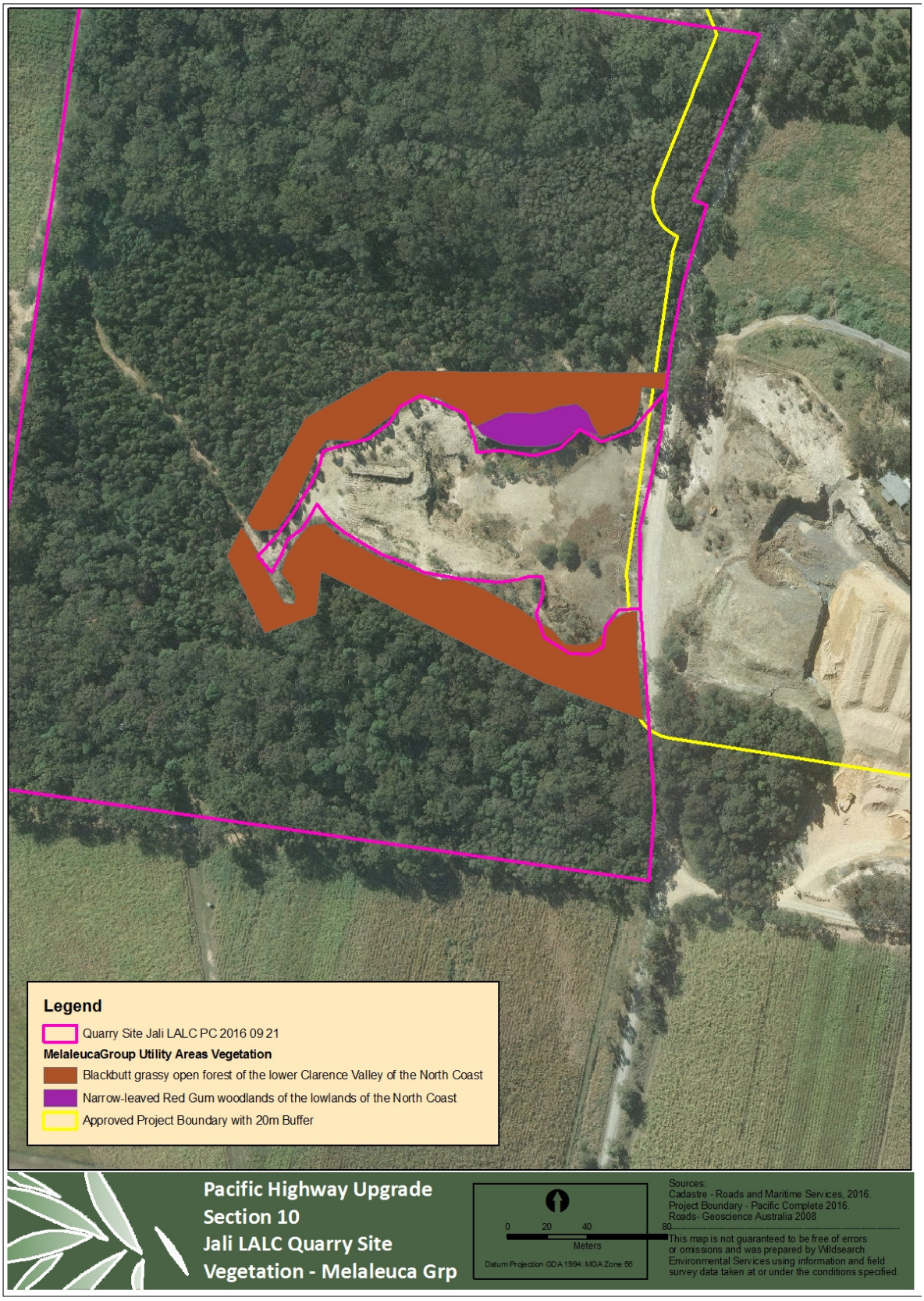

Figure A5. Vegetation communities (Melaleuca Group 2016)

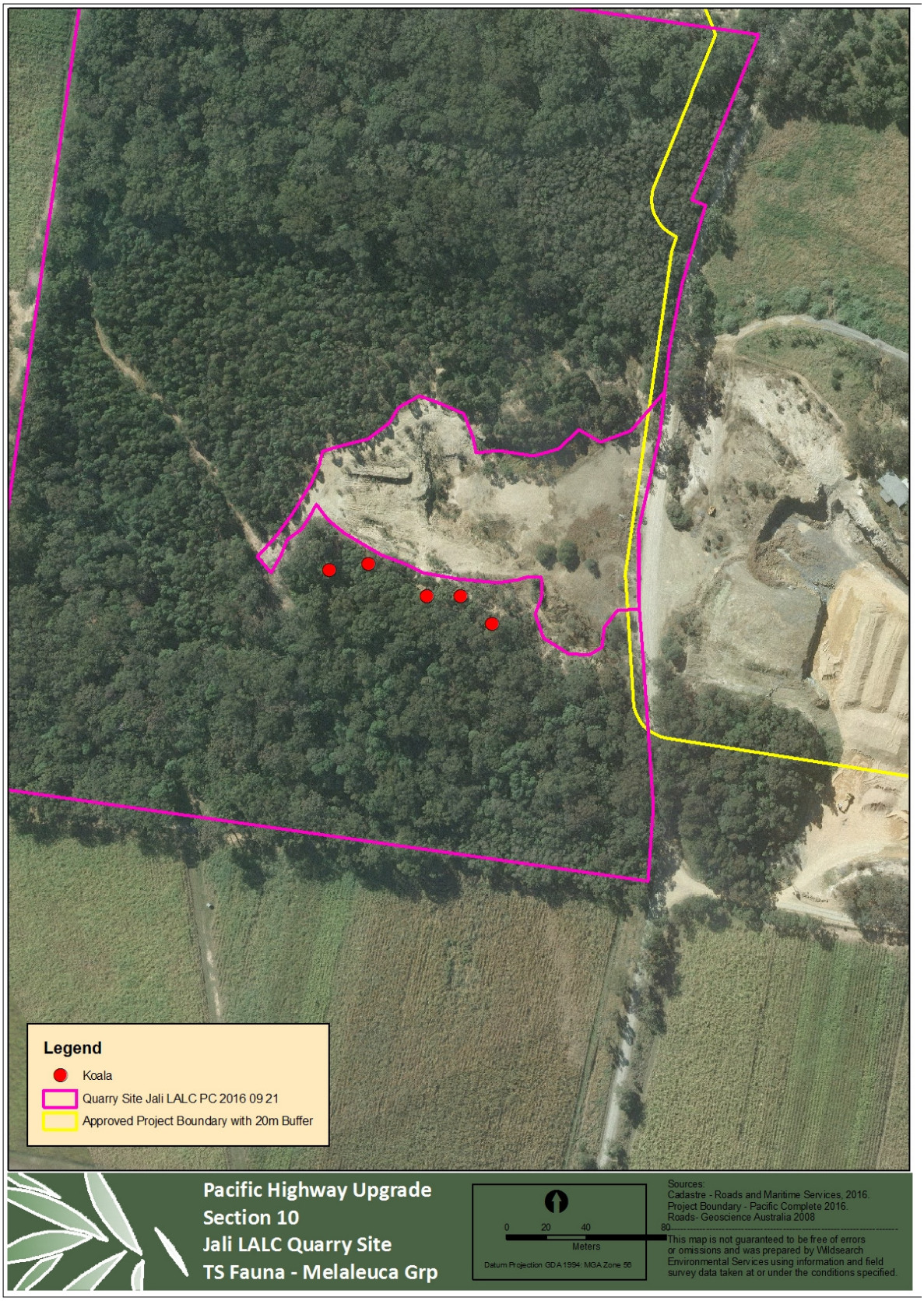

Figure A6. Threatened Species – Fauna Records (Melaleuca Group 2016)

Site Photographs

Photograph A1. View to south west across the centre of quarry floor. The site is delineated by the quarry walls pictured.

Photograph A2. Small wetland on northern edge of quarry floor.

Photograph A3. View of regrowth vegetation in south eastern corner of quarry floor.

Photograph A4. View of regrowth vegetation along southern 10m buffer.

Attachment B. Methodology

General

The following methods used to conduct this assessment are:

- A review of relevant documents and past studies pertaining to the subject land;
- A review of available recent aerial photographs;
- A search of Schedules 1, 2 and 3 of the NSW Threatened Species Conservation Act 1995 (TSC Act), the Atlas of Living Australia (ALA) and of the National Parks and Wildlife Service (NPWS) Bionet Atlas of NSW Wildlife (Atlas) to identify threatened species, populations and ecological communities, or their habitats recorded on and within a five kilometre radius of the subject land;
- Search of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) database to identify threatened species, ecological communities, Ramsar Sites and migratory species recorded within a five kilometre radius of the subject land;
- A 0.5-day flora assessment of the subject land with particular attention given to mapping of vegetation communities and Endangered Ecological Communities and identification of threatened flora identified in the NPWS Atlas search;
- A number of meandering transect fauna assessments of the subject land with particular attention given to identification of threatened fauna identified in the NPWS Atlas search; and
- An evaluation of the habitat and wildlife corridor value of the subject land.

Flora Survey Methodology

Introduction

One person carry out field surveys. Surveys were carried out over the entirety of the Site and focussed on mapping occurrences and distribution of threatened flora species, and characterising and mapping vegetation communities. The field inspection allowed description of the environmental features of the site with particular attention given to identification of any of the threatened flora and threatened communities identified in the OEH Bionet Atlas search and previous investigations.

Vegetation community types identified by previous studies were verified in the field through recording vegetation structure, species composition and condition. Attributes of structure, floristics and landform necessary for verification of EECs and TECs were recorded. Threatened flora species were surveyed using a random meander method within vegetation types.

The methodology for Hairy Jointgrass (HJG) survey adapted closely followed that employed by Stewart and McKinley (2008) in their study of the species in the Ballina Shire LGA. Searches used a meandering transect method. Search tracks were recorded on a hand held Garmin 62sc GPS. Any HJG specimens detected were marked with numbered waypoints.

Information on habitat, abundance, distribution and associated species was collected in field notebooks. Data captured in WGS84 datum was downloaded into ArcView Shapefiles and compiled within an ArcGIS system. Survey results are shown on figures as required.

Weed Survey Methodology

Weed surveys focussed on weeds identified as:

- Weeds of National Significance (WONS);
- National Environmental Alert List Weeds;
- Noxious weeds requiring control under the *Noxious Weeds Act* 1993; and
- Environmental and agricultural weeds relevant to the local area.

In addition, a review of available data and mapping from Australian Museum (2014) was undertaken and verified within the study area.

Survey Limitations

The methods were considered appropriate for identifying the spatial extent of the vegetation communities and flora species across the study area however the data must be interpreted in conjunction with the following limitations and constraints.

- While all attempts were made to consistently identify and locate HJG throughout the survey, the species is known to be difficult to detect particularly in situations of dense grasses and herbs. Therefore, any failure to record the species may not necessarily mean that it is not present.
- Areas with tree cover of more than 70% FPC were also excluded from HJG survey.
- Where two HJG waypoints are marked a few meters apart, the raw data may not distinguish between continuous occurrence of the grass, or two clumps separated by a few meters.
- The survey occurred in September, which is outside of the recommended survey window for HJG. Finds of the grass consisted of senescent specimens from the previous growing season.
- Some small (<2cm) seedlings were potentially identified, however at this small height; positive identification could not be confirmed.

<u>Fauna Survey Methodology</u>

Introduction

An initial desktop review was undertaken to identify threatened fauna previously recorded, or with potential to occur, within 5km of the Subject Site (OEH Atlas 2016, Atlas of Living Australia). Satellite and aerial imagery were reviewed to delineate major habitat types present on the Site.

Field inspections were undertaken in order to determine the likelihood of threatened species occurring at the Site based on available habitat and habitat condition, and to compile an inventory of species observed. A meandering transect survey was conducted on the 22nd September 2016. The full extent of the Site was traversed as far as practical. All vegetation communities within and immediately adjacent to the subject land were assessed in terms of the location and extent of fauna habitat and the likelihood of threatened fauna species occurring based on the available habitat. Species data was recorded in a field notebook.

Given the highly modified and open nature of a majority of the site (a former quarry), the intent not to clear any of the trees or disturb any of the forest communities along the boundaries of the quarry site, the limited micro-habitat values, the detailed previous assessments of those forested parts to be cleared as part of the Pacific Highway upgrade and known value of the area proposed to be utilised, it was considered sufficient to conduct a rapid fauna habitat assessment rather than a detailed fauna survey.

Potential habitat was determined for the major vegetation type(s) within the Subject Site (e.g. connectivity with surrounding native vegetation, presence of tree hollows, feed trees and frog breeding habitat). Particular attention was given to threatened fauna species and threatened populations identified in a search of the NPWS Atlas of NSW Wildlife (see Section 3).

The methods utilised during the fauna survey were specifically selected to target those threatened species most likely to occur at the site.

Survey Limitations

Fauna detectability is limited by seasonal, behavioural or lifecycle characteristics of each species and by habitats variability such as seasonal flowering all of which can vary over time. Habitat evaluation is used to counter this limitation by assessing the potential occurrence of threatened species based on potentially suitable habitat in the study area and local records. The site was generally accessible with only small areas not accessible due to dense undergrowth and vines. The species diversity at the site was typical of early spring.

Habitat and Hollow-bearing Tree Surveys

A meandering foot traverse was undertaken to search for hollow-bearing trees (HBT), nest trees and other significant habitat trees. If applicable, all previously identified habitat trees were relocated. The boundaries of the survey area were identified in the field using hardcopy plans and ARCGIS shapefiles of the areas uploaded to a hand-held Garman GPSMAP 62. The boundaries were not marked in the field.

All potential hollow-bearing trees were scanned for viable / functional hollows using 10 x 42 binoculars. A viable or functional hollow was one which appeared to have an open entrance and some depth that was sufficient to shelter fauna and was at least two metres above the ground. All dead and live hollow-bearing trees were recorded. Fallen limbs and branches around the potential hollow-bearing tree were also inspected for hollows enabling an assessment of the potential viability of the hollows in the tree. For completeness trunk basal hollows were also noted but were not used in the final analysis. A cautious approach to identifying hollows was adopted to ensure that all available hollow-bearing trees were identified and that all functional hollows were recorded.

It was recognised that for some tree species such as Callitris Pine (*Callitris columellaris*), Pink Bloodwood (*Corymbia intermedia*), Grey Ironbark (*Eucalyptus siderophloia*), Swamp Box (*Lophostemon suaveolens*) and Broad-leaved Paperbark (*Melaleuca quinquenervia*) it is often difficult to determine the presence of hollows or determine if the hollows detected are in fact functional. Similar difficulties are associated with trees containing termite colonies. Particular care was taken in assessing these and other problematic trees.

Each new hollow-bearing tree was assigned a unique reference number (i.e. 10HT01). The prefix number indicated the corridor section number, HT indicated that the tree was a hollow-bearing tree and the final number indicated the sequential number of the tree. A metal tag with this unique reference number was attached to the tree together with a ring of white paint and white flagging tape. Flagging tape was not attached to trees located in grazing paddocks where domestic stock were present. This was done so as to minimise the risk of the tape being ingested by stock.

Information gathered on each potential hollow-bearing tree included:

- Tree species;
- Location (Datum – GDA94);
- Tree height (m) approximated using a Tangent Height Gauge;
- Diameter at Breast Height (DBH);
- Hollow types – base, fissure, trunk and branch;
- Approximate hollow sizes based on standard categories: - Small (<5cm), medium (5-15cm), large (>15cm). Very large hollows (>30cm) were noted separately.
- Condition of tree: Live or dead;
- Status of the crown;
- Evidence of use such as scratch marks, worn hollow entrances, white wash, climb marks on the trunk, etc.;
- Evidence of nests; and,
- Presence of termites or European Bees and other comments.

The location and individual tree data was recorded on standard proforma and later transferred to an excel spreadsheet and uploaded to ARCGIS for further analysis and mapping.

Moth and Butterfly Host Vine Searches

Targeted searches for the Threatened Southern Pink Underwing Moth (*Phyllodes imperialis smithersi)* and the regionally restricted Richmond Birdwing Butterfly (*Ornithoptera richmondia*) were carried-out. The searches focussed on locating the host vines for the Pink Underwing Moth (*Carronia multisepalea*) and Birdwing Butterfly Vine (*Pararistolochia praevenosa*). All known and potential biometric communities and potential habitat linked to the Pink Underwing Moth and Richmond Birdwing Butterfly within the Project area were searched. Each vine was searched for signs of caterpillar damage (chewed leaves) and / or eggs or caterpillars. Due to the survey timing it was unlikely that caterpillars and / eggs would be found. The location of each vine was recorded using a hand-held GPS unit.

Atlas Rainforest Ground Beetle Habitat Searches

The rainforest ground beetles are large carnivorous flightless beetles belonging to the genus *Nurus* and are mostly restricted to the rainforests of the subcoastal mountains of north eastern NSW, South east Queensland and around Townsville (Monteith 2016). *Nurus atlas* is listed as endangered in NSW and has been recorded from small rainforest remnants such as Victoria Park and David Scrub Nature Reserves near Alstonville and more recently from the rainforests on the southern slopes of the Blackwall Range south of Alstonville.

Nurus atlas, like all of the species in the genus, constructs a shallow burrow with a typical and diagnostic semi-circular cleared area of about 5-8cm diameter in front of the burrow entrance. The beetles rarely leave the burrow but ambush prey from the burrow entrance. Surveys for this species focus on searching for these tell-tale burrows that are commonly located under the lower edge of an exposed root, rock or log. They are not found in areas that are inundated by rain or floods or in areas of very heavy clays or sands.

Assessment of habitat condition

Habitat condition or quality is a measure of how well a site supports a threatened species or an ecological community and which contributes to the ongoing viability of those species or communities. Where applicable, vegetation community habitat scores identified by previous studies were verified and assessed using the following primary components:

- Site condition (assessed structure and condition, species diversity, and habitat features of the polygon).
- Site context (assessed habitat connectivity, importance of the site in relation to the species population or the occurrence of the community, and threatening processes).
- Threatened Species occurrence (stocking rate) = confirmed presence, density, and role of the population in regards to the overall species population).

The method of assigning a habitat quality score (0-10) to each vegetation community polygon adapts the principles identified in the EPBC Environmental Offsets Policy 2012 and the Offsets Assessment Guide. These attributes were scored in the field and reviewed utilising survey data. The habitat quality attributes are as follows:

Habitat Condition (AM Consulting):

The AM Consulting scoring, summary of an analysis of detailed site assessments was:

- Low condition (score of 1)
- Moderate condition (score of 2)
- Good condition (score of 3)

Habitat Context (AM Consulting):

The AM Consulting scoring was:

- Isolated (score of 1)
- Connectivity on one side to a large tract of vegetation (score of 2)
- Connectivity on both sides to a large tract of vegetation (score of 3)

Species Stocking Rate (AM Consulting):

- Moderate likelihood of occurrence (score of 1)
- High likelihood with feeding habitat present (score of 2)
- High likelihood with breeding and feeding habitat present (score of 3)
- Species records confirmed (score of 4).

For the Koala feed tree presence was assessed and for the Pink Underwing Moth the presence of host plants was assessed.

Where applicable, for each vegetation community mapping polygons delineated, a habitat score was assigned individually for the seven EPBC listed threatened flora and fauna species. These species included: Hairy Joint Grass, Stinking Cryptocarya, Rusty Rose Walnut, Rough-shelled Bush Nut, Pink Underwing Moth, Grey-headed Flying-Fox and the Koala.

For consistency each species and vegetation community was ranked using the same categories used by AM Consulting (Pages 46 – 48 of their report). All values are contained within a seamless GIS layer enabling spatial representation of habitat quality and condition.

Attachment C. Bionet Atlas of NSW Wildlife and Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) search results

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -28.86 West: 153.42 East: 153.53 South: -28.96] returned a total of 1,182 records of 25 species.
Report generated on 22/09/2016 6:53 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Plantae	Flora	Apocynaceae	1233	*Marsdenia longiloba*		Slender Marsdenia	E1,P	V	5	
Plantae	Flora	Apocynaceae	1176	*Ochrosia moorei*		Southern Ochrosia	E1,P	E	6	
Plantae	Flora	Asteraceae	6943	*Blumea lacera*			E4,P		1	
Plantae	Flora	Corynocarpaceae	6662	*Corynocarpus rupestris subsp. rupestris*		Glenugie Karaka	V,P	V	2	
Plantae	Flora	Cunoniaceae	10943	*^^Davidsonia jerseyana*		Davidson's Plum	E1,P,2	E	1	
Plantae	Flora	Cunoniaceae	10944	*Davidsonia johnsonii*		Smooth Davidson's Plum	E1,P	E	12	
Plantae	Flora	Dennstaedtiaceae	7478	*Hypolepis elegans*			E4,P		2	
Plantae	Flora	Euphorbiaceae	9466	*Acalypha eremorum*		Acalypha	E1,P		4	
Plantae	Flora	Euphorbiaceae	8325	*Baloghia marmorata*		Jointed Baloghia	V,P	V	6	
Plantae	Flora	Fabaceae (Mimosoideae)	7757	*Archidendron hendersonii*		White Lace Flower	V,P		38	
Plantae	Flora	Lauraceae	3477	*Cryptocarya foetida*		Stinking Cryptocarya	V,P	V	73	
Plantae	Flora	Lauraceae	3491	*Endiandra hayesii*		Rusty Rose Walnut	V,P	V	24	
Plantae	Flora	Lauraceae	8480	*Endiandra muelleri subsp. bracteata*		Green-leaved Rose Walnut	E1,P		121	

Plantae	Flora	Lindsaeaceae	8126	*Lindsaea brachypoda*	Short-footed Screw Fern	E1,P,3		1
Plantae	Flora	Menispermaceae	3691	*Tinospora tinosporoides*	Arrow-head Vine	V,P		16
Plantae	Flora	Myrtaceae	4290	*Syzygium hodgkinsoniae*	Red Lilly Pilly	V,P	V	18
Plantae	Flora	Orchidaceae	7077	*^^Oberonia titania*	Red-flowered King of the Fairies	V,P,2		26
Plantae	Flora	Orchidaceae	4479	*^^Peristeranthus hillii*	Brown Fairy-chain Orchid	V,P,2		3
Plantae	Flora	Orchidaceae	4480	*^^Phaius australis*	Southern Swamp Orchid	E1,P,2	E	2
Plantae	Flora	Poaceae	4776	*Arthraxon hispidus*	Hairy Jointgrass	V,P	V	643
Plantae	Flora	Polypodiaceae	8154	*Belvisia mucronata*	Needle-leaf Fern	E1,P		4
Plantae	Flora	Proteaceae	5354	*Floydia praealta*	Ball Nut	V,P	V	1
Plantae	Flora	Proteaceae	5446	*Macadamia tetraphylla*	Rough-shelled Bush Nut	V,P	V	149
Plantae	Flora	Rutaceae	6457	*Acronychia littoralis*	Scented Acronychia	E1,P	E	12
Plantae	Flora	Rutaceae	12433	*Coatesia paniculata*	Axe-Breaker	E1,P		12

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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3007	*Assa darlingtoni*		Pouched Frog	V,P		1	
Animalia	Amphibia	Myobatrachidae	3137	*Crinia tinnula*		Wallum Froglet	V,P		8	
Animalia	Reptilia	Cheloniidae	2004	*Caretta caretta*		Loggerhead Turtle	E1,P	E	1	
Animalia	Reptilia	Scincidae	2293	*Coeranoscincus reticulatus*		Three-toed Snake-tooth Skink	V,P	V	1	
Animalia	Reptilia	Elapidae	2645	*Cacophis harriettae*		White-crowned Snake	V,P		1	
Animalia	Aves	Anseranatidae	0199	*Anseranas semipalmata*		Magpie Goose	V,P		1	
Animalia	Aves	Columbidae	0025	*Ptilinopus magnificus*		Wompoo Fruit-Dove	V,P		10	
Animalia	Aves	Columbidae	0021	*Ptilinopus regina*		Rose-crowned Fruit-Dove	V,P		7	
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		3	
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*		Black-necked Stork	E1,P		15	
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*		Black Bittern	V,P		2	
Animalia	Aves	Accipitridae	0218	*Circus assimilis*		Spotted Harrier	V,P		1	
Animalia	Aves	Accipitridae	0223	*^^Erythrotriorchis radiatus*		Red Goshawk	E4A,P,2	V	2	
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*		Little Eagle	V,P		1	
Animalia	Aves	Accipitridae	8739	*Pandion cristatus*		Eastern Osprey	V,P,3		24	

Animalia	Aves	Gruidae	0177	*Grus rubicunda*	Brolga	V,P		1
Animalia	Aves	Rallidae	0053	*Amaurornis moluccana*	Pale-vented Bush-hen	V,P		3
Animalia	Aves	Burhinidae	0174	*Burhinus grallarius*	Bush Stone-curlew	E1,P		1
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*	Pied Oystercatcher	E1,P		74
Animalia	Aves	Charadriidae	0141	*Charadrius leschenaultii*	Greater Sand-plover	V,P	V,C,J,K	1
Animalia	Aves	Scolopacidae	0161	*Calidris ferruginea*	Curlew Sandpiper	E1,P	CE,C,J,K	4
Animalia	Aves	Scolopacidae	0167	*Limicola falcinellus*	Broad-billed Sandpiper	V,P	C,J,K	2
Animalia	Aves	Scolopacidae	0152	*Limosa limosa*	Black-tailed Godwit	V,P	C,J,K	1
Animalia	Aves	Scolopacidae	0149	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	12
Animalia	Aves	Scolopacidae	0160	*Xenus cinereus*	Terek Sandpiper	V,P	C,J,K	3
Animalia	Aves	Turnicidae	0013	*Turnix maculosus*	Red-backed Button-quail	V,P		2
Animalia	Aves	Laridae	0117	*Sternula albifrons*	Little Tern	E1,P	C,J,K	2
Animalia	Aves	Cacatuidae	0265	*^^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*	Little Lorikeet	V,P		1
Animalia	Aves	Psittacidae	8913	*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V,P,3		1
Animalia	Aves	Strigidae	0248	*Ninox strenua*	Powerful Owl	V,P,3		1
Animalia	Aves	Tytonidae	0252	*Tyto longimembris*	Eastern Grass Owl	V,P,3		26
Animalia	Aves	Tytonidae	9924	*Tyto tenebricosa*	Sooty Owl	V,P,3		1
Animalia	Aves	Menuridae	0351	*Menura alberti*	Albert's Lyrebird	V,P		48
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		1
Animalia	Aves	Campephagidae	0428	*Coracina lineata*	Barred Cuckoo-shrike	V,P		4
Animalia	Aves	Monarchidae	0376	*Carterornis leucotis*	White-eared Monarch	V,P		9

Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	2	
Animalia	Mammalia	Dasyuridae	1017	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		1	
Animalia	Mammalia	Dasyuridae	1045	*Planigale maculata*	Common Planigale	V,P		7	
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*	Koala	V,P	V	155	
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*	Squirrel Glider	V,P		3	
Animalia	Mammalia	Potoroidae	1175	*Potorous tridactylus*	Long-nosed Potoroo	V,P	V	7	
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	11	
Animalia	Mammalia	Pteropodidae	1294	*Syconycteris australis*	Common Blossom-bat	V,P		7	
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		1	
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*	Little Bentwing-bat	V,P		9	
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		2	
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		1	
Animalia	Mammalia	Vespertilionidae	1336	*Nyctophilus bifax*	Eastern Long-eared Bat	V,P		7	
Animalia	Mammalia	Dugongidae	1558	*Dugong dugon*	Dugong	E1,P		1	
Animalia	Mammalia	Physeteridae	1578	*Physeter macrocephalus*	Sperm Whale	V,P		1	
Animalia	Insecta	Carabidae	I009	*Nurus atlas*	Atlas Rainforest Ground-beetle	E1,3		2	
Animalia	Insecta	Noctuidae	I021	*Phyllodes imperialis southern subspecies*	Southern Pink Underwing Moth	E1	E	18	

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Communities in selected area [North: -28.86 West: 153.42 East: 153.53 South: -28.96] returned 0 records for 10 entities.
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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Community				*Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion*		Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion	E3		K	
Community				*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	K	
Community				*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community				*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	K	

Community	*Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE	K	
Community	*Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion*	Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	E3	CE	K	
Community	*Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion*	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	E3		K	
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*White Gum Moist Forest in the NSW North Coast Bioregion*	White Gum Moist Forest in the NSW North Coast Bioregion	E3		K	

Australian Government

Department of the Environment

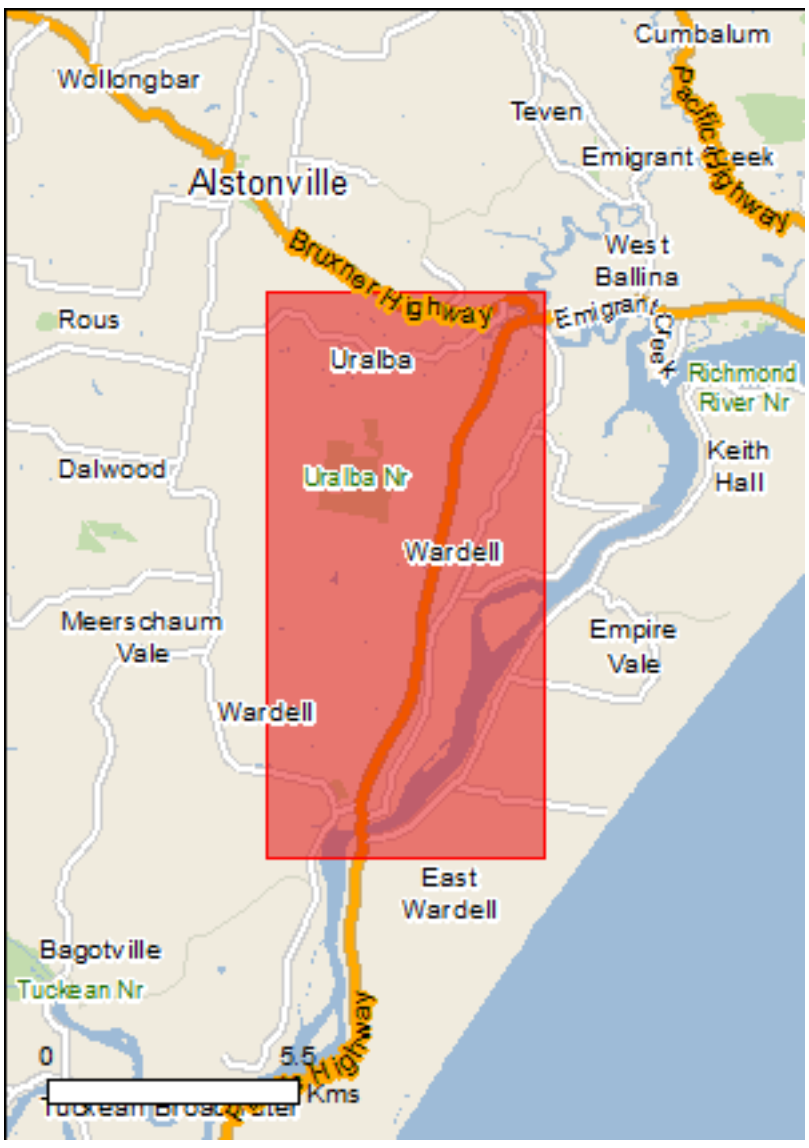
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 22/09/16 06:57:00



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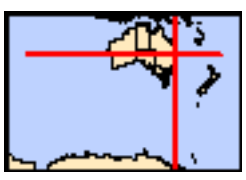
Coordinates

Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	67
Listed Migratory Species:	63

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	68
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	43
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities		[Resource Information]
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.		
Name	Status	Type of Presence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		

Name	Status	Type of Presence
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria olongburensis		
Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Phyllodes imperialis smithersi		
Pink Underwing Moth [86084]	Endangered	Breeding may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Acronychia littoralis		
Scented Acronychia [8582]	Endangered	Species or species habitat likely to occur within area
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Baloghia marmorata		
Marbled Balogia, Jointed Baloghia [8463]	Vulnerable	Species or species habitat likely to occur within area
Bulbophyllum globuliforme		
Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat may occur within area
Corynocarpus rupestris subsp. rupestris		
Glenugie Karaka [19303]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Desmodium acanthocladum Thorny Pea [17972]	Vulnerable	Species or species habitat likely to occur within area
Diploglottis campbellii Small-leaved Tamarind [21484]	Endangered	Species or species habitat likely to occur within area
Endiandra hayesii Rusty Rose Walnut, Velvet Laurel [13866]	Vulnerable	Species or species habitat likely to occur within area
Floydia praealta Ball Nut, Possum Nut, Big Nut, Beefwood [15762]	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat likely to occur within area
Hicksbeachia pinnatifolia Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut, Red Boppel Nut, Ivory Silky Oak [21189]	Vulnerable	Species or species habitat likely to occur within area
Isoglossa eranthemoides Isoglossa [16663]	Endangered	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat known to occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Ochrosia moorei Southern Ochrosia [11350]	Endangered	Species or species habitat likely to occur within area
Owenia cepiodora Onionwood, Bog Onion, Onion Cedar [11344]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Syzygium hodgkinsoniae Smooth-bark Rose Apple, Red Lilly Pilly [3539]	Vulnerable	Species or species habitat likely to occur within area
Syzygium moorei Rose Apple, Coolamon, Robby, Durobby, Watermelon Tree, Coolamon Rose Apple [12284]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Calidris subminuta Long-toed Stint [861]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Foraging, feeding or related behaviour known to occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
[Numenius minutus](#) Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour known to occur within area
[Numenius phaeopus](#) Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
[Pandion haliaetus](#) Osprey [952]		Breeding known to occur within area
[Philomachus pugnax](#) Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
[Pluvialis fulva](#) Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
[Pluvialis squatarola](#) Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
[Tringa glareola](#) Wood Sandpiper [829]		Foraging, feeding or related behaviour known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Foraging, feeding or related behaviour known to occur within area
[Xenus cinereus](#) Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Calidris subminuta Long-toed Stint [861]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Foraging, feeding or related behaviour known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed	Vulnerable	Species or species

Name	Threatened	Type of Presence
Albatross [64459]		habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Little Pimlico Island	NSW
Ngunya Jargoon	NSW
Uralba	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus africanus Climbing Asparagus, Climbing Asparagus Fern [66907]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-28.86085 153.4467,-28.86085 153.50095,-28.95823 153.50095,-28.95823 153.4467,-28.86085 153.4467

Acknowledgements

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-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
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-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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Appendix D Noise Impact Assessment

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Jali and Gibsons Borrow Sites

SS D22 Construction Noise and Vibration Impact Assessment

Report Number 610.15470-CNIA-R10 Jali and Gibsons D22

22 December 2016

Pacific Complete

21 Prince Street

Grafton NSW 2460

Version: v1.1

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Jali and Gibsons Borrow Sites

SS D22 Construction Noise and Vibration Impact Assessment

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Table of Contents

TABLES

Table of Contents

1 INTRODUCTION

1.1 Project Background

NSW Roads and Maritime Services (RMS) is progressively upgrading the Pacific Highway to a dual carriageway between the Hunter and the NSW / Queensland border.

The Woolgoolga to Ballina Pacific Highway Upgrade (W2B) involves upgrading approximately 155 km of highway to a four-lane dual-carriageway road between Woolgoolga (north of Coffs Harbour) and Ballina (near the NSW / Queensland border) on the NSW north coast. The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell. The project will include road duplication, alignment modification and new road sections. Once complete, the project will create a four-lane divided road, with two lanes in each direction. It would also allow for the road's upgrade in the future to a six-lane divided highway.

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Pacific Complete to prepare a Construction Noise Vibration Impact Assessment (CNVIA) of the noise impacts associated with the Jali and Gibsons Borrow Sites. This report presents the results of the assessment.

1.2 Relevant Guidelines

The main guidelines, specifications and policy documents relevant to this CNIA include:

- RMS QA Specification G36: Environmental Protection (Management System) (RMS, 2014)
- NSW *Road Noise Policy* (RNP) (DECCW 2011)
- NSW *Industrial Noise Policy* (EPA 2000)
- RTA *Environmental Noise Management Manual* (ENMM) (RTA 2001)
- NSW *Interim Construction Noise Guideline* (ICNG) (DECC 2009)
- NSW *Assessing Vibration: A Technical Guideline* (DEC 2006)
- British Standard *BS7385: Part 2 Evaluation and Measurement of Vibration in Buildings*
- German *DIN 4150: Part 3 – 1999 Effects of Vibration on Structure* (DIN 1999)
- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990)* Australian and New Zealand Environment and Conservation Council (ANZECC)
- Australian Standard *AS2187.2-2006: Explosives – Storage, Transport and Use*

1.3 Terminology

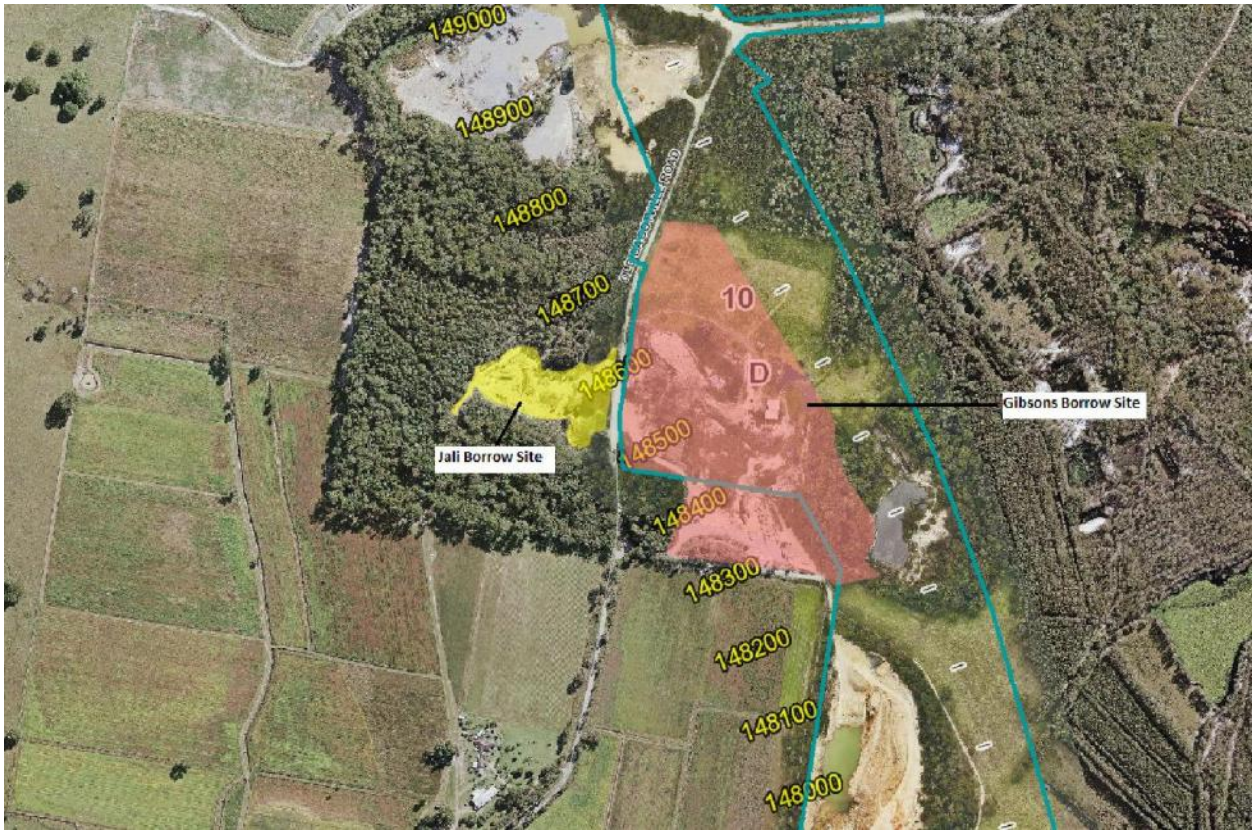
The assessment has used specific acoustic terminology. An explanation of common terms is included as **Appendix A**.

2 ANCILLARY FACILITY DETAILS

2.1 Description of Ancillary Facility

The proposed Jali and Gibsons Borrow Sites (the Site) is located within Lot 244 DP 755691 Bagotville, Lot 2 DP585377 and Lot 5 DP843369, Wardell, in the Ballina Council Local Government Area which is situated in Section 10 of the W2B project. The Site is approximately 9 hectares in size and would be accessed from Old Bagotoville Road, Bagotoville. The concept layout for the proposed Jali and Gibsons Borrow Sites are shown in **Figure 1**.

Figure 1 Proposed Site Layout Plan for Jali and Gibsons Borrow Sites



Note 1: Drawing provided by the client.

The primary uses of the Site would be:

- Satellite office compound.
- Material Extraction including Blasting
- Crushing and Screening
- Material stockpile.

2.2 Approved Project Construction Hours

Activities associated with the use of the site would be undertaken during the following standard project approved construction hours:

- 7:00 am to 6:00 pm Monday to Friday, inclusive.
- 8:00 am to 5:00 pm Saturday.
- At no time on Sunday or Public Holidays

Activities which would be deemed as being of low noise impact to the surrounding environment may be conducted between 6:00 am and 7:00 am Monday to Friday, and 6:00 pm and 7:00 pm Monday to Friday in accordance with the Project Approval. Any Out of Hours works (OOHW) would be undertaken in accordance with the projects approved Out of Hours Works Protocol included in the *Construction Environmental Management Plan* (CEMP) for the Approved Project.

3 EXISTING ENVIRONMENT

3.1 Sensitive Receivers

The *Construction Noise and Vibration Management Plan* (CNVMP) for the Approved Project identified sensitive receivers within the project area and defined Noise Catchment Areas (NCAs) characterising the changing land uses adjacent to the project. The Jali and Gibsons Borrow Sites is located within NCA-J, as defined in the CNVMP. NCA-J consists primarily of farmland and bushland, with scattered rural dwellings and the townships of Wardell. There are six residential receivers and one commercial receiver which have been identified within 1000 m of the Jali and Gibsons Borrow Sites.

3.2 Ambient Noise

To quantify and characterise the existing ambient noise environment, a baseline noise survey was undertaken as part of the Environmental Impact Statement (EIS) for the Approved Project.

The noise monitoring location applicable to NCA-J is Noise Monitor ID 68, located at 109 Medidian Drive, Coolgardie. The measured noise levels have been used as a basis for assessing potential noise impacts during construction and are summarised in **Table 1**.

Table 1 Ambient Noise Monitoring Results

NCA	Noise Monitor ID	Address	RBL[1] (dBA)		
			Day (07:00-18:00)	Evening (18:00-22:00)	Night-time (22:00-07:00)
NCA-J	68	109 Medidian Drive, Coolgardie, NSW 2478	41	42	38

Note 1: The Rating Background Levels (RBL) have been obtained using the calculation procedures documented in the *NSW Industrial Noise Policy* (INP).

4 CONSTRUCTION NOISE AND VIBRATION CRITERIA

4.1 Construction Noise Criteria

The NSW EPA *Interim Construction Noise Guideline* (ICNG) requires project specific Noise Management Levels (NMLs) to be established for noise affected receivers. In the event construction noise levels are predicted to be above the NMLs, all feasible and reasonable work practices are investigated to minimise noise emissions.

Having investigated all feasible and reasonable work practices, if construction noise levels are still predicted to exceed the NMLs then the potential noise impacts would be managed via the construction noise mitigation and management measures outlined in the Approved Project CNVMP and this CNIA.

4.1.1 Residential Receivers

The ICNG provides an approach for determining $L_{Aeq(15minute)}$ NMLs at residential receivers in the vicinity of the Jali and Gibsons Borrow Sites by applying the measured $L_{A90(15minute)}$ background noise levels, as described in **Table 2**.

Table 2 Determination of Noise Management Levels for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard hours Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise management level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences. • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Adopting the measured background noise levels in **Table 1**, the NMLs derived for the project are detailed in **Table 3**.

Table 3 Construction Noise Management Levels for Residential Receivers

NCA	NML (dBA)				
	Standard Hours – Daytime	Out of Hours – Daytime	Out of Hours – Evening	Out of Hours – Night-time	Sleep Disturbance
NCA-J	51	46	47	43	53

4.1.2 Other Sensitive Receivers

The ICNG provides NMLs for other sensitive land uses such as schools and commercial premises. The NMLs applicable to this project are shown in **Table 4**.

Internal noise levels are assessed at the centre of the occupied room. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. Some buildings may achieve greater performance, such as where windows are fixed (ie, cannot be opened).

Table 4 Constructions Noise Management Levels for Other Sensitive Receivers

Land Use	**NML $L_{Aeq(15minute)}$ (Applicable when the property is in use)**
Classrooms at schools and other educational institutions	Internal noise level 45 dB
Hospitals and operating theatres	
Places of worship	
Active recreation areas[1]	External noise level 65 dB
Passive recreation areas[2]	External noise level 60 dB
Community centres	Maximum internal levels recommended in AS2107 for specific use
Industrial and commercial premises	External noise level 75 dB
Other noise sensitive businesses	Investigation to determine suitable noise levels on project-by-project basis

Note 1: Active recreation areas are characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

Note 2: Passive recreation areas are characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg. reading, meditation).

4.2 Construction Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself.

Vibration criteria for these three categories have been defined in the CNVMP for the Approved Project.

The first of these vibration effects relating specifically to the human comfort aspects of the project are taken from the *Assessing Vibration – A Technical Guideline*, DEC (2006). This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to **Table 5**).
- Impulsive vibration – up to three instances of sudden impact, eg dropping heavy items, per monitoring period (refer to **Table 6**).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to **Table 7**).

Table 5 Continuous Vibration Acceleration Criteria (m/s^2) 1-80 Hz

Location	Assessment Period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z- axis	x- and y-axis
Residences	Daytime	0.010	0.007	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Educational institutions, places of worship and offices	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 6 Impulsive Vibration Acceleration Criteria (m/s^2) 1-80 Hz

Location	Assessment Period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z- axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.07	0.20	0.14
Educational institutions, places of worship and offices	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 7 Intermittent Vibration Impacts Criteria (m/s$^{1.75}$) 1-80 Hz

Location	Assessment Period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z- axis	x- and y-axis
Residences	Day or night-time	0.20	0.40	0.13	0.26
Educational institutions, places of worship and offices	Day or night-time	0.40	0.80	0.40	0.80
Workshops	Day or night-time	0.80	1.60	0.80	1.60

The other two effects relate to impacts on the building itself and are assessed against international standards as follows:

- British Standard *BS7385: Part 2-1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration* (BSI 1993)
- German *DIN4150: Part 3 – 1999 Effects of Vibration on Structure* (DIN 1999).

The German standard provides the most stringent criteria and has been adopted in the CNVMP. The DIN guideline values for peak particle velocity (mm/s) measured at the foundation of the building are summarised in **Table 8**. The criteria are frequency dependent and specific to particular categories of structure.

Table 8 Structural Damage Criteria

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of:			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in Rows 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: The criteria applied for frequencies above 100 Hz shall be at least the values specified in this column.

4.2.1 Safe Working Distances

The CNVMP outlines safe working distances for construction plant that may be used in the construction of the project. These are reproduced in **Table 9** and **Table 10**.

Key:

Expected to comply with vibration criteria
Expected to exceed the recommended vibration criteria
Expected to exceed the maximum vibration criteria

Table 9 Typical Plant Vibration Levels – Structural Damage

Plant Description	Vibration Level (mm/s)[1] at Distance from Structure				
	5 m	10 m	25 m	50 m	100 m
Criterion	5 (typical) / 3 (heritage)				
Vibratory roller (3-8 tonne)[2]	7	3	0.7	0.3	0.1
Vibratory roller (8-13 tonne)[2]	19	9	2	1	0.4
Vibratory roller (13-18 tonne)[2]	22	10	3	1	0.4
Vibratory roller (>18 tonne)[2]	28	13	4	1	0.5
Hydraulic hammer	6	2	0.5	0.2	0.1
Impact Pile driver[3]	30	12	3.6	1.5	0.6
Vibratory pile driver[4]	28	11	3	1	0.4
Drilling of blasting holes	6	2	0.5	0.2	0.1
Pile boring	6	2	0.5	0.2	0.1
Jackhammer (hand held)	2	0.8	0.2	<0.1	-

Note 1: Calculated in accordance with *BS5228 – Code of practice for noise and vibration control on construction and open sites (95% confidence) / FTA Guidance Manual for Transit Noise and Vibration Impact Assessment*
Note 2: Mid amplitude setting.
Note 3: Assumes soft ground
Note 4: Steady state operation (startup / shutdown may be higher).

Table 10 Typical Plant Vibration Levels – Human Comfort

Plant Description	eVDV (mm/s$^{1.75}$)[1] at Distance from Receiver				
	5 m	10 m	25 m	50 m	100 m
Criterion	0.2 daytime / 0.1 night-time				
Vibratory roller (3-8 tonne)[2]	5.9	2.3	0.6	0.2	0.1
Vibratory roller (8-13 tonne)[2]	16.2	7.3	2.2	0.8	0.3
Vibratory roller (13-18 tonne)[2]	18.2	8.2	2.5	0.9	0.3
Vibratory roller (>18 tonne)[2]	23.7	10.7	3.2	1.2	0.4
Hydraulic hammer	5	1.8	0.5	0.2	0.1
Impact Pile driver[3]	65	26	8	3.2	1.3
Vibratory pile driver[4]	23	9	2.5	0.9	0.4
Drilling of blasting holes	5	1.8	0.5	0.2	0.1
Pile boring	5	1.8	0.5	0.2	0.1
Jackhammer (hand held)	1.9	0.7	0.2	<0.1	-

Note 1: Calculated in accordance with *Assessing vibration a technical guideline* and assumes 6 hrs per day of intermittent vibration.

Note 2: Mid amplitude setting.

Note 3: Assumes soft ground

Note 4: Steady state operation (startup / shutdown may be higher).

5 CONSTRUCTION NOISE IMPACT ASSESSMENT

People are usually more tolerant to noise during the construction phase of projects than during normal operation. This response results from recognition that the construction emissions are of a temporary nature – especially if the most noise-intensive construction impacts occur during the less sensitive daytime period. For these reasons, acceptable noise levels are normally higher during construction than during operations.

Construction often requires the use of heavy machinery which can generate high noise levels at nearby buildings and receivers. For some equipment, there is limited opportunity to mitigate the noise levels in a cost-effective manner and hence the potential impacts should be minimised by using all feasible and reasonable management techniques.

At any particular location, the potential impacts can vary greatly depending on factors such as the relative proximity of sensitive receivers, the overall duration of the construction works, the intensity of the noise levels, the time at which the construction works are undertaken and the character of the noise emissions.

The following section details the assessment of potential noise impacts associated with the Jali and Gibsons Borrow Sites. Construction noise goals have been determined based on the measured RBLs in accordance with the procedure outlined in the ICNG. Potential noise levels have been predicted at sensitive receivers for expected activities and where levels are above the goals, feasible and reasonable noise mitigation measures are considered.

5.1 Proposed Construction Activities

The construction noise and vibration assessment has considered the following construction activities associated with the Jali and Gibsons Borrow Sites:

- Site establishment (setup) including earthworks, vehicles and loading.
- Site operation including Stockpiling, Extraction, Crushing and Screening and Blasting.
- Site decommissioning including earthworks, vehicles and loading and rehabilitation.

5.2 Construction Noise Modelling

Construction noise modelling of the Jali and Gibsons Borrow Sites was undertaken using SoundPLAN V7.1 modelling software.

Maximum sound power levels (L_{WA}) for the typical construction equipment (item) and construction activities that have been used in the noise modelling are listed in **Table 11**.

Table 11 Sound Power Levels for Construction Equipment

ID	Construction Activity	Equipment	Operating minutes in 15-min period	No of items in same location	Sound Power Level L_{WA} (dB)	
					Item	Activity
1a	Site Set Up / Decommission – Vehicles & Loading	Water Tanker (8000 litre)	15.0	1	98	107
		Mobile Crane (100 tonne)	15.0	1	101	
		Semi-Trailer	5.0	1	106	
		Vehicle (Light commercial e.g. 4WD)	5.0	4	101	
		Truck (12-15 tonne)	5.0	1	103	

ID	Construction Activity	Equipment	Operating minutes in 15-min period	No of items in same location	Sound Power Level L_{WA} (dB)	
					Item	Activity
1b	Earthworks	Excavator (25 tonne)	15.0	1	102	112
		Grader	15.0	1	108	
		Vibratory Roller (10 - 12 tonne)	15.0	1	109	
		Vehicle (Light commercial e.g. 4WD)	5.0	1	101	
2a	Satellite office	Vehicle (Light commercial e.g. 4WD)	5.0	2	101	105
		Generator	15.0	2	101	
		Air Conditioning Exchange Unit	15.0	10	75	
3a	Extraction	Excavator (Breaker)[1]	7.5	2	121	124
		Excavator (40 tonne)	15.0	1	109	
		Dozer	15.0	2	110	
		Front End Loader	15.0	1	112	
		Back Hoe (7.5 tonne JCB)	15.0	1	102	
		Articulated Dump Truck	15.0	3	103	
		Scraper	15.0	3	111	
		Semi-Trailer	5.0	1	106	
		Water Tanker (8000 litre)	15.0	1	98	
		Vibratory Roller (10 - 12 tonne)	15.0	1	109	
		Vehicle (Light commercial e.g. 4WD)	5.0	4	101	
4a	Crushing and Screening	Crusher - Jaw	15.0	1	120	123
		Screen	15.0	1	119	
		Excavator (30 tonne)	15.0	1	104	
		Front End Loader	15.0	1	112	
		Water Tanker (8000 litre)	15.0	1	98	
		Vehicle (Light commercial e.g. 4WD)	5.0	2	101	
5a	Stockpiling	Excavator (30 tonne)	15.0	1	104	115
		dozer	15.0	1	110	
		Truck (12-15 tonne)	5.0	1	103	
		Articulated Dump Truck	15.0	1	103	
		Back Hoe (7.5 tonne JCB)	15.0	1	102	
		Front End Loader	15.0	1	112	
		Semi-Trailer	5.0	1	106	
		Water Tanker (8000 litre)	15.0	1	98	

ID	Construction Activity	Equipment	Operating minutes in 15-min period	No of items in same location	Sound Power Level L_{WA} (dB)	
					Item	Activity
6a	Rehabilitation	Excavator (25 tonne)	15.0	1	102	114
		Dozer	15.0	1	110	
		Articulated Dump Truck	15.0	1	103	
		Vibratory Roller (10 - 12 tonne)	15.0	1	109	
		Vehicle (Light commercial e.g. 4WD)	5.0	5	101	

Note 1: In accordance with the ICNG, for activities identified as particularly annoying (such as jackhammering, rock breaking and power saw operations), a 5 dB 'penalty' is added to the source sound power level when predicting noise using the quantitative method.

Consistent with the requirements of the ICNG, the construction noise impacts are based on a realistic worst-case assessment. For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted for the realistic worst-case assessment.

5.3 Predicted Construction Noise Impacts

The predicted $L_{Aeq(15minute)}$ noise levels at the surrounding noise sensitive receivers are detailed in **Table 12**. Construction activities are representative of the 'noisiest' construction periods, which accounts for the simultaneous operation of noise intensive construction plant in close proximity. Noise contour maps of the worst-case maximum $L_{Aeq(15minute)}$ noise levels are provided in **Appendix B**.

Table 12 Predicted Construction Noise Levels

Sensitive Receiver Type	NML				Noise Level – $L_{Aeq(15minute)}$ (dB)					Number of Exceedances (Receivers)			
					Worst-case Predicted	NML Exceedance							
	Day	Day OOH	Eve OOH	Night OOH		Day	Day OOH	Eve OOH	Night OOH	Day	Day OOH	Eve OOH	Night OOH
1a – Site Set Up / Decommission – Vehicles & Loading													
Residential	51	46	47	43	Up to 42	-	-	-	-	-	-	-	-
Commercial	75	-	-	-	Up to 41	-	-	-	-	-	-	-	-
1b – Site Set Up / Decommission – Earthworks													
Residential	51	46	47	43	Up to 47	-	Up to 1	-	Up to 4	-	1	-	1
Commercial	75	-	-	-	Up to 46	-	-	-	-	-	-	-	-
2a – Site Operation – Site Office													
Residential	51	46	47	43	Up to 40	-	-	-	-	-	-	-	-
Commercial	75	-	-	-	Up to 39	-	-	-	-	-	-	-	-
3a – Site Operation – Extraction													
Residential	51	46	47	43	Up to 57	Up to 6	Up to 11	Up to 10	Up to 14	1	5	4	6
Commercial	75	-	-	-	Up to 56	-	-	-	-	-	-	-	-
4a - Site Operation – Crushing and Screening													
Residential	51	46	47	43	Up to 58	Up to 7	Up to 12	Up to 11	Up to 15	1	5	4	6
Commercial	75	-	-	-	Up to 57	-	-	-	-	-	-	-	-

Sensitive Receiver Type	NML				Noise Level – $L_{Aeq(15minute)}$ (dB)					Number of Exceedances (Receivers)			
					Worst-case Predicted	NML Exceedance							
	Day	Day OOH	Eve OOH	Night OOH		Day	Day OOH	Eve OOH	Night OOH	Day	Day OOH	Eve OOH	Night OOH
5a - Site Operation – Stockpiling													
Residential	51	46	47	43	Up to 50	-	Up to 4	Up to 3	Up to 7	-	1	1	1
Commercial	75	-	-	-	Up to 49	-	-	-	-	-	-	-	-
6a – Rehabilitation													
Residential	51	46	47	43	Up to 49	-	-	-	-	-	1	1	1
Commercial	75	-	-	-	Up to 48	-	-	-	-	-	-	-	-

5.3.1 Site Commissioning/Decommissioning

During standard construction hours, no exceedances of the NMLs are predicted at any residential receivers during site commissioning and decommissioning. Exceedances of the Out of Hours NMLs of up to 4 dB are predicted at 1 residential receiver when earthworks activities are taking place as part of the site establishment/decommissioning.

No exceedances of the NMLs are predicted at any commercial receivers.

5.3.2 Extraction

As multiple extraction activities will be undertaken concurrently across the two sites, the construction equipment as detailed **Table 11** has been evenly distributed throughout the two borrow sites to represent a realistic cumulative operation.

During standard construction hours, exceedances of the NMLs up to 6 dB are predicted at one residential receiver. Exceedances of the Out of Hours NMLs of up to 14 dB are predicted at up to 6 residential receivers when extraction activities are taking place outside of standard construction hours.

No exceedances of the NMLs are predicted at any commercial receivers.

5.3.3 Crushing and Screening

During standard construction hours, exceedances of the NMLs up to 7 dB are predicted at one residential receiver during crushing and screening activities. Exceedances of the Out of Hours NMLs of up to 15 dB are predicted at up to 6 residential receivers when these activities are taking place outside of standard construction hours.

No exceedances of the NMLs are predicted at any commercial receivers.

5.4 Borrow Site Cumulative Operation

Based on our current understanding of the proposed site operations, there is potential for multiple activities to occur simultaneously across both sites. To assess the potential impact from this worst case operating scenario, a cumulative assessment of both extraction and crushing / screening activities has been undertaken and is detailed in **Table 13**.

Table 13 Cumulative Construction Noise Levels

Sensitive Receiver Type	NML				Noise Level – $L_{Aeq(15minute)}$ (dB)					Number of Exceedances (Receivers)			
					Worst-case Predicted	NML Exceedance							
	Day	Day OOH	Eve OOH	Night OOH		Day	Day OOH	Eve OOH	Night OOH	Day	Day OOH	Eve OOH	Night OOH
Cumulative Extraction & Crushing and Screening													
Residential	51	46	47	43	Up to 60	Up to 9	Up to 14	Up to 13	Up to 17	4	6	6	6
Commercial	75	-	-	-	Up to 59	-	-	-	-	-	-	-	-

During standard construction hours, exceedances of the NMLs of up to 9 dB at four residential receivers are predicted with the cumulative operation of the borrow pit activities (extraction, and crushing / screening). Exceedances of the Out of Hours NMLs of up to 17 dB at six residential receivers are predicted during cumulative works.

From the assessment the cumulative operations it is evident that the site emissions are equally dominated by both extraction and crushing / screening activities.

5.5 Cumulative Construction Noise Impacts

In order to assess the cumulative noise impacts of the Jali and Gibsons Borrow Sites with construction activities which may occur on the mainline, construction activities for the mainline works have been extracted from the CNVMP. Mainline construction activities are shown in **Table 14**.

Table 14 Mainline Construction Activities

Construction Activity			Overall Sound Power Level L_{WA} (dB)
ID	Reference	Activity	
01	08_BAS	Construction of water quality basins	106
	20_SGN	Signage installation	
02	17_LMK	Linemarking	107
	18_WLI	Wall installation	
03	11_ENV	Installation of environmental controls	108
04	16_SPS	Spray sealing activities	109
05	01_GEO	Geotechnical works	110
	02_DCL	Discrete clearing	
	07_SER	Services and drainage installation	
	14_CSC	Soft concrete saw cutting	
06	03_BCL	Broad clearing	111
	09_HAU	Plant and materials haulage	
07	10_VMW	Verge and median works	112
	19_BDG	Bridge installations – bored piling	
08	05_DRL	Earthworks – drill and blasting	113
	12_KCB	Kerb and barrier works	
	15_SCP	Shoulder concrete paving	
	21_MCP	Main compound	
09	13_CCP	Carriageway concrete paving	114

10	06_FIL	Earthworks – fill and compact	116
11	04_CUT	Earthworks – cut	124
12	22_CCP	Crushing compound	125

Cumulative impacts from the mainline construction activities were modelled with the Jali and Gibsons Borrow Sites construction activities. The cumulative noise levels, exceedances and dominant construction activities are summarised in **Table 15**.

Table 15 Cumulative Construction Noise Impacts at Residences

Mainline Scenarios	Worst-case Predicted Noise Level – $L_{Aeq(15minute)}$ (dB) Cumulative Noise Level (Day NML Exceedance)[2]							Dominant Construction Noise Source[1]						
	Ancillary Construction Scenarios							Ancillary Construction Scenarios						
	01a	01b	02a	03a	04a	05a	06a	01a	01b	02a	03a	04a	05a	06a
01	43 (-)	47 (-)	41 (-)	57 (5)	58 (6)	50 (-)	49 (-)	CU	AF	CU	AF	AF	AF	AF
02	44 (-)	48 (-)	43 (-)	57 (5)	58 (6)	50 (-)	49 (-)	CU	CU	CU	AF	AF	AF	AF
03	44 (-)	48 (-)	43 (-)	57 (5)	58 (6)	50 (-)	50 (-)	CU	CU	CU	AF	AF	AF	CU
04	45 (-)	48 (-)	44 (-)	57 (5)	58 (6)	51 (-)	50 (-)	CU	CU	CU	AF	AF	CU	CU
05	45 (-)	48 (-)	45 (-)	57 (5)	58 (6)	51 (-)	50 (-)	CU	CU	CU	AF	AF	CU	CU
06	46 (-)	49 (-)	45 (-)	57 (5)	58 (6)	51 (-)	50 (-)	CU	CU	CU	AF	AF	CU	CU
07	47 (-)	49 (-)	46 (-)	57 (5)	58 (6)	51 (-)	50 (-)	CU	CU	CU	AF	AF	CU	CU
08	47 (-)	49 (-)	47 (-)	57 (5)	58 (6)	51 (-)	51 (-)	CU	CU	CU	AF	AF	CU	CU
09	48 (-)	50 (-)	48 (-)	57 (5)	58 (6)	52 (-)	51 (-)	CU	CU	CU	AF	AF	CU	CU
10	50 (-)	51 (-)	49 (-)	57 (5)	58 (6)	52 (-)	52 (-)	CU	CU	ML	AF	AF	CU	CU
11	57 (5)	57 (5)	57 (5)	60 (8)	60 (8)	58 (6)	57 (5)	ML	ML	ML	CU	CU	CU	ML
12	58 (6)	58 (6)	58 (6)	60 (8)	61 (9)	58 (6)	58 (6)	ML	ML	ML	CU	CU	ML	ML

Note 1: AF = Ancillary Facility; ML = Mainline; CU = Cumulative.
Note 2: Day NML exceedances notes in Red.

Where the dominant noise source is listed as ancillary facility (AF), mainline construction activities do not contribute to the $L_{Aeq(15minute)}$ noise levels at the most-affected receivers.

Where the dominant noise source is listed as mainline (ML), ancillary facility construction activities do not contribute to the $L_{Aeq(15minute)}$ noise levels at the most-affected receivers.

Where the dominant noise source is listed as cumulative (CU), both the ancillary facility and mainline construction activities contribute to the $L_{Aeq(15minute)}$ noise levels at the most-affected receivers.

As shown in **Table 15**, the worst-case noise levels during some concurrent activities of the borrow pit and mainline construction activities (where an exceedance of the NML is predicted) result with the borrow pit having a cumulative impact or dominant impact at the worst affected receiver location.

5.6 Construction Traffic

Criteria and Procedure

While light and heavy vehicle movements within the Jali and Gibsons Borrow Sites are classified as part of the site noise, once they move off the site and onto public roads they are assessed under the *NSW Road Noise Policy* (RNP).

One of the objectives of the RNP is to apply permissible noise increase criteria to protect sensitive receivers against excessive changes in noise existing noise environment from the project.

The RNP requires that an initial screening test should be applied by evaluating whether daytime and/or night-time noise levels would increase by more than 2 dB (an increase in the number vehicles of approximately 60%) due to construction traffic or a temporary reroute due to a road closure. Where increases are 2 dB or less then no further assessment is required as noise level changes would most likely not be perceptible to most people.

Where noise levels increase by more than 2 dB (ie 2.1 dB or greater) further assessment is required using criteria provided in the RNP and presented below.

- 60 dB $L_{Aeq(15hour)}$ daytime and 55 dB $L_{Aeq(9hour)}$ night-time for existing freeway / arterial / sub-arterial roads.
- 55 dB $L_{Aeq(1hour)}$ daytime and 50 dB $L_{Aeq(1hour)}$ night-time for existing local roads.

Assessment

The main access route to the Jali and Gibsons Burrow Sites would be via the existing Old Bagotovile Road to the east, onto Back Channel Road/Carlisle Street and linking up to the Pacific Highway. This is the only route from these work sites to the Pacific Highway, therefore construction traffic, including the transportation of extracted material by HGV, would be required to use these local roads. There are several existing sensitive receivers adjacent to Carlisle Street that would potentially be affected by construction traffic using this route

It is understood that up to 600 HGV movements and 70 light vehicle (LV) movements per day would be required. This translates into 55 HGV movements per hour and 6 LV movements per hour. No construction traffic would use the route outside of standard daytime construction hours. Construction traffic is anticipated to use this route for around four months before alternative access along the main line will be possible.

The existing traffic along Carisle Street is currently unknown, however it is anticipated that there would likely be a small number of daily HGVs using the route from the existing quarries that are in the area together with some LV movements of local residents. As such, noise increases of greater than 2 dB are considered highly likely along the route.

When construction traffic accesses the Pacific Highway, the existing volume of traffic is sufficiently high in comparison to the construction related vehicles to not result in a noticeable increase in existing noise levels. As such, no further mitigation is considered necessary once vehicles reach the Pacific Highway.

Calculations have been undertaken to predict the potential noise levels on Carlisle Street based on the above assumptions and assuming a setback distance from nearest residential receiver to the road of approximately 18 meters. On this basis, the likely worst-case construction traffic noise level is predicted to be in the region of 60 dB $L_{Aeq(1hour)}$, which exceeds the daytime criteria for local roads by 5 dB.

The options for mitigating the potential impacts are limited. In order for the road traffic noise criteria for local roads to be achieved, the maximum number of HGV movements could be limited to around 16 per hour, however this significant reduction in HGV movements will cause significant disruption to the project program and will likely result in the potential impacts from construction traffic in this area being significantly increased in duration. As such, reducing the number of daily HGVs is unlikely to be considered feasible.

It is therefore recommended that the mitigation strategy should focus on community engagement prior to the works occurring to explain the potential impacts and reasons for them, and to determine if there are any periods of the day where the affected receivers are particularly sensitive noise (for example during church services and school assemblies) where respite periods from construction traffic can be offered.

It is relevant to note that construction traffic impacts would only be apparent during the daytime, and that HGV's are only proposed to be using this route for approximately four months. Construction traffic movements would also not be likely to be sustained for the whole of this four month period.

6 CONSTRUCTION VIBRATION IMPACT ASSESSMENT

6.1 Predicted Construction Vibration Impacts

No vibration intensive items of plant have been identified to operate within the safe working distances outlined in **Table 10**.

Where vibration intensive construction activities are proposed within 100 m of sensitive receivers, it is recommended that construction vibration mitigation measures should be considered, where reasonable and feasible. Construction vibration mitigation measures are discussed in **Section 7**.

7 CONSTRUCTION NOISE AND VIBRATION MITIGATION

The CNVMP for the Approved Project outlines a range of environmental requirements and control measures to minimise construction noise and vibration impacts associated with the project. The strategies are designed to minimise, to the fullest extent practicable, noise and vibration during construction.

Where construction noise levels are predicted to exceed the NMLs or vibration intensive construction activities are proposed within 100 m of sensitive receivers, it is recommended that construction noise and vibration mitigation measures should be considered, where reasonable and feasible.

Particular works which are noted in **Table 12** as having the potential for impacts are;

- Borrow site extraction works (scenario 3a)
- Borrow site crushing and screening (scenario 4a)

Scenarios listed above include items of construction equipment with relatively high sound power levels, such as rock breakers, front end loaders, dozers and crushers. Mitigating noise emission from these key items of plant is crucial in minimising noise impacts at nearby receivers.

Mitigating exceedances through the means of locating noisy equipment as far away from receivers as practicable is not always feasible due to the nature of the works, i.e. borrow site extraction works which will be required where the material is located. Judicious selection of the location of the crusher and screen can (where feasible and practicable) manage / mitigate predicted exceedances due to the source being stationary.

Predictions have been conducted to investigate the area within the site for crushing and screening activities that will reduce noise impacts to the surrounding receivers. **Figure 2** indicates the location investigated while results are presented in **Table 16**.

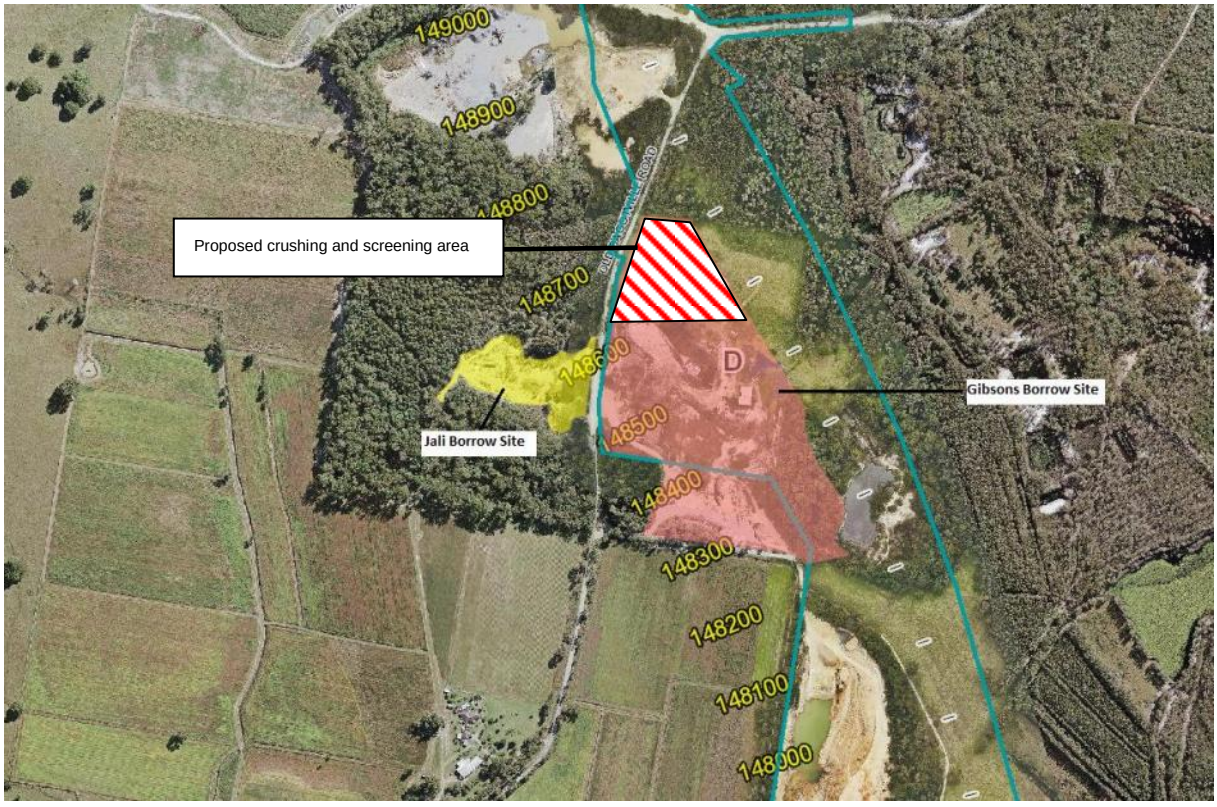
Table 16 Screening and Crushing Works (Mitigated)

Sensitive Receiver Type	NML				Noise Level – LAeq(15minute) (dB)					Number of Exceedances (Receivers)			
					Worst-case Predicted	NML Exceedance							
	Day	Day OOH	Eve OOH	Night OOH		Day	Day OOH	Eve OOH	Night OOH	Day	Day OOH	Eve OOH	Night OOH
4a Screening and Crushing (Mitigated)													
Residential	51	46	47	43	Up to 54	Up to 3	Up to 8	Up to 7	Up to 11	1	5	3	6
Commercial	75	-	-	-	Up to 53	-	-	-	-	-	-	-	-

With the screening and crushing activities limited to the Northern portion of the Gibsons borrow site, predictions indicate that during standard construction hours, the worst case exceedance of the NMLs is reduced by 3dB at the nearest residential receiver.

It should be noted that the mitigation strategies discussed above should be considered in conjunction with the mitigation and management measures outline in the Approved Project CNVMP.

Figure 2 Mitigated Borrow Pit Screening and Crushing location



General construction noise and vibration mitigation measures outlined in the CNVMP are provided in **Table 17**.

Table 17 Noise and Vibration Management and Mitigation Measures

ID	Measurement / Requirement	Responsibility	Timing	Reference
NV15	The contractor will provide training to all project personnel, including relevant sub-contractors on noise and vibration requirements from this plan through inductions, toolbox talks and targeted awareness training	Contractor	Pre-construction	Good practice
NV17	Site entry and exit points will be located as far as possible from sensitive receivers, taking into account the importance of safe access.	Contractor	Pre-construction	Good practice
NV26	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any structure or service, a building condition survey will be conducted and preliminary vibration monitoring undertaken by a qualified contractor.	Contractor	Pre-construction	Submissions / PIR (CNV15)
NV27	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any heritage structure or potentially structurally unsound service, a building condition survey will be conducted and preliminary vibration monitoring undertaken by a qualified contractor. A follow-up survey will be conducted in response to any vibration complaints.	Contractor	Pre-construction	Submissions / PIR (CNV16)
NV28	Prior to the use of the dynamic compaction construction method, the contractor will undertake an assessment of vibration generated by dynamic compaction on nearby sensitive receivers. Feasible and reasonable mitigation measures shall be implemented to minimise vibration impacts.	Contractor	Pre-construction	MCoA B26
NV2	Haulage routes will be located as far away as possible from residential receivers, where this is reasonable and feasible.	Contractor	Construction	Submissions / PIR (CNV3)
NV3	Equipment will be maintained in efficient working order.	Contractor	Construction	Submissions / PIR (CNV4)
NV4	Quieter construction methods will be used, where there are sensitive receivers potentially affected and where this is considered reasonable and feasible.	Contractor	Construction	Submissions / PIR (CNV5)
NV5	Where acceptable from a work health and safety perspective, quieter alternatives to reversing alarms (such as spotters, closed circuit television monitors and 'smart' reversing alarms) will be used.	Contractor	Construction	Submissions / PIR (CNV6)
NV6	Machinery will not be turned on prior to the approved construction hours. This will include daily maintenance activities and/or 'warming up' of engines.	Contractor	Construction	Submissions / PIR (CNV8)
NV7	Truck movements will be restricted to identified haulage routes and the routes outlined in the Construction Traffic Management Plan.	Contractor	Construction	Submissions / PIR (CNV9)
NV8	The use of temporary noise shielding will be considered at locations where substantial exceedances of noise criteria are predicted.	Contractor	Construction	Submissions / PIR (CNV11)
NV9	Static noise sources, such as generators, pumps and lighting towers, will be located as far as possible from sensitive receivers.	Contractor	Construction	Submissions / PIR (CNV12)
NV10	Regular noise monitoring will be undertaken during proposed construction hours at a representative receiver location, between: • 6am to 7pm, Monday to Friday. • 8am to 5pm, Saturday.	Contractor	Construction	Submissions / PIR (CNV13)
NV11	Noise and vibration monitoring will be undertaken in where exceedances of the criteria are predicted. The program for construction noise and vibration monitoring indicates monitoring frequency, location, how the results of this monitoring are recorded and, procedures that are followed where significant exceedances of relevant noise and vibration goals are detected.	Contractor	Construction	Good practice

ID	Measurement / Requirement	Responsibility	Timing	Reference
NV12	Initial noise monitoring of plant and equipment will be undertaken to ensure the noise performance levels predicted in this CNIA are being met.	Contractor	Construction	Good practice
NV13	The selection of plant and equipment will be based on noise emission levels. This equipment will be operated and maintained so that noise emissions are minimised.	Contractor	Construction	Submissions / PIR (CNV13)
NV18	Loading and unloading will be carried out as far as practical away from sensitive receivers.	Contractor	Construction	Good practice
NV19	Truck movements will be kept to a minimum, ie trucks will be sufficiently utilised for each trip.	Contractor	Construction	Good practice
NV20	Trucks will not queue outside residential properties. No trucks will arrive on site or be permitted to queue near sensitive receivers outside of standard construction hours unless required by road safety considerations.	Contractor	Construction	Good practice
NV21	Noisy plant working simultaneously close together will be avoided to the greatest extent practical adjacent to noise affected sensitive receivers.	Contractor	Construction	Good practice
NV22	Whenever practical, at the end of shifts, excavation plant will be taken from their work areas and left overnight away from the immediate vicinity of sensitive receivers. Warming up of the plant will then be conducted away from such receivers.	Contractor	Construction	Good practice
NV23	Truck drivers will limit compression braking as far as practicable.	Contractor	Construction	Good practice
NV24	Where possible, noise generating equipment will be strategically positioned to take advantage of natural screening from geographical features or other structures to reduce the transmission of noise between work sites and receiver locations.	Contractor	Construction	Good practice
NV29	Appropriately sized equipment will be selected to minimise vibration emissions, where required	Contractor	Construction	Submissions / PIR (CNV17)
NV30	Building Condition Inspections for each public utility, structure and building will be carried out where: (i) Pile driving activities are within 250 metres or the distance at which the calculated 95th percentile Peak Velocity of ground vibration from the proposed pile driving is 2 mm/s, whichever is the greater (ii) Other vibration causing activities where the distance at which the calculated 95th percentile Peak Velocity of ground vibration is 2 mm/s.	Contractor	Construction	Good practice
NV31	The Building Condition Inspection report will include as a minimum: (i) Floor plan of the subject building. (ii) Record site details - age, construction, site slope and provision for drainage, presence of trees. (iii) Type of defects and their positions and extents on the floor plan. (iv) Photograph of external view and photograph of all defects of significance (especially if of concern to the owner), or typical examples of say, hairline plaster cornice cracks. (v) How doors sit in the jambs - out of line may indicate foundation settlement. (vi) External signs of reactive clay foundation soil, e.g. lifting of slabs, uneven kerbing.	Contractor	Construction	Good practice

8 CONCLUSION

SLR consulting has conducted a Construction Noise Impact Assessment (CNIA) of the noise impacts associated with the Jali and Gibsons Borrow Sites.

An assessment of the airborne construction noise against the project NMLs (refer to **Section 4**) has been conducted and is presented in **Section 5** of this report.

Recommended mitigation measures of the construction traffic have been provided, focusing on community engagement prior to the works occurring to explain the potential impacts.

General construction noise mitigation and management measures for the project have been defined in the CNVMP for the Approved Project and are provided in **Section 7**. Where construction noise levels are predicted to exceed the NMLs, it is recommended that construction noise mitigation measures should be considered, where reasonable and feasible.

No vibration intensive items of plant have been identified to operate within the safe working distances for the proposed construction activities. Where vibration intensive construction activities are proposed within 100 m of sensitive receivers, it is recommended that construction noise mitigation measures should be considered, where reasonable and feasible.

Acoustic Terminology

1 Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that in common usage 'noise' is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3 Sound Power Level

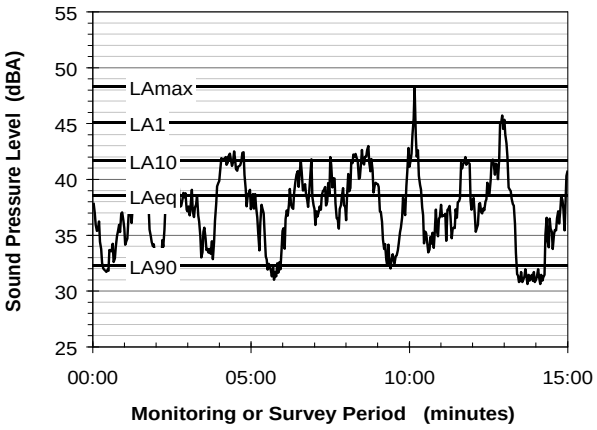
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the 'repeatable minimum' L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or 'average' levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than 'broad band' noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

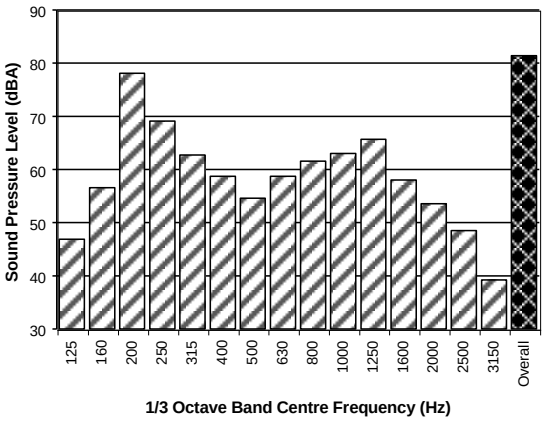
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

10 Over-Pressure

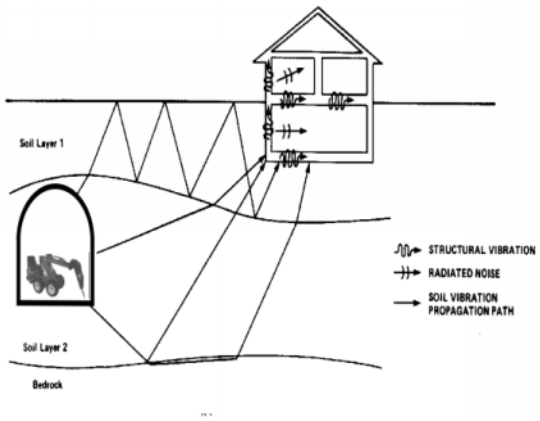
The term 'over-pressure' is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise

Noise Contour Maps

Mainline Works

Jali and Gibsons Borrow

Predicted LAeq Noise Levels

45 dBA | 50 dBA | 55 dBA | 60 dBA

Receiver Categories

Community | Educational | Residential
Commercial | Hospital | Recreational

N

100 0 100 200 300 m

Pacific Complete

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Construction Noise Assessment
Extraction Operations LAeq(15minute)
Jali and Gibsons Borrow Site

SLR
2 LINCOLN STREET
LANE COVE
NSW 2066
AUSTRALIA
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Project No.:	610.15470
Date:	23/11/2016
Drawn by:	NV
Scale:	1:10,116
Sheet Size:	@A4
Projection:	GDA 1994 MGA Zone 56

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N

100 0 100 200 300 m

Mainline Works

Jali and Gibsons Borrow

Predicted LAeq Noise Levels

45 dBA 50 dBA 55 dBA 60 dBA

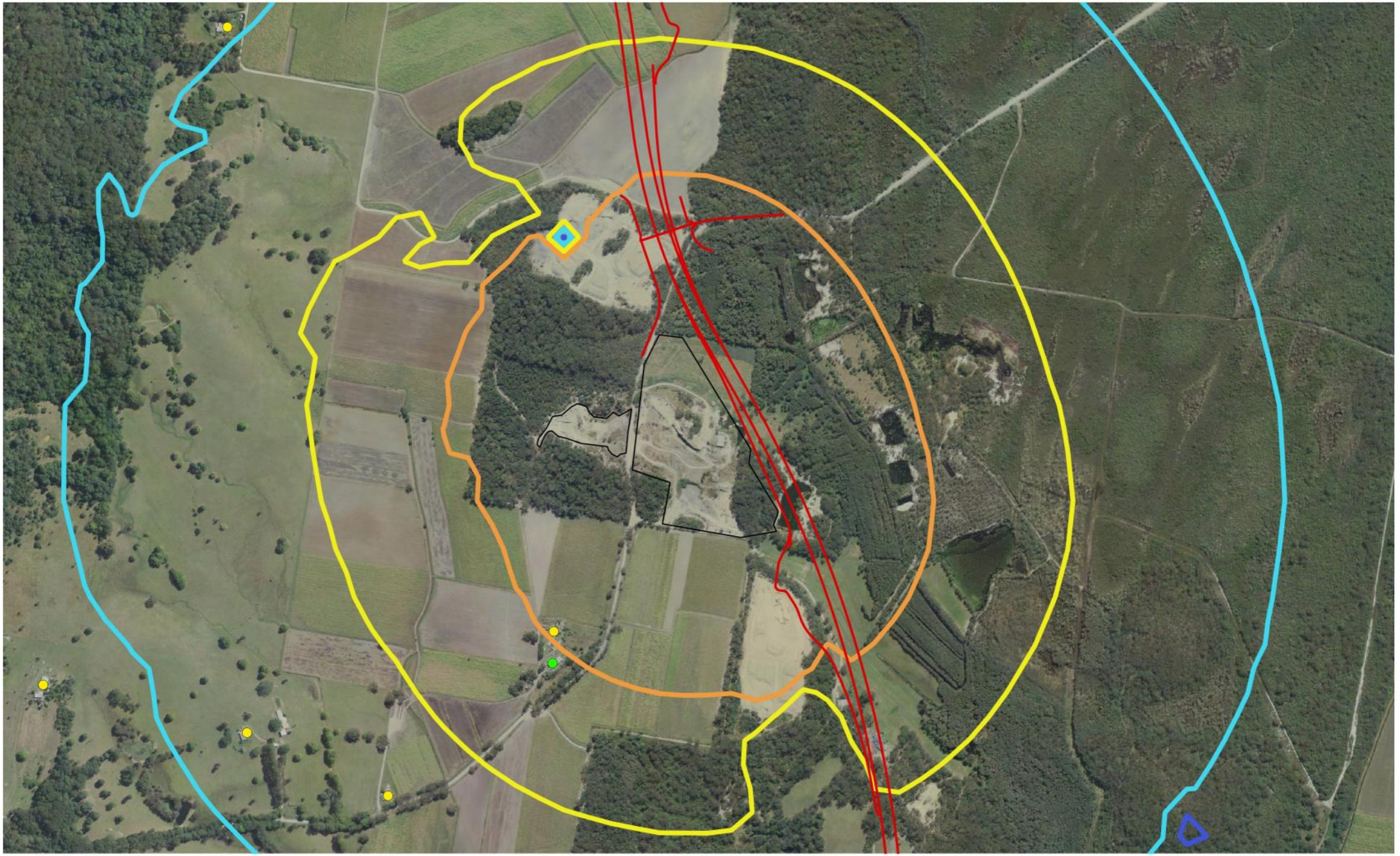
Receiver Categories

Community Educational Residential
Commercial Hospital Recreational

Pacific Complete

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Construction Noise Assessment
Crushing and Screening LAeq(15minute)
Jali and Gibsons Borrow Site



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Mainline Works

Jali and Gibsons Borrow

Predicted LAeq Noise Levels

45 dBA 50 dBA 55 dBA 60 dBA

Receiver Categories

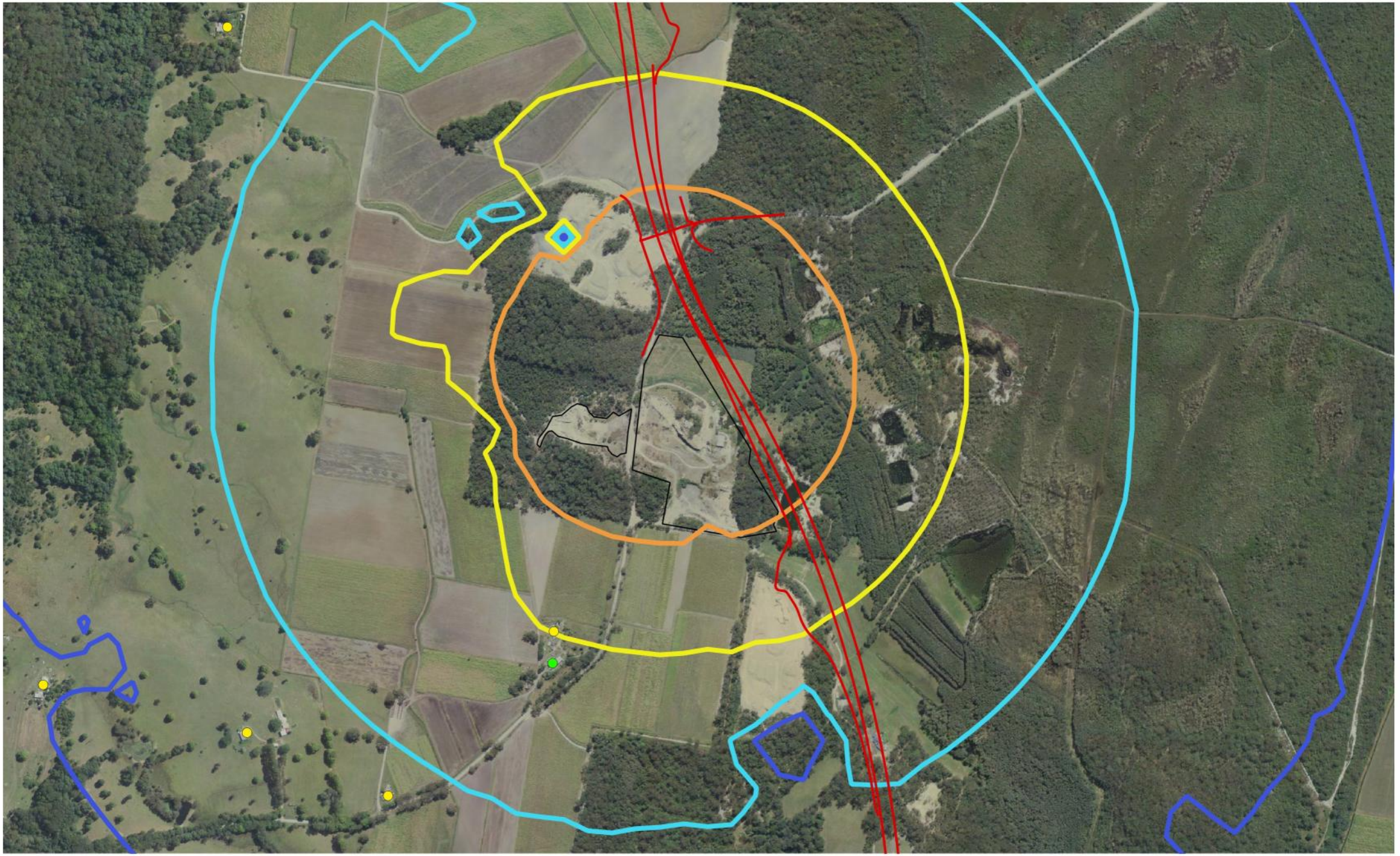
Community Educational Residential
Commercial Hospital Recreational

Pacific Complete

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Construction Noise Assessment
Cummulative Operations
Extraction and Crushing & Screening
LAeq(15minute)

Jali and Gibsons Borrow Site



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100 0 100 200 300 m

Mainline Works

Jali and Gibsons Borrow

Predicted LAeq Noise Levels

45 dBA 50 dBA 55 dBA 60 dBA

Receiver Categories

Community Educational Residential
Commercial Hospital Recreational

Pacific Complete

Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11)

Construction Noise Assessment
Crushing and Screening (Mitigated)
LAeq(15minute)
Jali and Gibsons Borrow Site

Appendix E Aboriginal Heritage Assessment

Transport
Roads & Maritime
Services

14/10/16

John Bruin
Senior Environmental Advisor
Pacific Complete
Unit 2/ 4-8 King Street
GRAFTON NSW 2460

Dear John

Re: Preliminary assessment results for HW 10 Upgrade W2B Portion D – Jali Quarry Borrow Site works, proposal based on Stage 1 of the Procedure for Aboriginal cultural heritage consultation and investigation (the procedure).

Jali Quarry Site	W2B Project Approx. Chainage: **148,550**	AHIMS Basic Search (GDA94 MGA56) X: 541722 – 541951 Y: 6794647 – 6794770	AHIMS Basic Search Results: **NIL**

The project, as described in the Stage 1 assessment checklist, was assessed as being unlikely to have an impact on Aboriginal cultural heritage. The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate any known Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.
- A stage 1 PACHCI Physical assessment was carried out on the 13/10/16 with all areas cleared for Aboriginal places and objects.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact me and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease and the RMS Aboriginal cultural heritage officer and regional environment manager contacted immediately. Follow the steps outlined in the Roads and Maritime Services *standard Management Procedure*: *Unexpected Heritage Items* must be followed.

For further assistance in this matter please do not hesitate to contact me.

Yours sincerely

Graham Purcell
Aboriginal Cultural Heritage Officer – Northern Region

Appendix F Community Consultation Letter

Australian Government

BUILDING OUR FUTURE

NSW MAKING IT HAPPEN

April 2017

Have your say on using Gibsons borrow site and Jali borrow site for Woolgoolga to Ballina Pacific Highway upgrade

The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. As part of the project, we are seeking your feedback on working in the quarry known as Gibsons and Jali owned quarry at Bagotville until Wednesday 26 April 2017

Rock and gravel to build the highway between the Richmond River and Ballina Bypass is available from two previously operational quarries, now known as Gibsons borrow site and Jali borrow site. The two sites are located either side of Old Bagotville Road, Bagotville with Gibsons borrow site located next to the new highway route, and mostly within the approved project boundary.

What are we proposing?

Our proposal seeks to access the quarry sites as they are close to the project work area. We also propose to construct a haulage road, which will limit the need for heavy vehicles to use local roads.

Roads and Maritime Services own the land where Gibsons borrow site is located. It was identified in the Submissions/Preferred Infrastructure Report as a suitable location to extract material for the upgrade.

Roads and Maritime Services is also proposing to borrow material from the cleared areas of the Jali owned quarry at Bagotville. Using material from these sites to build the road will reduce the number of trucks on the existing highway and travel distances, improving safety and efficiency for all road users.

We expect to start using these sites in late May/early June 2017. We expect to use both sites for about three years and they will be rehabilitated after completion, in line with the project's conditions of approval.

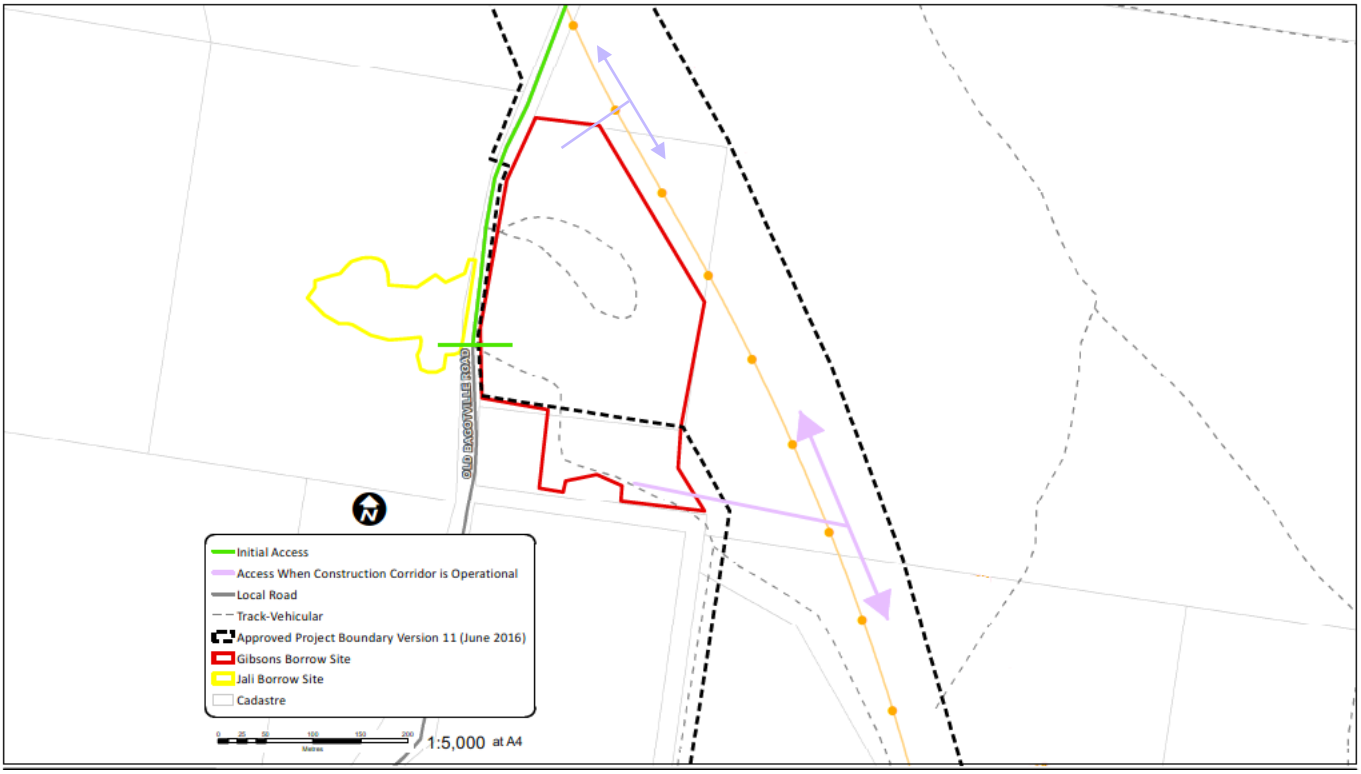
The quarry material will be used to build the new highway. We will remove about 384,000 cubic metres from the two sites. Initially some of the extracted material will be transported along Old Bagotville Road, to Back Channel Road and then onto the existing highway for use on the project. To prepare for work we need to:

- Install temporary fencing along Old Bagotville Road, Bagotville to prevent koalas entering work sites
- Remove scattered patches of vegetation at the sites
- Demolish existing sheds at the sites
- Set up site access
- Install environmental controls and site security, including fencing
- Install site offices
- Use plant and equipment.

When we are operating at the two sites, our activities will include:

- Using machines and equipment within the site
- Excavating, drilling and blasting
- Crushing and sorting the material according to size and grade
- Stockpiling material
- Moving material from the site to the project area
- Staff travelling to and from the site.

Proposed Gibsons Borrow Site and Jali Borrow Site



How will the work affect you?

Excavation, drilling and blasting will be carried out to extract the material from the two sites. This material will then be crushed and sorting according to size and grade so we can use it to build the road.

Noise and dust will be managed to reduce the impact to the community. Our approaches to managing noise and dust include:

- Spraying water to increase the moisture content of material
- Ensuring equipment is serviced and maintained
- Placing stockpiled materials in mounds to help reduce noise
- Carrying out noise and dust monitoring
- Reporting on noise and dust levels.

Koala management measures

Koala food trees will not be cleared in either of the proposed locations. As part of the project's conditions of approval, we will implement measures outlined in the Koala Management Plan, including:

- Installing temporary fencing around the sites
- Introducing temporary reduced speed limits on local roads
- Inducting and training workers in koala awareness and management
- Having an ecologist with suitable experience in koala handling on site during pre-clearing surveys, clearing activities and throughout the work.

Work hours

7am – 6pm Monday – Friday
8am – 5pm Saturdays

In areas where residents live more than 200m from the project boundary, extended work hours from 6am to 7pm weekdays may be permitted. We will notify nearby residents at least five working days in advance of any activities scheduled outside of these working hours.

How is noise managed?

There will be noise when we are building and working at this site. To manage the impact of noise we will wherever possible:

- Establish site entry and exit points away from residential properties
- Service and maintain plant and equipment so they are in good working order
- Direct noise generating plant and equipment away from residential properties where practicable
- Only carry out blasting from Mondays to Fridays between 9am and 5pm and on Saturdays from 9am to 1pm
- Minimise the number of plant and equipment operating at the same time
- Monitor noise
- Use natural features and site structures to help mitigate noise.

We will not carry out blasting on Sundays or public holidays.

Construction traffic

To limit the need for construction heavy vehicles to use local roads we will be building a haulage road within the project. The haulage road will take about four to six months to build, which will see this being the peak period of vehicle movements for local roads. During this time, there will be up to 600 heavy vehicle movements and up to 100 light vehicle movements per day along Old Bagotville Road. After the haulage road is built, the majority of vehicle movements will use the haulage road within the project.

600 truck movements per day during peak periods

100 car movements per day during peak periods

* Expected vehicle movements (one vehicle travelling in and out of the site is two movements)

How is traffic managed?

To manage the increase in vehicle movements in the area for the project, we will wherever possible:

- Use the construction corridor haulage road for heavy vehicle movements

- Reduce the speed limit to 80km/h on Old Bagotville Road at site access points while we are using the borrow sites
- Maintain the condition of Old Bagotville Road for the duration of the project construction.

Next steps

We are carrying out an assessment of the two proposed borrow sites. As part of this we are seeking your feedback on the use of the site. You can use the form attached to give us your comments by **Wednesday 26 April 2017**.

Please fill in the form and return it to W2B@pacificcomplete.com.au or use the supplied reply paid envelope. Alternatively, you can provide your feedback over the phone by calling 1800 778 900.

Once responses are received, the project team will consider key matters raised as part of the sites' assessment. A consultation report will also be prepared, which will include project team responses to matters raised. Letters that respond to the matters raised in individual submissions will also be sent.

For more information about the project, please contact us on 1800 778 900, email W2B@pacificcomplete.com.au or visit the project website at rms.nsw.gov.au/W2B

If you need help understanding this information, please contact the Translating and Interpreting Service on 131 450 and ask them to call us on 1800 778 900.

Feedback form

Woolgoolga to Ballina Gibsons borrow site and Jali borrow site Bagotville

We are seeking your feedback on Gibsons borrow site and Jali borrow site, Bagotville.

Your feedback will help us manage any specific concerns you may have during the building and operating the borrow sites.

Please complete this form and return it to us by **Wednesday 26 April 2017** at W2B@pacificcomplete.com.au, using the supplied reply paid envelope or to

Community Manager, Woolgoolga to Ballina upgrade, PO Box 546, Grafton, NSW, 2460.

Name:	
Address	
Phone:	
Email:	
Signature	
Date	

Do you have any objections or comments on the proposed use of the Gibsons borrow site or the Jali borrow site?

□ Yes (if yes, please outline your comments below)

□ No

Feedback form

Woolgoolga to Ballina Gibsons borrow site and Jali borrow site Bagotville

Would you like the project team to contact you to discuss your feedback?

□ Yes □ No

Would you like to receive future project updates?

□ Yes □ No

Once responses are received, the project team will consider key matters raised as part of the sites' assessment. A consultation report will also be prepared, which will include project team responses to matters raised. Letters that respond to the matters raised in individual submissions will also be sent.

If you require further information, please contact the community team on 1800 778 900 (press 1) or email W2B@pacificcomplete.com.au

Thank you.

Privacy: Roads and Maritime Services ("RMS") is subject to the Privacy and Personal Information Protection Act 1998("PPIP Act") which requires that we comply with the Information Privacy Principles set out in the PPIP Act. All information in correspondence is collected for the sole purpose of assisting in the assessment of this proposal. The information received, including names and addresses of respondents, may be published in subsequent documents unless a clear indication is given in the correspondence that all or part of that information is not to be published. Otherwise RMS will only disclose your personal information, without your consent, if authorised by the law. Your personal information will be held by RMS at 76 Victoria St, Grafton. You have the right to access and correct the information if you believe that it is incorrect.

Appendix G Community Consultation Report

Roads & Maritime

Gibsons borrow site and Jali borrow site, Wardell

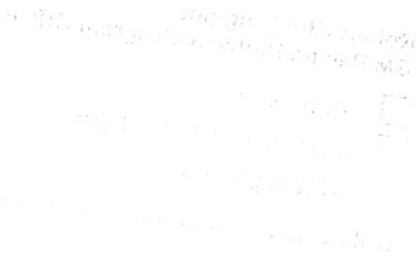
Community Consultation Report

June 2017

Robert (Bob) Higgins
GM Pacific Highway Program Office

☑ Approved
☐ Approved with changes
☐ Not approved

Date: 16/6/17



Executive summary

This report provides a summary of the Woolgoolga to Ballina Pacific Highway upgrade community and stakeholder consultation for two proposed borrow sites (sources of general earth fill and rock for use in foundation work). The proposal is part of the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade, which the Australian and NSW governments are funding.

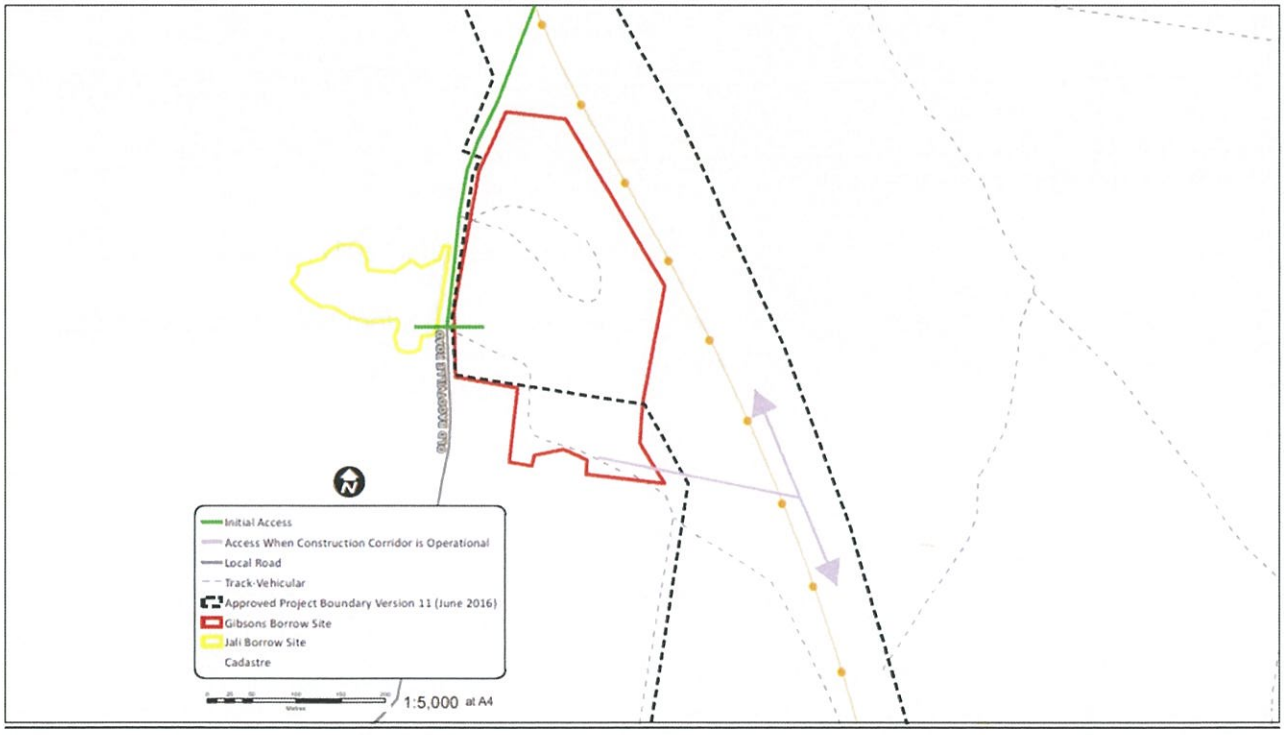
The sites were assessed as part of the project's Environmental Impact Statement (EIS) in 2012 and the Submission/Preferred Infrastructure Report (SPIR) in 2013.

The proposal

The Woolgoolga to Ballina project team proposed to operate two borrow sites within the project boundary at Old Bagotville Road, Wardell for about three years to provide material to build the road in this area. The proposed sites are existing quarries known locally as Gibsons borrow site and Jali borrow site.

We are proposing to use the two borrow sites to provide earth and rock for the upgrade in the Wardell area. The sites are located next to the project route. This work will involve mechanical excavation and crushing and screening of material, then hauling it from the sites along the construction corridor. There is a possibly that controlled blasting may be required and if so, further consultation will be carried out. To prepare for work to start we propose to:

- Remove isolated pockets of vegetation
- Build site access
- Build temporary offices with amenities for staff including car parking
- Install environmental controls, fencing and site security
- Install machinery and equipment parking
- Create storage and stockpiling areas for equipment and materials.



The locations of proposed Gibsons and Jali borrow sites, noting planned access points.

The Woolgoolga to Ballina project team invited feedback on this proposal from Monday 3 April to Wednesday 26 April 2017. We received comments from nine people and two organisations, with three people supporting the proposal, one against the proposal and seven neutral. Key matters raised included:

- Traffic and access
- Noise and vibration
- Hours of operation
- Biodiversity
- Rehabilitation
- Impact on the use of Lumleys Hill borrow site.

We thank everyone who provided comments and the community and stakeholders for considering the proposal.

The outcome

The Woolgoolga to Ballina project team has considered feedback from the community and stakeholders. The approved *Construction Environmental Management Plan* and its sub-plans provide information on many of the measures that will be put in place for the operation of these two sites to minimise impact on nearby property owners, residents and the wider community plus the environment. Additionally, the *Koala Management Plan* and *Ballina Koala Plan* provide clear direction about the measures Roads and Maritime is taking to protect and manage this important native animal as we build the Woolgoolga to Ballina upgrade.

The project team will seek to operate from the proposed borrow sites, known as Gibsons and Jali.

The project team will continue to work with the community and stakeholders to mitigate and manage impact of the work it needs to carry out to build the upgrade.

Next steps

The project team will be producing management plans for the borrow sites. These will undergo a consistency assessment in line with project requirements and where needed, will be submitted to the Department of Planning and Environment for approval. They will be reviewed against the Minister's Conditions of Approval to determine compliance.

The project team expects the borrow sites to be operational from mid-2017, weather permitting.

The project team will continue to notify the community and stakeholders before work starts and keep them informed as the project progresses.

Contents

Figures and tables

1.0 Introduction

1.1 Background

To enable the construction of the Woolgoolga to Ballina Pacific Highway upgrade, Roads and Maritime Services identified several potential borrow sites (sources of general earth fill and rock) along the 155 kilometre route. For the northern section of the upgrade, the Woolgoolga to Ballina project team needs access to borrow sites close to the project corridor to build the new road. A separate proposal to use a site at Lumleys Hill, Wardell has been progressed, and in this proposal, additional sites at two existing quarries, known as Gibsons and Jali, at Bagotville have been proposed.

These sites were assessed as part of the project's Environmental Impact Statement (EIS) in 2012 and the Submission/Preferred Infrastructure Report (SPIR) in 2013.

1.2 The proposal

The Project team is proposing to operate borrow sites at two existing quarries known as Gibsons and Jali, at Wardell, for about three years to provide materials to build the road in this area.

The proposed borrow sites involve:

- Removing isolated pockets of vegetation
- Building site access
- Building temporary offices with amenities for staff including car parking
- Installing environmental controls, fencing and site security
- Installing plant and equipment parking
- Storage and stockpiling areas for equipment and materials.

We are proposing to use Gibsons and Jali as borrow sites to provide earth and rock for building the new road in the Wardell area. The site is located next to the project route. This work will involve mechanical excavation and possibly blasting and crushing and screening of material, then hauling the vast majority of it to the site along the construction corridor.

How will the work affect you?

We will manage noise and dust ensuring minimal impact to the community. This involves using mitigation measures including water spraying to increase the moisture content of the material, ensuring equipment is serviced and maintained, placing stockpiled materials in mounds to help reduce noise as well as conducting noise and dust monitoring in accordance with the project's approved plans.

Key activities at the site will include:

- Using machines and equipment
- Excavating, drilling and blasting
- Crushing and sorting the material according to size and grade
- Stockpiling
- Moving material to the project area
- Staff arriving and leaving.

We have provided a map to explain our proposal.

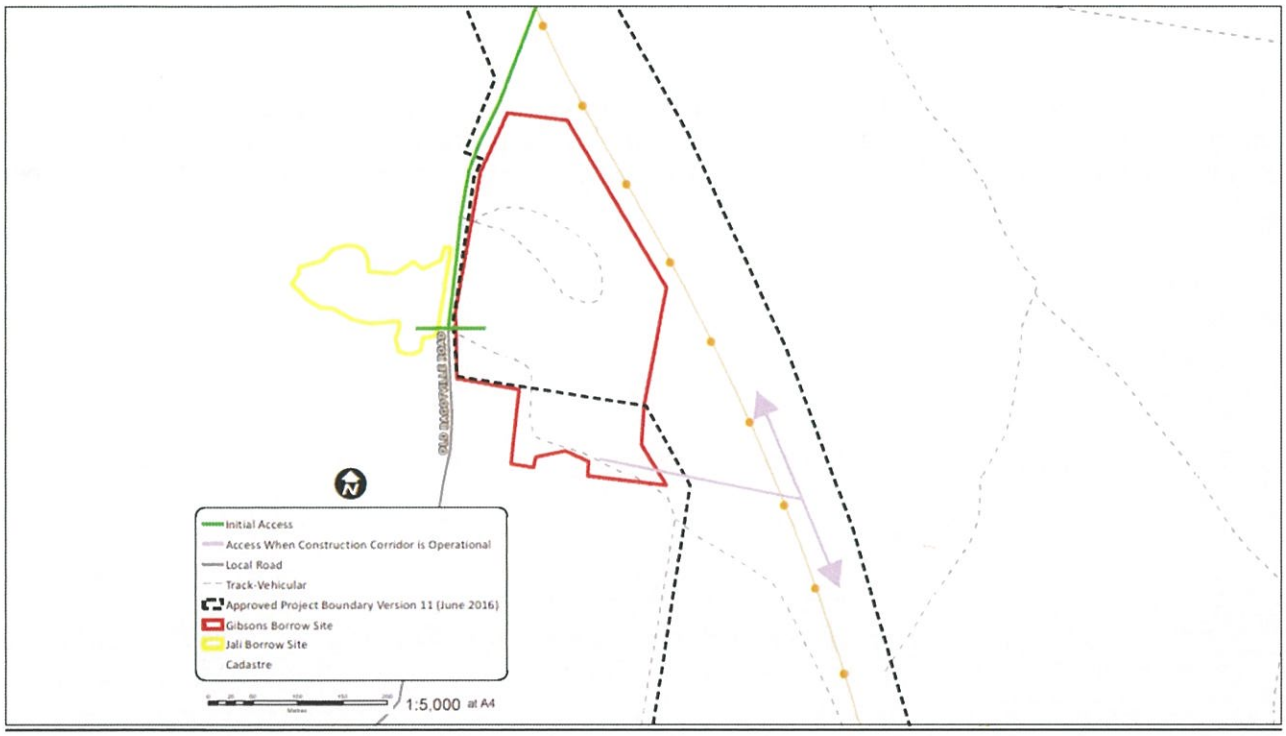


Figure 1 – The locations of proposed Gibsons and Jali borrow sites, noting planned access points.

2.0 Consultation approach

2.1 Consultation objectives

We consulted with the community and stakeholders on the proposal to:

- seek comment, feedback, ideas and suggestions for consideration in the decision making
- build a database of interested community members which the project team could continue to engage throughout the project.

2.2 How consultation was done

The community and stakeholders were encouraged to provide feedback via mail, email or phone. Consultation was carried out from Monday 3 April to Wednesday 26 April 2017.

About 300 letters were delivered to local residents and businesses and stakeholders inviting feedback on the proposal (Appendix A). Copies were also provided to the NSW Member of Parliament for Ballina, Ballina Shire Council and emergency services.

3.0 Consultation summary

3.1 Overview

We received comments from nine people and two organisations, with three people supporting the proposal, one against the proposal and seven neutral. The people and organisations raised six different matters related to the proposal. Some people provided comments on more than one topic in their feedback. Key matters included:

- Traffic and access
- Noise and vibration
- Hours of operation
- Biodiversity
- Rehabilitation
- Impact on the use of Lumleys Hill borrow site.

3.2 Feedback and responses

We have provided responses to all feedback received on this proposal. The responses are provided directly to the person who commented as well as being summarised in this report, which will be made available to the public. All comments have been considered to assist us in the decision making on this proposal.

A number of responses refer to the project's Construction Environmental Management Plan (CEMP) and its appendices. The relevant one for this proposal include:

- Construction Traffic and Access Management Plan (Appendix B1)
- Construction Soil and Water Quality Management Plan (Appendix B3)
- Construction Noise and Vibration Management Plan (Appendix B4).

These plans are available on the Roads and Maritime website at http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/project-documents.html#ConstructionEnvironmentalManagementPlans(CEMPs)

Additional plans referenced in our responses to community and stakeholder comments include:

- Koala Management Plan
- Communications and Stakeholder Engagement Strategy.

These plans are available on the Roads and Maritime website at http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/index.html

Table 1 – Feedback summary and the Woolgoolga to Ballina team project team responses

Category	Matters raised	Project team response
Traffic and access	Heavy vehicle movements on local roads Traffic management signage Speed reductions for heavy vehicles Road surface/condition Haulage routes on local roads	Traffic management for the establishment and operation of the two proposed borrow sites would be implemented in accordance with the approved Woolgoolga to Ballina Pacific Highway Construction Traffic and Access Management Plan (sections 3 to 11), Appendix B1 of the CEMP for all traffic movements associated with the proposed borrow sites. The contractor/s operating the sites would also be required to prepare a number of site specific traffic management, safety and control plans. The project team will be working with identified contractors through the procurement process to minimise the duration and number of heavy and light vehicle movements on local roads. The construction of the haul corridor within the project alignment will minimise vehicles using local roads and will therefore be recommended to the preferred contractor. In instances where direct access to the project within the boundary is unable to be achieved, material excavated from the two proposed borrow sites would be hauled along Old Bagotville Road, onto Back Channel Road and then either divert onto Carlisle Street and then the existing Pacific Highway or onto Bath Street towards Wardell Road. This haulage route has been used previously for the operation of quarries in the area including during times of the supply of material for other Pacific Highway projects including Alstonville Bypass and Ballina Bypass. It is estimated that at peak construction, up to 600 heavy vehicle movements and 100 light vehicle movements per day would use this route during the early operation of the site for about four months, prior to the opening of the construction corridor. It is noted that the use of this haulage route may coincide with the cane harvest season. The project team works closely with industry to coordinate and manage traffic and will be particularly doing this during the cane harvest season to manage impact.. The additional haulage vehicles on the road network will be considered in preparing management plans as required. When material is being hauled along the local road network, the project team does expect there to be increased vehicle numbers and noise. Material required to build access along the corridor would be extracted from the two proposed borrow sites therefore the corridor can't be used as a haul route during this early work. Driver behaviour and safety training and toolbox talks would be provided to all drivers working on the project to ensure they are aware of obligations and expectations of safe driving practices. All haul vehicles used would be fitted with IVMS trackers to monitor speed limits and routes. In addition to vehicle tracking, the project team has implemented project vehicle speed limits through the local road network of 80 kilometres/hour. This system is monitored to ensure compliance.

Category	Matters raised	Project team response
		The road condition of the haul route will be assessed before project haul starts. Any requirements for road improvements or maintenance, changes to speed limits and/or additional traffic control measures would be considered before operation of the site. The project team has established strong working relationships with Ballina Shire Council to proactively plan, implement and manage traffic movements for proposed work activities. Traffic management, safety and control plans would be prepared by the contractor/s to detail traffic movements and additional traffic controls required to ensure safety. The following upgrades and maintenance measures will be carried out within the vicinity of the borrow sites and the township of Wardell. It is intended that this work will be completed before operation of the proposed borrow sites. The work includes: • At Old Bagotville and Back Channel roads intersection Council to replace signage and line marking • On Old Bagotville Road assess road condition with possible management measures being sealing, grading and/or use of water carts to reduce the generation of dust • At Bath and Carlisle streets intersection carry out improvement for safer truck movements • On the Pacific Highway build a northbound acceleration lane from Carlisle Street. The project team will notify community before work start, and will work with identified stakeholders and site neighbours to minimise impacts and maintain access.
Noise and vibration	Noise and vibration Blasting	Noise background levels for the area were determined as part of the Construction Environmental Management Plan – Appendix B4 Construction Noise and Vibration Management Plan. These background levels are considered to be reflective of the background levels for the area. Noise modelling for the operation of the two sites was carried out and provides a conservative scenario for the operation of the sites and is calculated based on what the maximum noise levels would be when all equipment is operating on the site. The modelling identified some potential impacts above the noise management level for the area. Noise mitigation and management measures outlined in the approved Construction Environmental Management Plan – Appendix B4 Construction Noise and Vibration Management Plan would be implemented where appropriate to minimise and manage these impacts. These measures include, but may not be limited to: • establishing site entry and exit points away from residential properties • service and maintain plant and equipment so they are in good working order • where practical noise generating plant and equipment would be directed away from residential properties • minimise the number of plant and equipment operating at the same time • monitoring noise

Category	Matters raised	Project team response
		• use natural features and site structures to provide noise shielding. When material is being hauled along the local road network, the project team does expect there to be increased vehicle numbers and noise. Material required to build access along the corridor would be extracted from the two proposed borrow sites, therefore the corridor can't be used as a haul route during this early work. The project team notes the concerns of residents where noise and vibration from passing heavy vehicles has been raised. The project team will carry out structural reports for houses along the proposed Bath Street and Carlisle Street haul route before work starts. The project team understands heavy vehicle movements may be inconvenient for residents along local road haul routes for the proposed period, particularly where cane harvesting season or other heavy vehicle operators may be using the route outside of the project. The project team will continue to meet with key stakeholder groups to manage these concerns during the proposed period of local road use, particularly where this period coincides with the local cane harvesting season. A Blast Management Plan would be implemented for the site to manage all blasting activities at the proposed borrow sites. The plan would include all safety measures to be implemented on sites before blasting activities are carried out. Blasting activities would be carried out during normal operating hours and where required nearby residents would be notified in advance of the activities. In accordance with the project conditions of approval (B21), blasting will be carried out: • Between 9am and 5pm from Monday to Friday • Between 9am and 1pm on Saturday. Blasting may occur outside the above hours and in accordance with the standard construction hours where: • no sensitive receivers in sparsely populated areas would be impacted by blasting or • an agreement has been made with receivers within 200 metres of the blast zone to permit blasting in accordance with the standard construction hours.

Category	Matters raised	Project team response
Hours of operation	Hours of operation Out of hours work	The two proposed sites would operate under the project's approved construction hours of: • Between 7am and 6pm from Monday to Friday • Between 8am and 5pm on Saturday. No work would take place on Sundays or public holidays. As there are no residents within 200 metres of the site, extended work hours of between 6am and 7pm on weekdays may be permitted. Any out of hours work would be approved and carried out in accordance with the project's approved Construction Noise and Vibration Management Plan, Appendix B3 of the Construction Environmental Management Plan. Residents would be notified at least five working days in advance of any activities scheduled outside of the above working hours as required under the project's Communications and Stakeholder Engagement Strategy.
Biodiversity	Vegetation removal Fauna management	The excavation work at both proposed sites would occur within the already disturbed footprint of the previous quarries that existed. Areas of remnant vegetation/regrowth have occurred within the site and would be removed before excavation work starts. This vegetation is not considered to be a biometric vegetation type. Removal limits would be defined. Temporary fauna (koala) exclusion fencing will be installed on the boundary of the proposed sites. This fencing will also prevent disturbance and impacts to adjacent areas of existing vegetation. Temporary koala fencing has already been installed along Old Bagotville Road toward Back Channel Road to improve safety and reduce the incidence of fauna mortality. The effectiveness of temporary fencing will be monitored while the work is carried out. Additional measures for fauna management will include driver education, reduced speed limits, additional awareness signage and koala grids at each borrow site access point.
Rehabilitation		The two borrow sites would be rehabilitated in accordance with the principles outlined in the Urban Design and Landscape Plan (UDLP) for sections 10 and 11 including: 1. Establishing landowner requirements and identifying rehabilitation objectives 2. Considering the location context and amenity requirements 3. Integrating rehabilitation with adjacent landform, topography 4. Considering fauna connectivity and wildlife corridors and enhancing where possible 5. Applying landscape treatments consistent with the project UDLP to ensure an integrated outcome. The rehabilitation approach for the site would be approved by the Department of Planning and Environment as part of the proposed borrow site management plans.

Category	Matters raised	Project team response
Impact on the use of Lumleys Hill borrow site		The Woolgoolga to Ballina Pacific Highway upgrade Environmental Impact Statement (EIS) outlines that a large amount of material would be required to build the new highway in this area. The material required from the Gibson and Jali borrow sites is in addition to the material required from the Lumleys Hill borrow site. The project team also wishes to confirm that there is no proposal to relocate the batch plant proposed for the Lumleys Hill site to the Gibsons or Jali borrow sites, mainly due to the size restrictions of the two sites.

4.0 Decision

We thank everyone who provided comments and the community and stakeholders for considering the proposal.

The Woolgoolga to Ballina project team has considered feedback from the community and stakeholders. The approved *Construction Environmental Management Plan* and its sub-plans provide information on many of the measures that will be put in place for the operation of these three sites to minimise impact on nearby property owners, residents and the wider community. Additionally, the *Koala Management Plan* and *Ballina Koala Plan* provide clear direction about the measures Roads and Maritime is taking to protect and manage this important native animal as we build the upgrade.

The project team has decided to seek to operate the proposed borrow sites known as Gibsons and Jali at Wardell.

The project team will continue to work with the community and stakeholders to mitigate and manage impacts of the work it needs to carry out to build the Woolgoolga to Ballina Pacific Highway upgrade.

5.0 Next steps

The Woolgoolga to Ballina Pacific Highway upgrade team will be preparing management plans for the proposed borrow sites. These will be submitted to the Department of Planning and Environment for approval. They will be reviewed against the Minister's Conditions of Approval to determine compliance.

The project team expects the proposed borrow sites to be operational from mid-2017, weather permitting.

The project team will continue to notify the community and stakeholders before work starts and keep them informed as the project progresses.

6.0 Appendices

Appendix A - 'Have your say' letter April 2017

Australian Government

BUILDING OUR FUTURE

NSW MAKING IT HAPPEN

April 2017

Have your say on using Gibsons borrow site and Jali borrow site for Woolgoolga to Ballina Pacific Highway upgrade

The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. As part of the project, we are seeking your feedback on working in the quarry known as Gibsons and Jali owned quarry at Bagotville until Wednesday 26 April 2017

Rock and gravel to build the highway between the Richmond River and Ballina Bypass is available from two previously operational quarries, now known as Gibsons borrow site and Jali borrow site. The two sites are located either side of Old Bagotville Road, Bagotville with Gibsons borrow site located next to the new highway route, and mostly within the approved project boundary.

What are we proposing?

Our proposal seeks to access the quarry sites as they are close to the project work area. We also propose to construct a haulage road, which will limit the need for heavy vehicles to use local roads.

Roads and Maritime Services own the land where Gibsons borrow site is located. It was identified in the Submissions/Preferred Infrastructure Report as a suitable location to extract material for the upgrade.

Roads and Maritime Services is also proposing to borrow material from the cleared areas of the Jali owned quarry at Bagotville. Using material from these sites to build the road will reduce the number of trucks on the existing highway and travel distances, improving safety and efficiency for all road users.

We expect to start using these sites in late May/early June 2017. We expect to use both sites for about three years and they will be rehabilitated after completion, in line with the project's conditions of approval.

The quarry material will be used to build the new highway. We will remove about 384,000 cubic metres from the two sites. Initially some of the extracted material will be transported along Old Bagotville Road, to Back Channel Road and then onto the existing highway for use on the project. To prepare for work we need to:

- Install temporary fencing along Old Bagotville Road, Bagotville to prevent koalas entering work sites
- Remove scattered patches of vegetation at the sites
- Demolish existing sheds at the sites
- Set up site access
- Install environmental controls and site security, including fencing
- Install site offices
- Use plant and equipment.

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Customer feedback
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